TEST REPORT

Report Number: 101271372ATL-002

November 27, 2013

Product Designation: 250600 Wireless Power Sensor

Standard: FCC 15.249 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.
RSS-210, Issue 8, 2010

Tested by:
Intertek Testing Services NA Inc.
1950 Evergreen Blvd., Suite 100
Duluth, GA 30096

Client:
LeMond
404 3rd Avenue North, Suite 203
Minneapolis, MN 55401
Contact: Mr. Evan Solida
Phone: (336) 317-3711
E-mail: evan@lemond.cc

Tests performed by:

Mary Sampson
EMC Project Engineer

Report reviewed by:

Kouma Sinn
Senior Project Engineer

1.0 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatum text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2.0 Test Summary

Section	Test Full Name	Test Date	Result
4.0	System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)		
5.0	Overview of EUT (Low Power Transmitters) (FCC 15C - EUT Overview)		
6.0	Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)	09/18/2013	PASS
7.0	Occupied Bandwidth (FCC Part 2.1049)	10/18/2013	PASS
8.0	Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)	10/18/2013	PASS

3.0 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Power Sensor	LeMond Revolution LLC	250600	106

EUT receive date:	9/19/13
EUT receive condition:	Good

Description of EUT provided by Client:

The Power Sensor is a device which takes RPM inputs from the flywheel of the LeMond Revolution Trainer and additional sensors including pressure and temperature to calculate virtual power and transmit via nRF51422 using the ANT+ RF protocol to a cycling computers. Additionally, the Power Sensor can receive cadence information to determine if a user is actually pedaling or not.

Description of EUT exercising:

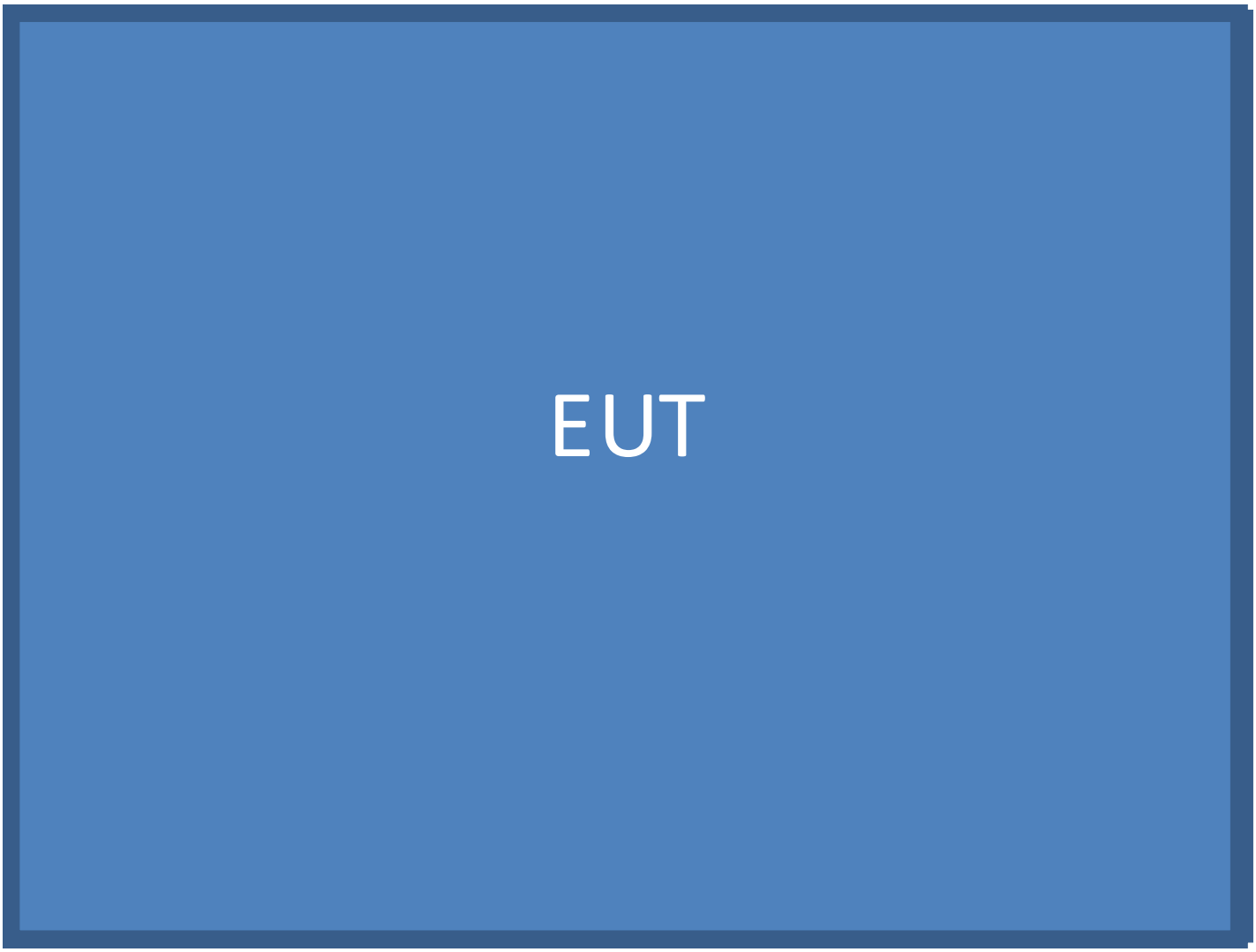
The EUT was powered by 3 Vdc. Transmitting continuous at low, mid and high channels at maximum power, 0 dBm.

4.0 System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)

Method:

Record the details of EUTcabling, document the support equipment, and show the interconnections in a block diagram.

Drawing:



Block Diagram

Data:

4.0 System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)

EUT Cabling						
					Connection	
ID	Description	Length	Shielding	Ferrites	From	To
	None					

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None			

5.0 Overview of EUT (Low Power Transmitters) (FCC 15C - EUT Overview)

Method:

Complete the overview spreadsheet.

Related Submittal(s) Grants: This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.

Data:

Applicant	LeMond Revolution LLC
Trade Name & Model No.	Watt Box 250600
FCC Identifier	2AA5K250600WAT
Frequency Range (MHz)	2400-2483.5 MHz
Antenna Type (15.203)	Internal/Integral
Manufacturer name & address	LeMond Revolution LLC 404 3rd Avenue North, Suite 203 Minneapolis, MN 55401

Related Submittals and Grants:	This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.
Additions, deviations and exclusions from standards	None

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Method:

Measurements shall be performed with a quasi-peak detector instrument that meets the requirements of Section One of CISPR 16.

Bandwidths:
30 MHz to 1000 MHz: 120 kHz RBW and 1 MHz VBW
Above 1000 MHz: 1 MHz RBW and 3 MHz VBW

Detectors:
Equal to or less than 1000 MHz: CISPR quasi-peak detector (alternative: peak detector)
Above 1000 MHz: Average detector (applies to average limit)
Above 1000 MHz: Peak detector (applies to peak limit)

Limits:
Equal to or less than 1000 MHz, the limits are specified as quasi-peak. If a peak detector is used, the limit does not change.
Above 1000 MHz, the limits are specified as average. The peak limit is 20 dB above the average limit. Both peak and average measurements are required to be reported.

Frequency range of radiated measurements
For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

Measurement antenna requirements:
Below 30 MHz - Loop antenna
30 to 1000 MHz - Biconical, Log Periodic, or equivalent
Above 1000 MHz - Horn or equivalent

Measurements of the radiated field are made with the antenna located at a distance of 3 or 10 meters from the EUT. The limit applied to the measurement shall be appropriate for the test distance. The test distance shall be indicated in the results section.

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

Exploratory tests should be carried out while varying the cable positions to determine the maximum or near-maximum emission level. During manipulation, cables shall not be placed under or on top of the system test components unless such placement is required by the inherent equipment design.

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

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

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

If the EUT is handheld, it shall be oriented in each of its othogonal axes.

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

If EUT is floor standing, the EUT was placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material.

Equipment setup for radiated disturbance tests shall follow the guidelines of ANSI C63.4:2003.

TEST SITE
The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
20MHz to 18GHz PreAmplifier	A.H. Systems Inc	PAM-0118	203	02/14/20	02/14/20

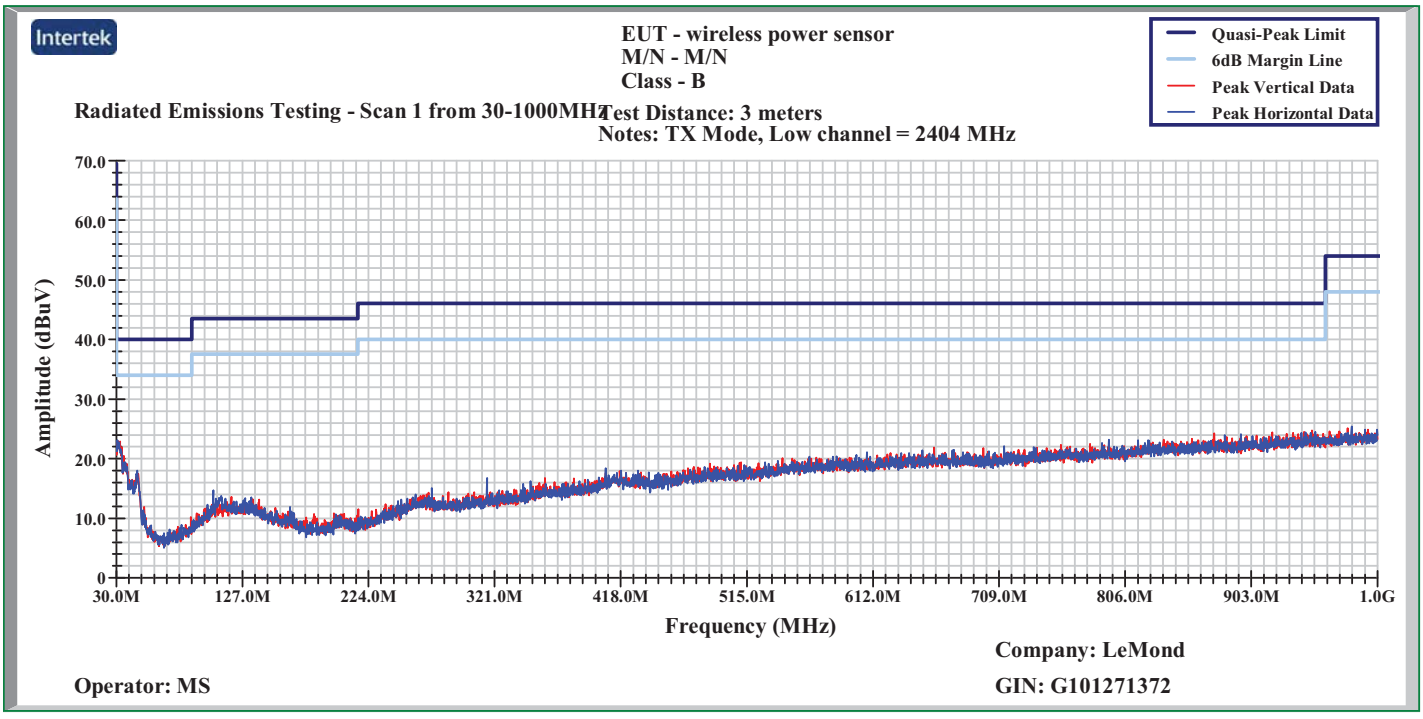
6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
20MHz to 40GHz Spectrum Analyzer	Hewlett Packard	E7405A			
7m Cable, 0.01-18GHz	Storm Products Co.	A81-0303-275.6	ST-5	08/05/2013	08/05/2014
Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	211386	11/12/2012	11/12/2013
Antenna, Horn, <18 GHz	EMCO	3115	213061	07/26/2013	07/26/2014
Cable E402, 40 GHz, 2.9, 9"	Megaphase	TM40 K1K1 9	E402	09/13/2013	09/13/2014
Cable E404, 40 GHz, 2.9, 2m	Megaphase	TM40 K1K1 80	E404	09/13/2013	09/13/2014
Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/13/2013	05/13/2014
Cable, N-N, 3 meters, 18GHz	Megaphase	TM18-NKNK-118	E206	05/13/2013	05/13/2014
EMI Receiver	Hewlett Packard	8546A	213109	01/03/2013	01/03/2014
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	01/03/2013	01/03/2014
Excel spreadsheet for radiated emissions	Software	Excel - RE Worksh	SW004	01/14/2013	01/14/2014
Preamplifier, 18-40GHz, 29 dB Gain	Miteq	JS41800400-30-5P	200106	09/06/2013	09/06/2014
Preamplifier, 18-40GHz, 29 dB Gain	Miteq	JS41800400-30-5P	200080	09/06/2013	09/06/2014
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	01/14/2013	01/14/2014

Results: The sample tested was found to Comply.

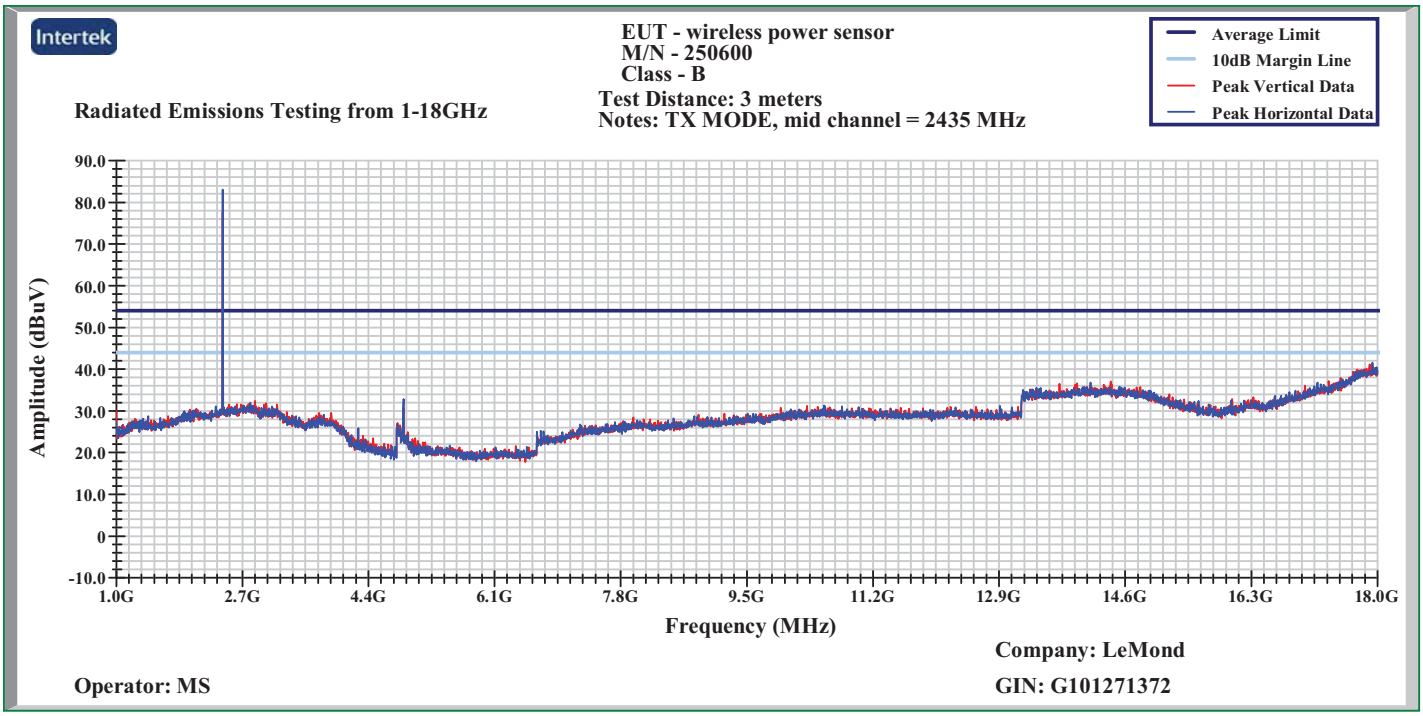
Plot:



RE MF TX Mode low channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

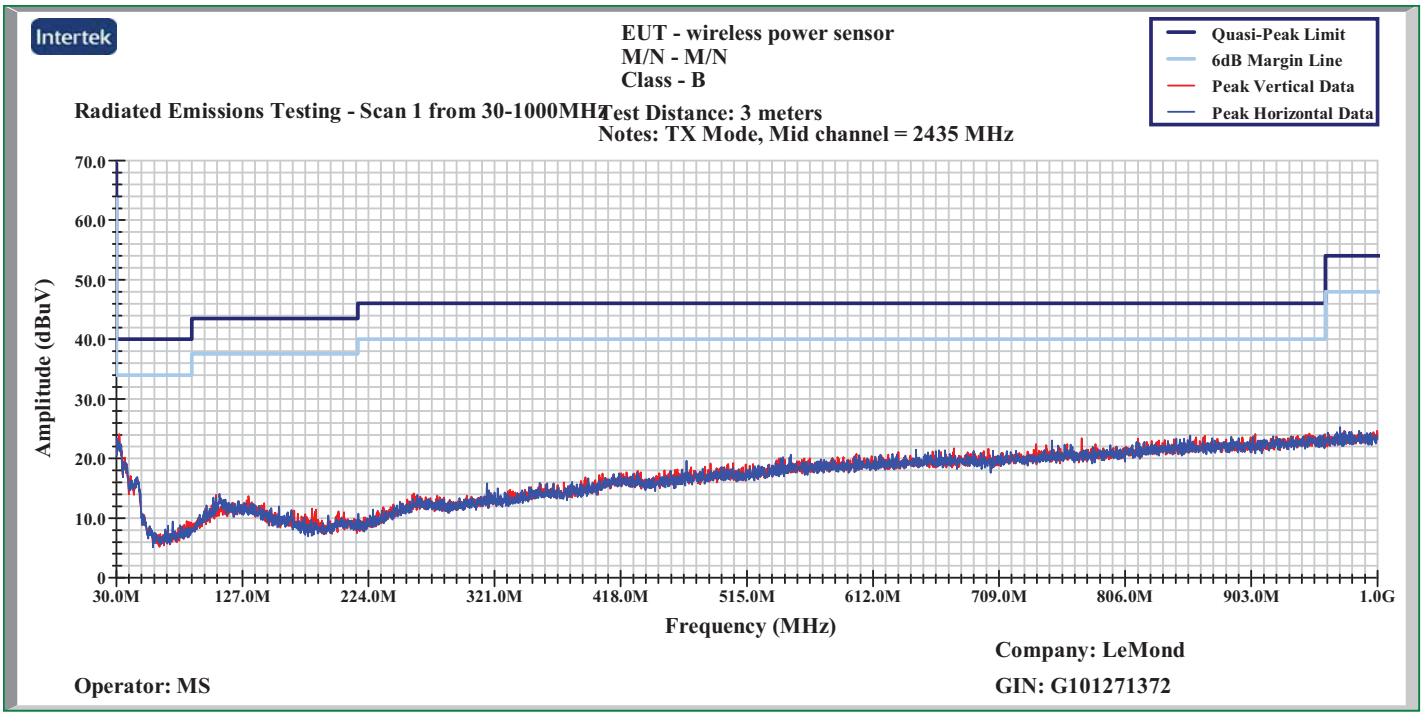
Plot:



RE HF TX Mode mid channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

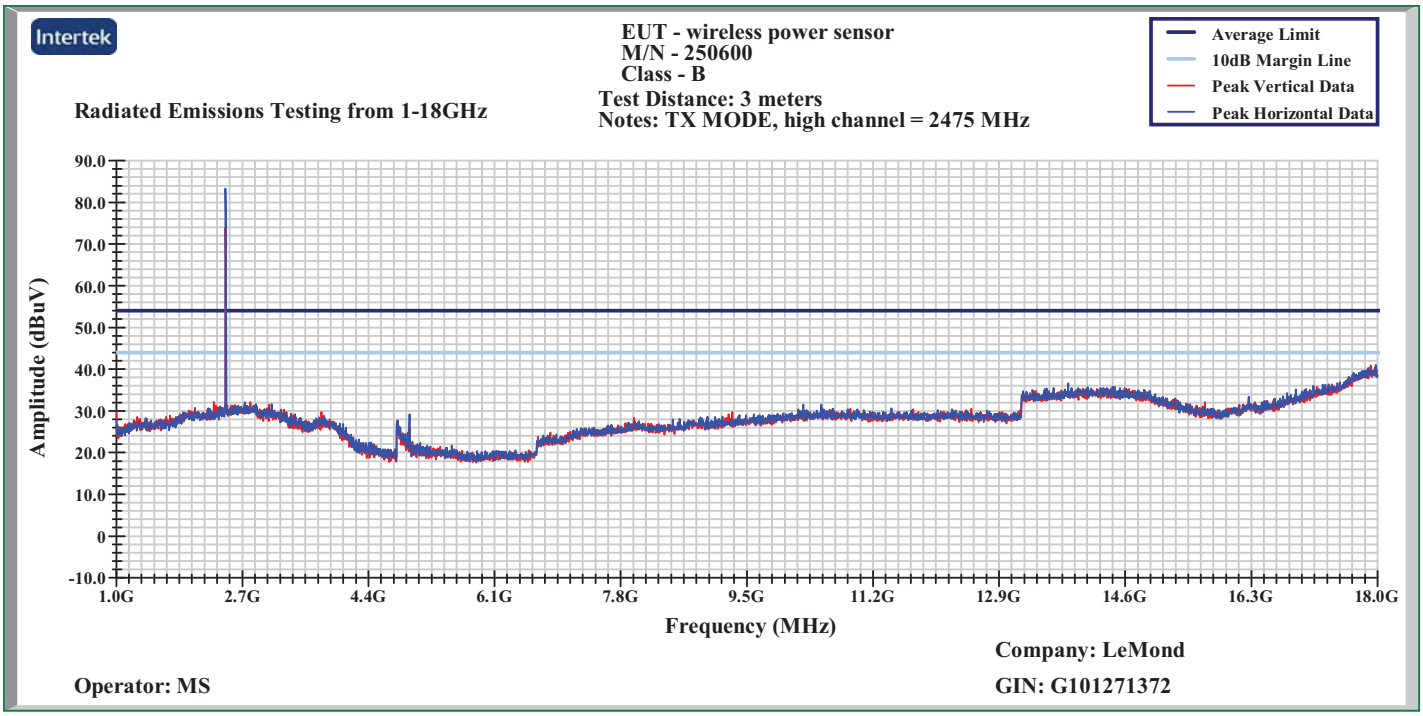
Plot:



RE MF TX mode mid channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

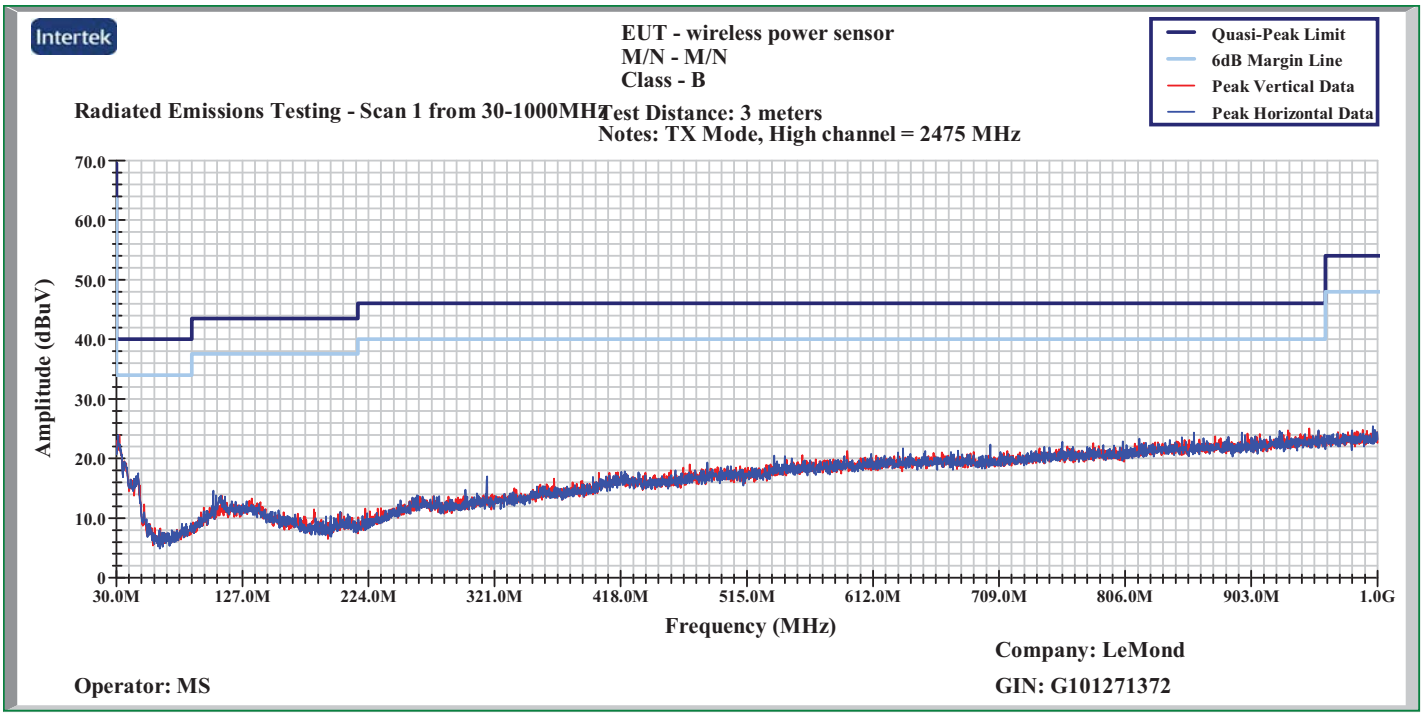
Plot:



RE HF TX Mode high channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

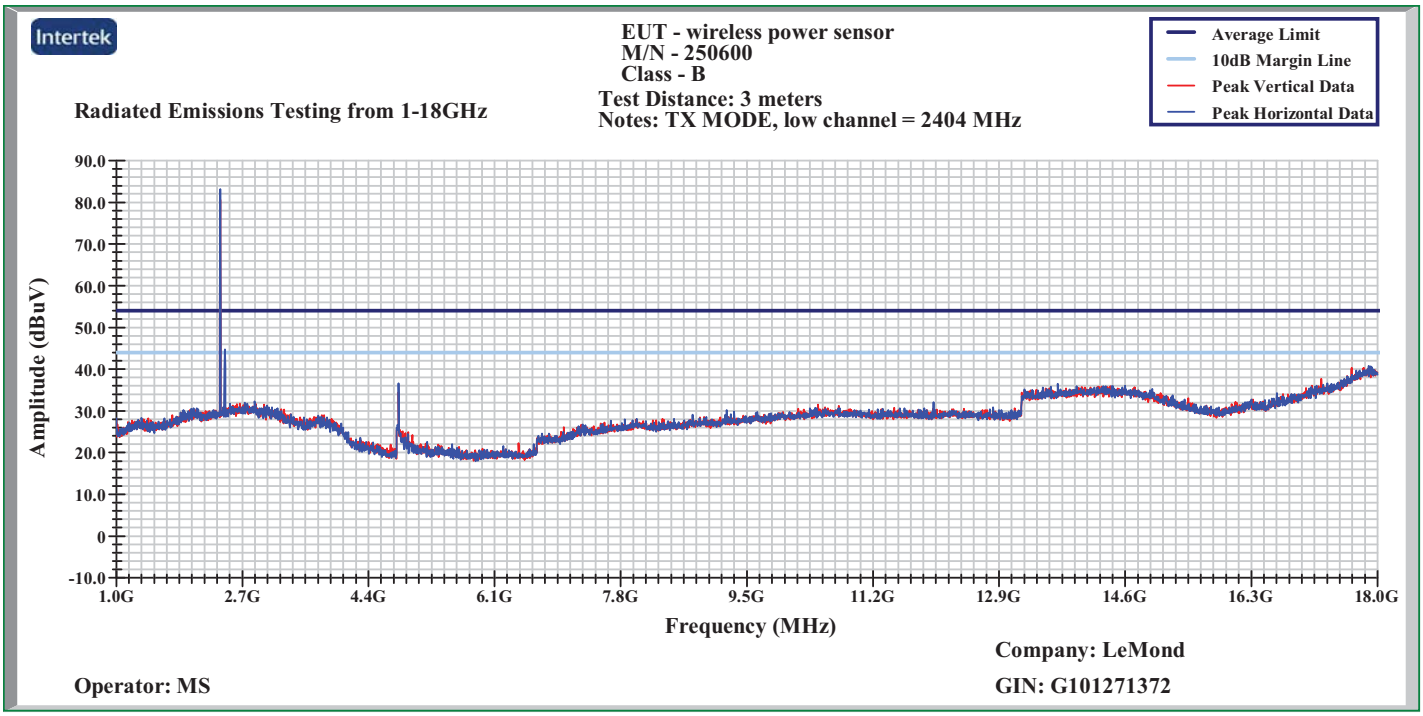
Plot:



RE MF TX Mode high channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

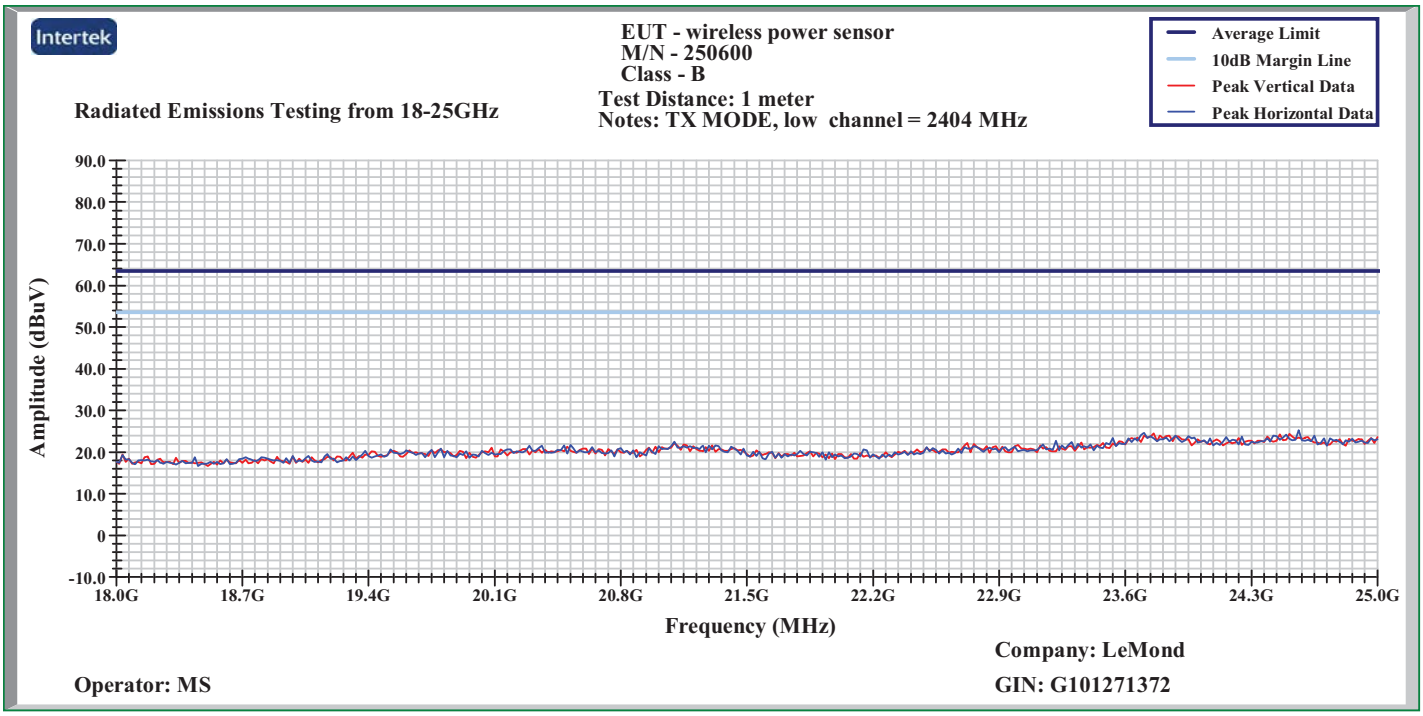
Plot:



RE HF TX Mode Low channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

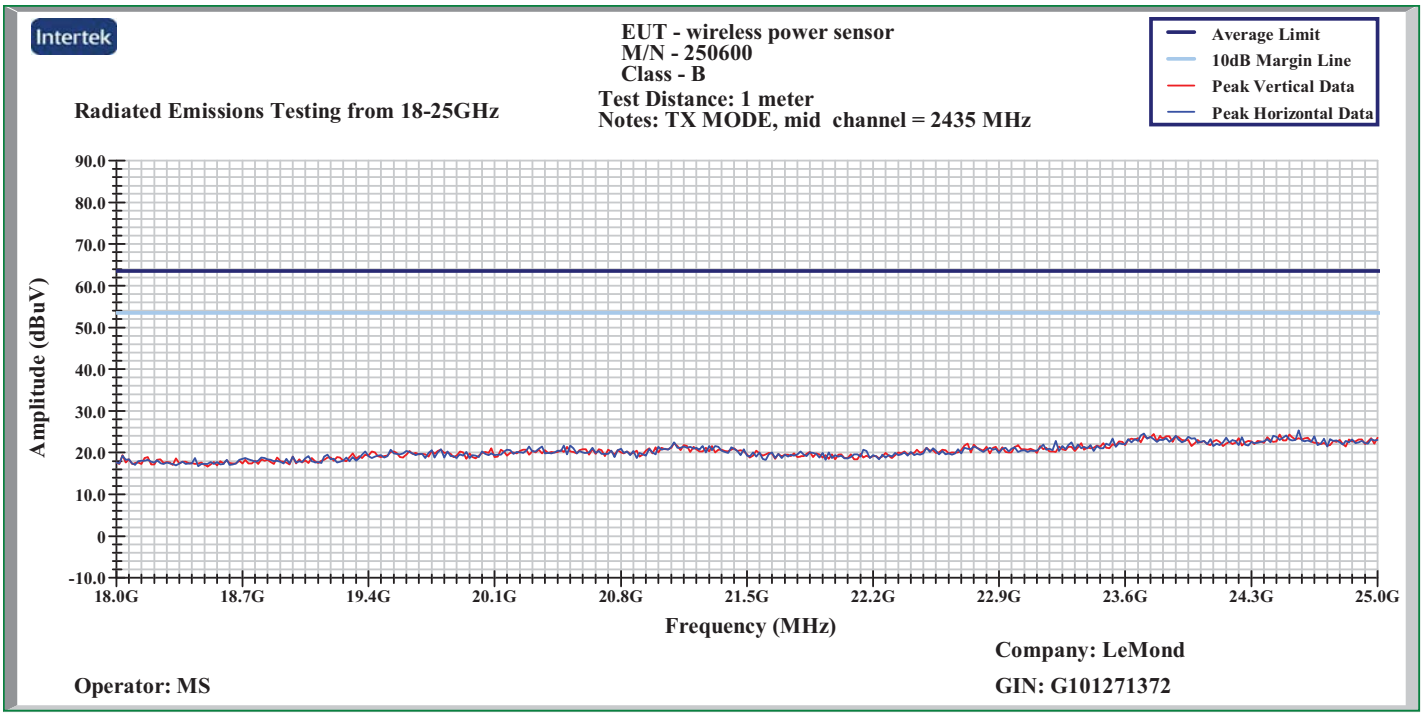
Plot:



RE HF TX Mode Low channel, 18 to 25 GHz

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

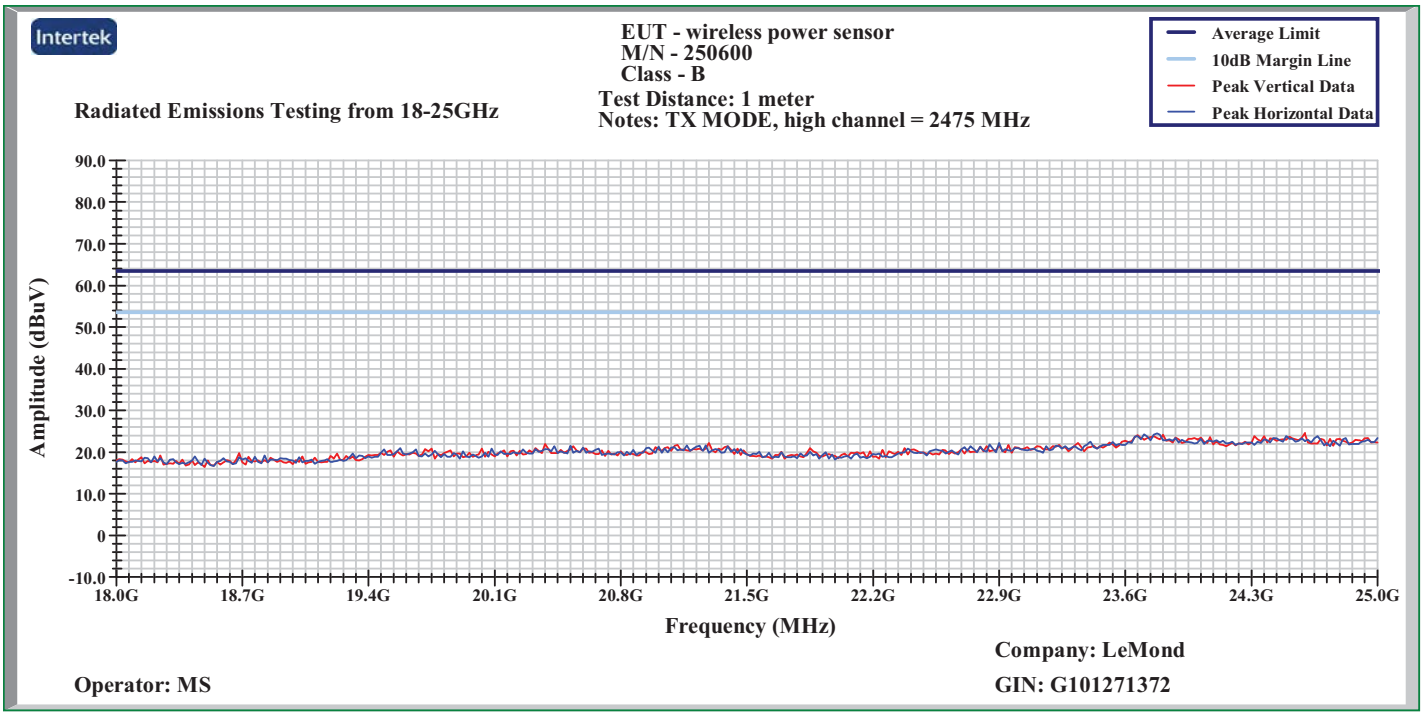
Plot:



RE HF TX Mode mid channel, 18 to 25 GHz

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Plot:



RE HF TX Mode high channel, 18 to 25 GHz

Data:

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Client: LeMond
Model Number: 250600 Wireless Power Sensor
Project Number: G101271372
Tested By: MS
Date: 20-Sep-2013
Frequency Range (MHz): 1000-18000
Input power: battery

Receiver: HP 8546A
Antenna: EMCO 3115
Cables: ST-4+MP3+E-205+E-206
Preamp: PAM-0118 -Rental Pre-amp
Test Distance (m): 3
Limit: 15_249a
Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
fc = 2404 MHz									
V	4808.000	48.0	32.8	22.8	43.3	60.3	74.0	-13.7	PK/1M/3M
V	4808.000	36.2	32.8	22.8	43.3	48.5	54.0	-5.5	AVG/1M/3M
H	4808.000	48.4	32.8	22.8	43.3	60.7	74.0	-13.3	PK/1M/3M
H	4808.000	37.9	32.8	22.8	43.3	50.2	54.0	-3.8	AVG/1M/3M
fc = 2435 MHz									
V	4870.000	47.8	32.9	23.2	43.3	60.5	74.0	-13.5	PK/1M/3M
V	4870.000	35.5	32.9	23.2	43.3	48.2	54.0	-5.7	AVG/1M/3M
H	4870.000	48.5	32.9	23.2	43.3	61.2	74.0	-12.8	PK/1M/3M
H	4870.000	37.2	32.9	23.2	43.3	49.9	54.0	-4.0	AVG/1M/3M
fc = 2475 MHz									
V	4950.000	46.6	33.1	23.6	43.4	59.9	74.0	-14.1	PK/1M/3M
V	4950.000	33.8	33.1	23.6	43.4	47.1	54.0	-6.8	AVG/1M/3M
H	4950.000	47.7	33.0	23.6	43.4	61.0	74.0	-13.0	PK/1M/3M
H	4950.000	33.8	33.0	23.6	43.4	47.1	54.0	-6.9	AVG/1M/3M
Calculations		G=C+D+E-F		I=G-H					

RE HF TX Mode Final Data

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Data:

Client: LeMond
Model Number: 250600 Wirless Power Sensor
Project Number: G101271372
Tested By: MS
Date: 18-Sep-2013
Frequency Range (MHz): Fundamental
Input power: battery

Receiver: HP 8546A
Antenna: EMCO 3115
Cables: ST-4+MP3+E-205+E-206
Preamp: PAM-0118 -Rental Pre-amp
Test Distance (m): 3
Limit: 15_249a
Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
V	2404.000	86.5	28.3	13.4	43.5	84.8	114.0	-29.2	PK/1MHz/3MHz
V	2404.000	86.4	28.3	13.4	43.5	84.7	94.0	-9.3	AVG/1MHz/3MHz
H	2404.000	92.8	28.4	13.4	43.5	91.1	114.0	-22.9	PK/1MHz/3MHz
H	2404.000	92.8	28.4	13.4	43.5	91.1	94.0	-2.9	AVG/1MHz/3MHz
V	2435.000	82.6	28.4	13.5	43.5	81.1	114.0	-32.9	PK/1MHz/3MHz
V	2435.000	82.5	28.4	13.5	43.5	81.0	94.0	-13.0	AVG/1MHz/3MHz
H	2435.000	87.5	28.5	13.5	43.5	86.0	114.0	-28.0	PK/1MHz/3MHz
H	2435.000	87.4	28.5	13.5	43.5	85.9	94.0	-8.1	AVG/1MHz/3MHz
V	2475.000	82.3	28.6	13.7	43.5	81.0	114.0	-33.0	PK/1MHz/3MHz
V	2475.000	82.2	28.6	13.7	43.5	80.9	94.0	-13.1	AVG/1MHz/3MHz
H	2475.000	91.8	28.6	13.7	43.5	90.6	114.0	-23.4	PK/1MHz/3MHz
H	2475.000	91.7	28.6	13.7	43.5	90.5	94.0	-3.5	AVG/1MHz/3MHz
Calculations		G=C+D+E-F		I=G-H					

RE TX Power

7.0 Occupied Bandwidth (FCC Part 2.1049)

Method:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Connect the antenna port of the EUT to a spectrum analyzer using a calibrated coaxial cable and attenuator. Set the EUT to transmit at its highest power setting. The 99% bandwidth function of the analyzer was used to automatically generate the occupied bandwidth plots. Repeat for low, mid, and high channels of each band of the EUT.

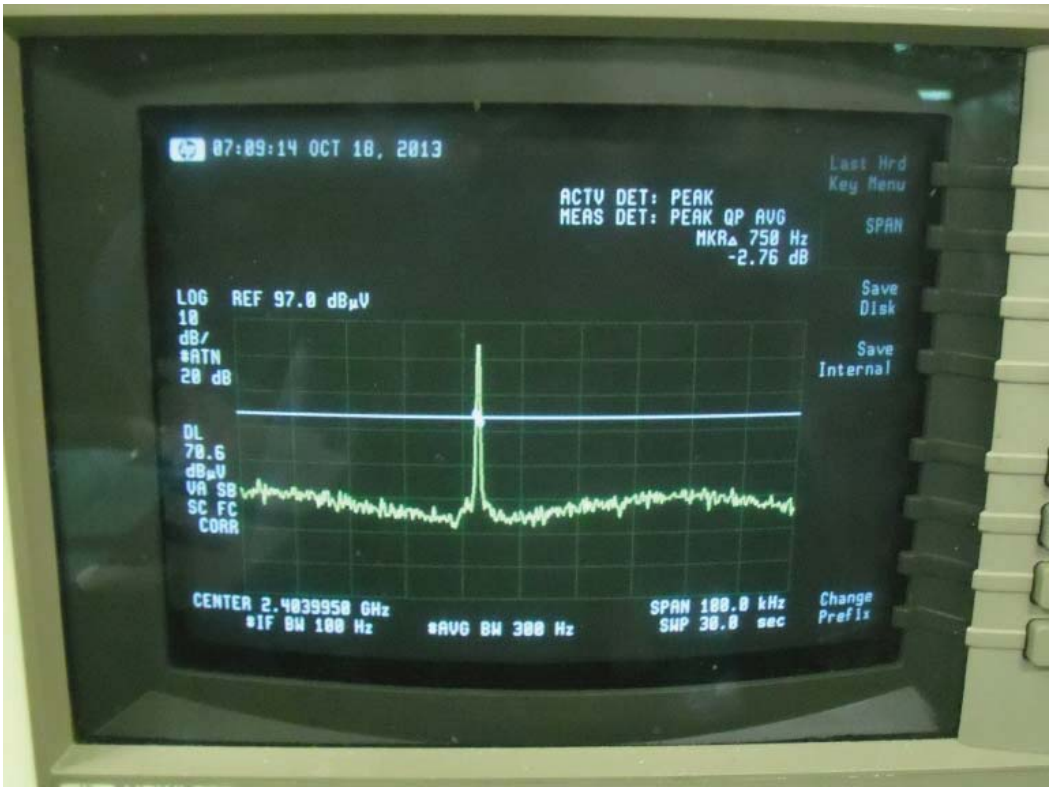
For amplifiers, the output bandwidth shall be less than or equal to the input bandwidth.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
EMI Receiver	Hewlett Packard	8542E	211876	04/05/2013	04/05/2014

Results: The sample tested was found to Comply.

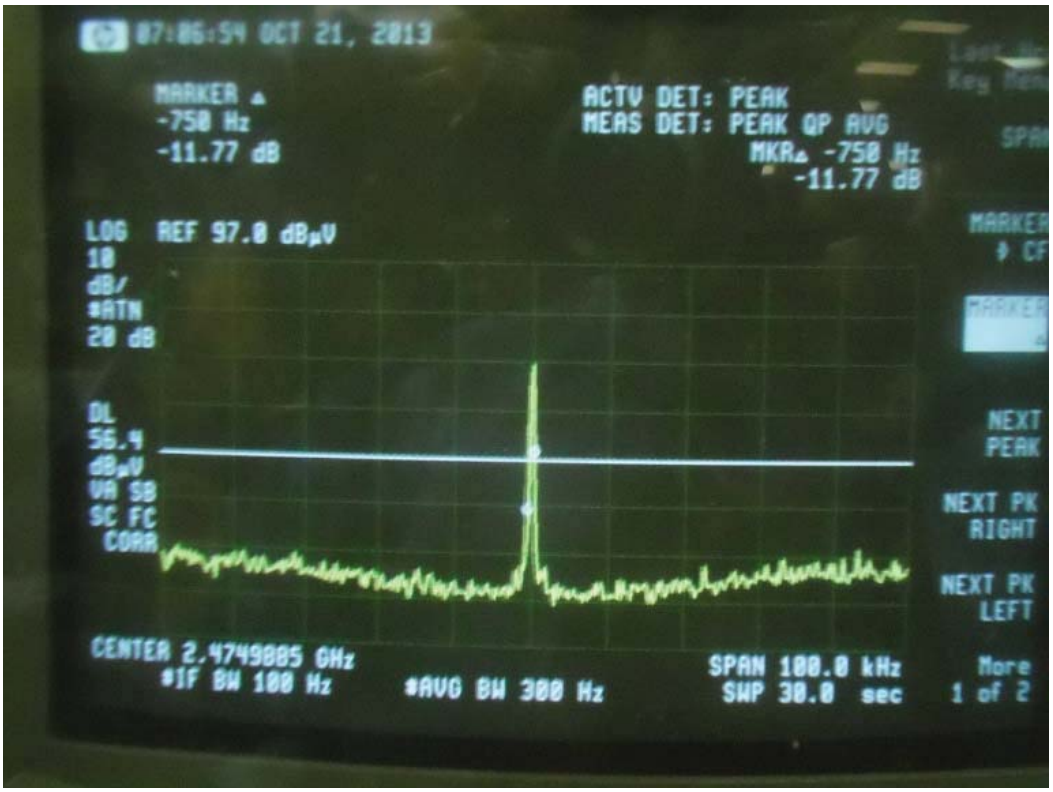
Plot:



OBW low channel

7.0 Occupied Bandwidth (FCC Part 2.1049)

Plot:



OBW High Channel

Data:

7.0 Occupied Bandwidth (FCC Part 2.1049)

Mode	Frequency MHz	Resolution Bandwidth (1)	Video Bandwidth	Sweep time Seconds	Output Measured Bandwidth MHz	Input Measured Bandwidth MHz
Transmit	2404	100 Hz	300 Hz	30	0.00075	
Transmit	2475	100 Hz	300 Hz	30	0.00075	

Note (1): Greater or equal to 1% of emission bandwidth.

8.0 Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)

Method:

§ 15.215 Additional provisions to the general radiated emission limitations.
(a) The regulations in §§15.217 through 15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.

(b) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in §15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.

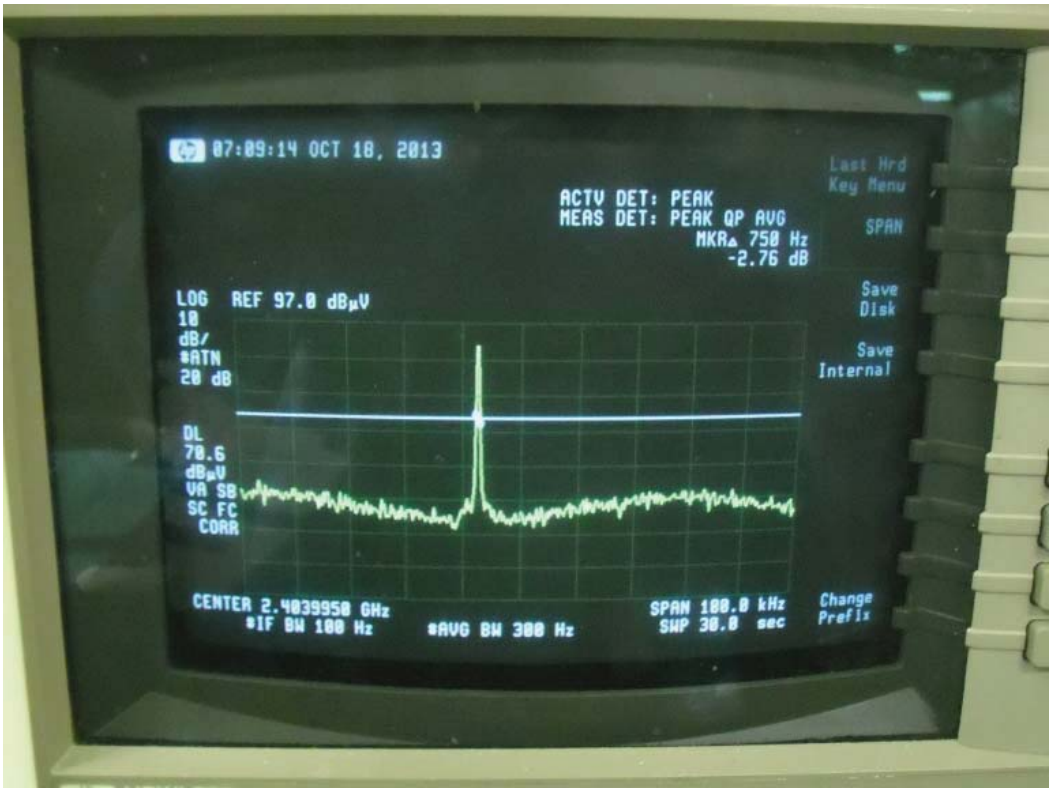
(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
EMI Receiver	Hewlett Packard	8542E	211876	04/05/2013	04/05/2014

Results: The sample tested was found to Comply.

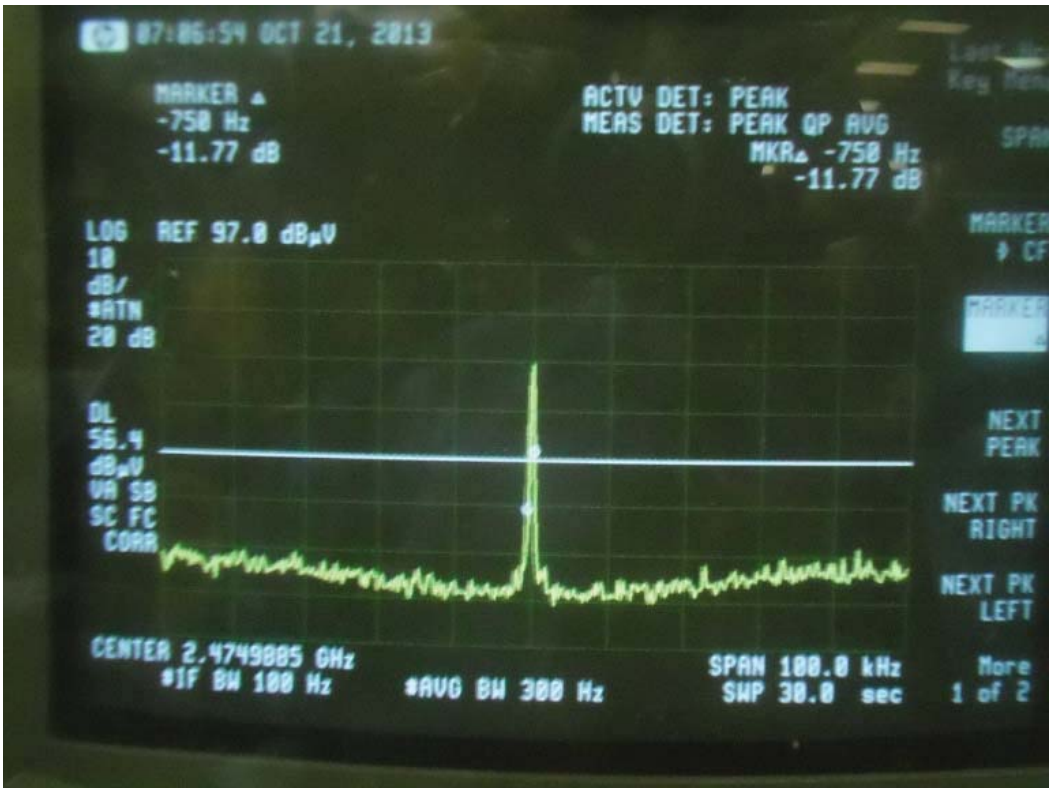
Plot:



Low channel OBW

8.0 Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)

Plot:



High Channel OBW