Project 10867-10

Prepared for:

Hetronic International, Inc.
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By

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September 23, 2010

CERTIFICATION
Wireless Test Report
Hetronic
LW9-Miller-HC
2119B-MillerHC

Table of Contents

Applicant:	Hetronic International, Inc.
Applicant's Address:	3000 N.W. 149th Street
	Oklahoma City, OK 73134
FCC ID:	LW9-Miller-HC
IC Number:	2119B-MillerHC
Project Number:	10867-10
Test Dates:	July 13, 29, September 13, 22, 2010

The **Hetronic LW9-Miller-HC** was tested to and found to be in compliance with FCC 47 CFR Part 15 and IC RSS-210 issue 7.

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

Parameter	Frequency (MHz)	Level		Limit	Margin (dB)
Transmitter: Mains Conducted	Not applicable, battery powered.				
Transmitter: Radiated Spurious	7320	63.4 dBµV/m @ 1 m		63.5 dBµV/m	-0.1
Transmitter: Output Power @ 1m	2440	10.27 dBm	10.64 mW	+30 dBm	-19.73
Receiver: Radiated Spurious	586.4	17.5 dBuV/m @ 10m		35.5 dBuV/m	-18

Note: See Pages 43-45 for Duty Cycle Correction factor which reduces the Average Radiated Spurious emissions level by -20dB.

Occupied Bandwidth		
6 dB	**20 dB**	**26 dB**
1.586 MHz	2.660 MHz	4.358 MHz

I, Jason Anderson, 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.

Jason Anderson
Director of Testing Services

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

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 USA and Canada.

1.2 EUT Description

The LW9-Miller-HC Miller Hand Control (Mini Transmitter) is a four-button coder board for the Hetronic MINI housing. The board combines a four-character / seven segment LCD and Blue LED to provide the user information. The module is equipped with variable R.F. duty cycle, and variable turn off time. It operates on 2 selected channels from 16 selectable 2.4GHz frequency channels. 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	Model	FCC ID Number	IC Identifier
Hetronic International, Inc.	Miller Hand Control	LW9-Miller-HC	2119B-MillerHC

The following rules apply to the operation of the EUT:

Guidelines	FCC Rules	IC Rules	
	Part 15	RSS-GEN Issue 1	RSS-210 Issue 7
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 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 Burnett Rd., Austin, Texas, 78758 while the main office is located at 1601 N. A.W. Grimes Blvd., Suite B, Round Rock, Texas, 78665. 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 C63.4:2003 and KDB Publication No. 558074 were utilized for making all emissions measurements.

1.4 Applicable Documents

The data collected for this report are presented entirely in Appendix B.

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. 558074	Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)	April 16, 2007
RSS-210	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment	Issue 7
RSS-Gen	General Requirements and Information for the Certification of Radio communication Equipment	Issue 2

2.0 Power Line Conducted Emissions

EUT is entirely battery operated. The battery pack is a + 4.5 VDC re-chargeable Lithium ion unit. This test does not apply.

3.0 Output Power

Output power measurements were made on selected fundamental transmit frequencies of the EUT for the lowest, most center, and highest transmit frequency.

Tests of the fundamental emissions 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.

3.1 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.

A spectrum analyzer with peak detection was used to find the maximum field strength during the variability testing. Resolution bandwidth (RBW) is chosen to encompass the entire 6 dB bandwidth of the fundamental signal, up to 3 times the bandwidth if possible. RBW used is recorded. A calculation was then made to determine the peak power at the antenna terminal. A drawing showing the test setup is given in Appendix A.

3.2 Test Criteria

The maximum output power is 1 W for devices operating in the frequency range 2400 - 2483.5 MHz according to FCC 15.247 and RSS-210.

4.0 Occupied Bandwidth

Occupied bandwidth measurements were performed on the EUT to determine compliance with FCC 15.247(a)(2) and RSS-210.

4.1 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 center frequency. The analyzer center frequency was set to the EUT carrier frequency. Display line and marker delta functions were used to measure the occupied bandwidth of the EUT. However, the 20 or 26 dB bandwidth is referenced to a peak power measurement taken at the entire bandwidth or more for RBW, then using 1% RBW for the 20 or 26 dB bandwidth. Measurements were made at three frequencies. A drawing showing the test setup is given in Appendix A.

4.2 Test Criteria

The minimum 6 dB occupied bandwidth for the EUT is 500 kHz as stated in 15.247(a)(2) and RSS-210. The 20 dB bandwidth must be measured and reported for the FCC and the 26 dB bandwidth must be measured and reported for IC.

5.0 Power Spectral Density

Power spectral density measurements were performed on the EUT to determine compliance with FCC 15.247(d) and RSS-210.

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 = 3 kHz, VBW > RBW, span = 300 kHz, and sweep time = 100s. The peak level is obtained after the sweep completes. The test setup is included in Appendix A.

5.2 Test Criteria

According to section FCC 15.247(d) and RSS-210 the maximum power spectral density is +8 dBm in any 3 kHz bandwidth.

6.0 Band Edge Spurious Emissions

Band edge spurious emissions measurements were performed on the EUT to determine compliance to FCC 15.247(c) and RSS-210.

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 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 500 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. The test setup is included in Appendix A.

6.2 Test Criteria

According to FCC 15.247(c) and RSS-210 the band edge spurious emissions must be 20 dB below the highest peak in the operating band in any 100 kHz bandwidth. If the frequency falls in the restricted bands of 15.205 the maximum permitted average must be below the field strength listed in 15.209.

Alternatively, the band edge spurious emissions will meet criteria if they are attenuated below the limits specified in FCC 15.209 or RSS-210 Table 3.

7.0 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(c), 15.209 and RSS-210.

7.1 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 is used with a resolution bandwidth of 120 kHz. All measurements below 1 GHz were normalized to 3 meters using a 20 dB/decade distance extrapolation. The emissions were maximized by rotating the EUT and raising and lowering the measurement antenna from 1-4 meters. The test setup is included in Appendix A.

Spurious/harmonic emissions above 1 GHz peak are measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 1 meter. Average detection is used to determine compliance of the EUT if the peak does not meet the average limit. Non-harmonic emissions must satisfy the average limit and the peak limit (20 dB above average). The test setup is included in Appendix A.

Above 1 GHz testing was completed at 3 transmit frequencies to determine compliance.

7.2 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
216 to 960	3	46.0	10	35.5
Above 960	3	54.0	10	43.5

8.0 Antenna Requirements

An antenna evaluation was performed on the EUT to determine compliance with FCC sections 15.203, 15.247(b) and RSS-210.

8.1 Evaluation Procedure

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

8.2 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.

Section 15.247(b)(4)(i) states that if the transmitting antenna has a directional gain greater than 6 dBi the power shall be reduced the amount in dB that the directional gain is greater than 6 dBi.

9.0 Modifications

N/A

10.0 Test Equipment

A list of the test equipment utilized to perform the testing is given below. The date of calibration is given for each.

Radiated Test Equipment

Asset #	Manufacturer	Model #	Description	Calibration Due
1280	HP	85650A	Quasi-peak Adapter (high band)	October 27, 2010
0949	HP	85662A	Spectrum Analyzer Display (high band)	NCR
1841	HP	8566B	Spectrum Analyzer (high band)	June 8, 2011
0990	HP	85685A	RF Preselector (high band)	March 24, 2011
1281	HP	85650A	Quasi-peak Adapter (low band)	January 13, 2011
1629	HP	85662A	Spectrum Analyzer Display (low band)	NCR
1129	HP	8568B	Spectrum Analyzer (low band)	August 5, 2010
1035	HP	85685A	RF Preselector (low band)	March 3, 2011
1454	HP	8447D	RF Preamplifier	July 06, 2011
1389	Emco	3108	Biconical Antenna	August 7, 2010
1487	Emco	3147	Log Periodic Dipole Array Antenna	July 29, 2010
C026	none	none	Coaxial Cable (low band)	July 27, 2010
C027	none	none	Coaxial Cable (high band)	July 27, 2010

Asset #	Manufacturer	Model #	Description	Calibration Due
0267	EMCO	3115	Ridge Guide Antenna	October 19, 2010
1529	Miteq	Antenna Mounted	Microwave Preamplifier (preamp 1)	July 16, 2011
1841	HP	8566B	Spectrum Analyzer	June 8, 2011
1273	HP	85662A	Spectrum Analyzer Display	NCR
1530	Miteq	None	Microwave Preamplifier (preamp 2)	July 16, 2011
C030	None	None	Coaxial Cable (MRE band)	July 27, 2010

Microwave Radiated Test Equipment

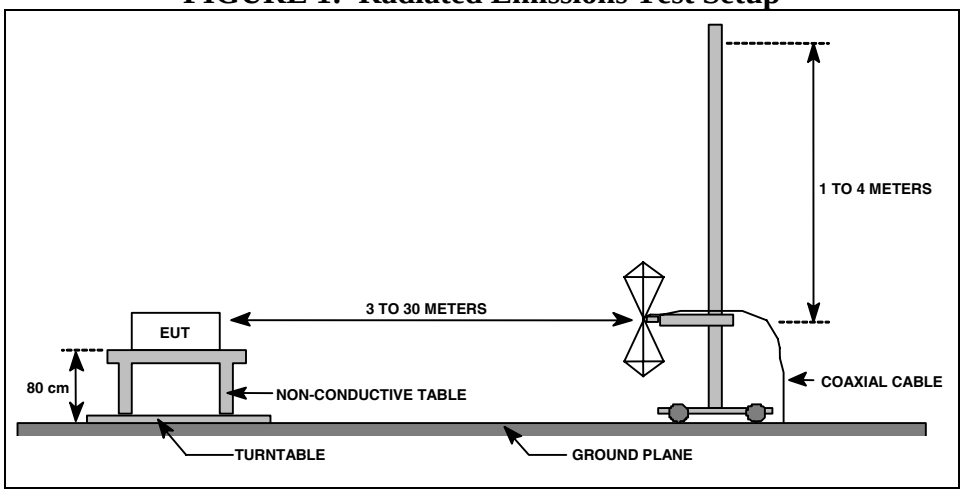
Asset #	Manufacturer	Model #	Description	Calibration Due
0267	EMCO	3115	Ridge Guide Antenna	October 19, 2010
1529	Miteq	Antenna Mounted	Microwave Preamplifier (preamp 1)	July 16, 2011
0084	HP	8566B	Spectrum Analyzer	April 5, 2011
1273	HP	85662A	Spectrum Analyzer Display	NCR
1530	Miteq	None	Microwave Preamplifier (preamp 2)	July 17, 2010
C030	None	None	Coaxial Cable (MRE band)	July 27, 2010

Asset #	Manufacturer	Model #	Description	Calibration Due
XXXX	Pasternack	LLS	2 sections, total 12ft	Cal Before Use
0582	EMCO	3115	Ridge Guide Antenna	October 19, 2010

1594	Miteq	AFS44-00102650	Microwave Preamplifier (preamp 1)	March 2, 2011
(Rental unit)	Agilent	E4446A	Spectrum Analyzer	July 6, 2012
1542	A.H. Systems	SAS 572	Antenna, Horn 18-26.5GHz	NCR
0897	Miteq	N/A	Microwave Preamplifier	July 14, 2011

Appendix A Test Setup Diagrams

FIGURE 1: Radiated Emissions Test Setup



Appendix B Test Results

Output Power Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	15.247	1m	Horn	1 MHz	1 MHz	Peak

COMMENT	Transmitting

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)
2405	0	1	105.1	26.4	29.0	2.8	110.5
2440	0	1	107.6	26.4	29.0	2.8	113.0
2480	0	1	106.7	26.4	29.0	2.8	112.1

Calculations

$$P = \frac{(E * d)^2}{30 * G}$$

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

Distance=1 meters
Gain=0 dBi

Calculated Result

Frequency (MHz)	Field Strength (dBµV)	E.I.R.P.		Limit (dBm)
		dBm	mW	
2405	110.5	7.77	5.984	30
2440	113.0	10.27	10.641	30
2480	112.1	9.37	8.649	30

NOTE: Computed power by applying a bandwidth correction factor of 10 log (EBW/1 MHz) to the spectral peak of the emission.

Transmit Power: 10 log (1.6 MHz / 1 MHz) = 2.04
2.04 was added to the measured value to compute real power in mW.

Power Spectral Density

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	15.247	1 m	Horn	3 kHz	300 kHz	Peak

COMMENT	Transmitting

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)
2405	0	1	91.6	26.4	29.0	2.8	97.0
2440	0	1	92.6	26.4	29.0	2.8	98.0
2480	0	1	92.8	26.4	29.0	2.8	98.2

Calculations

$$P = \frac{(E * d)^2}{30 * G}$$

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

Distance=1 meters
Gain=0 dBi

Calculated Result

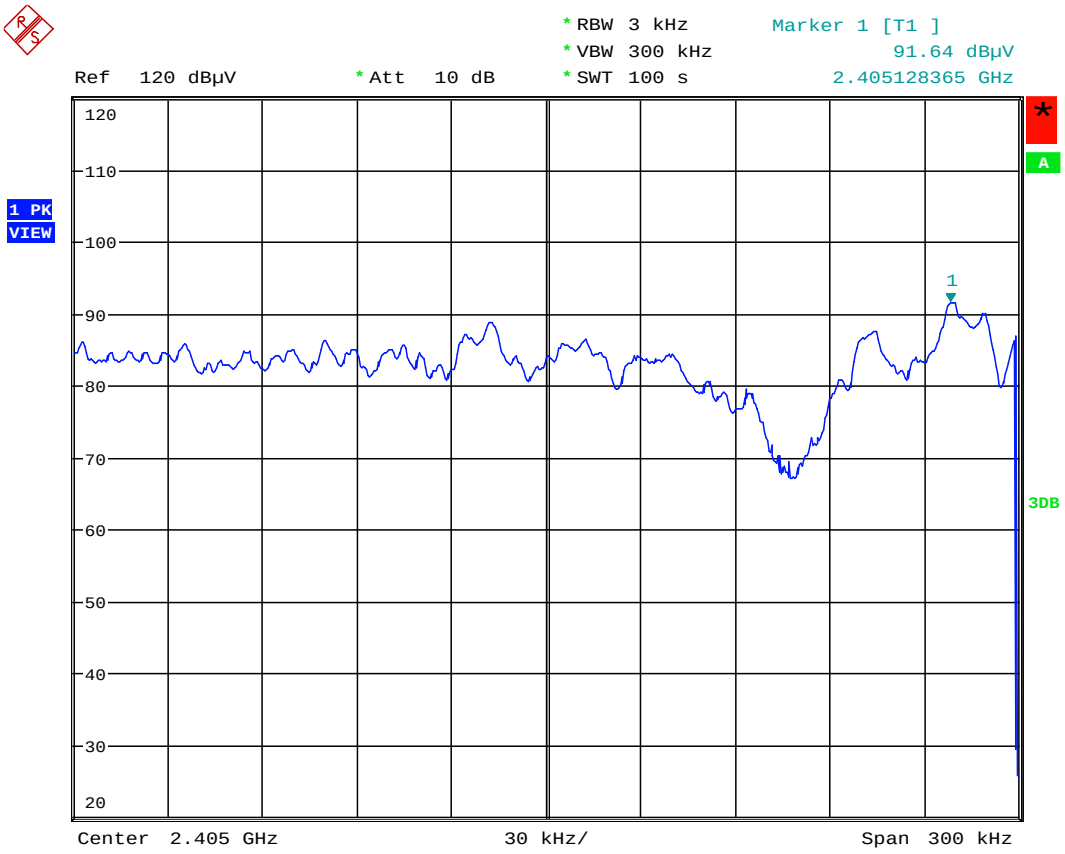
Frequency (MHz)	Field Strength (dBµV / 3 kHz)	E.I.R.P (dBm / 3 kHz)	Limit (dBm / 3 kHz)
2405	97.0	-7.77	8
2440	98.0	-6.77	8
2480	98.2	-6.57	8

Plots of PSD measurements are presented on the following pages.

Power Spectral Density Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	15.247	1m	Horn	3 kHz	300 kHz	Peak

Low Channel



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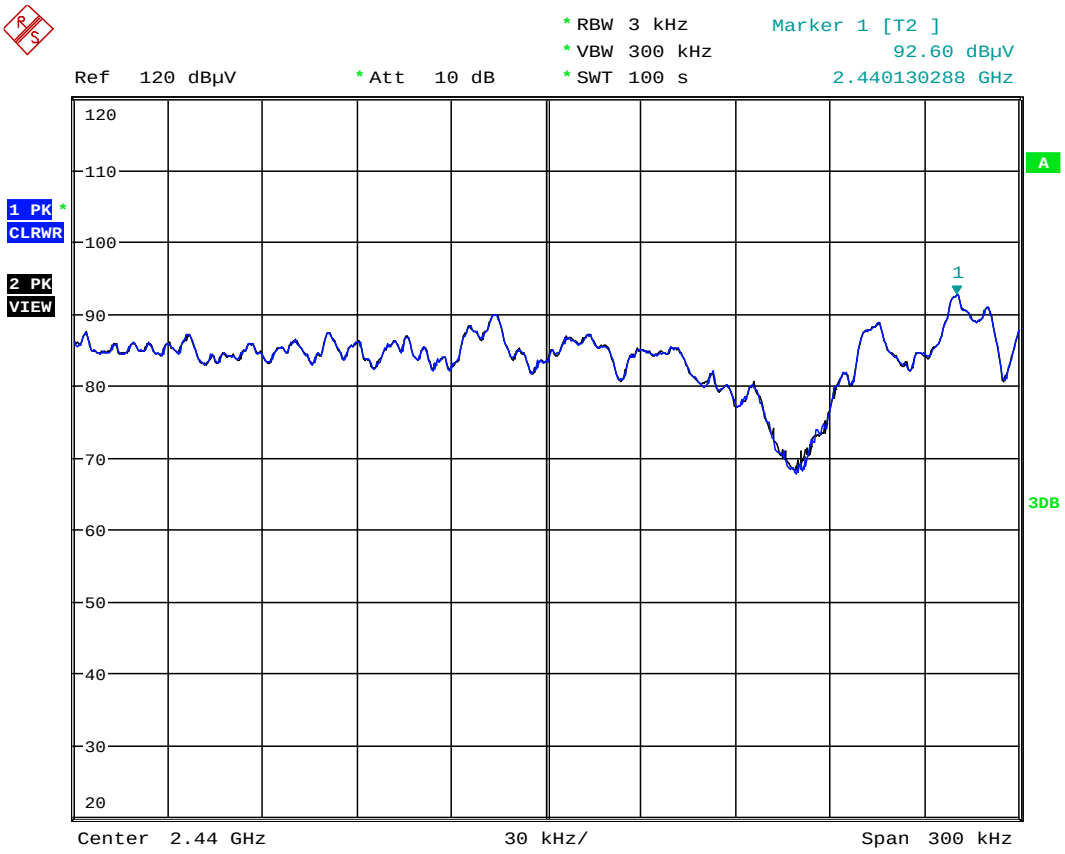
Power Spectral Density Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	15.247	1m	Horn	3 kHz	300 kHz	Peak

Middle Channel



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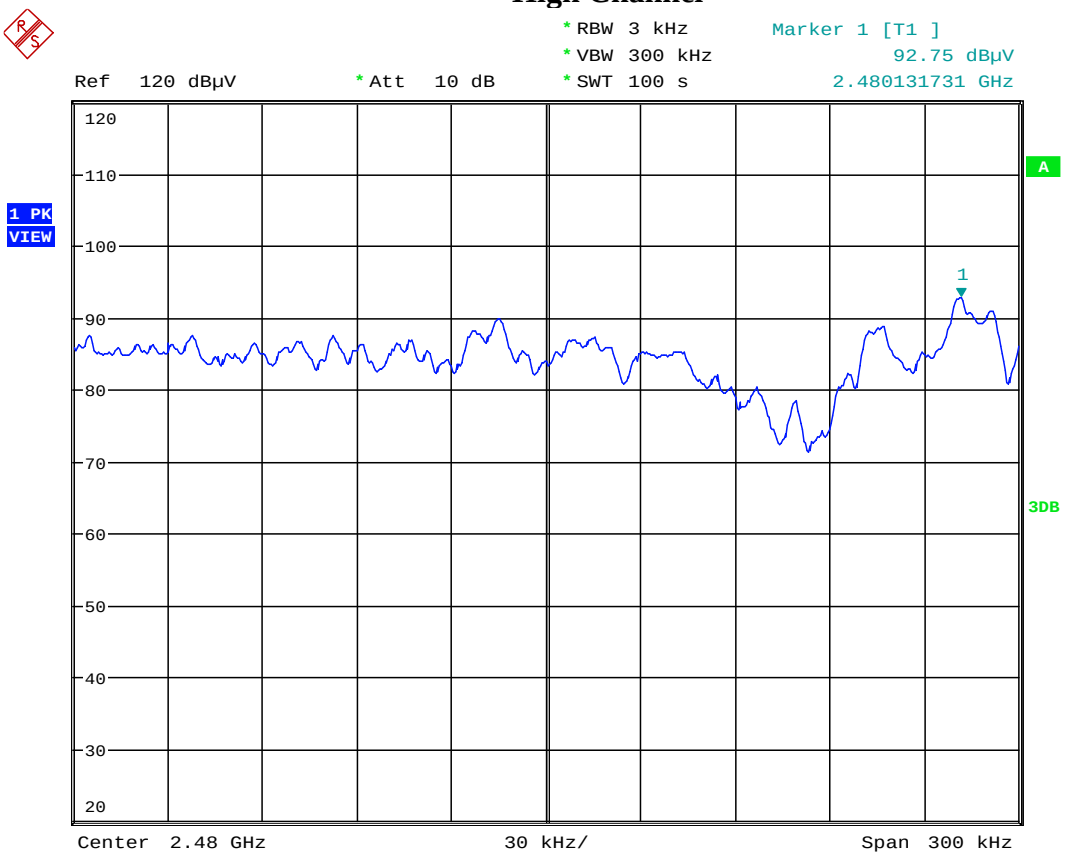
Power Spectral Density Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	15.247	1m	Horn	3 kHz	300 kHz	Peak

High Channel



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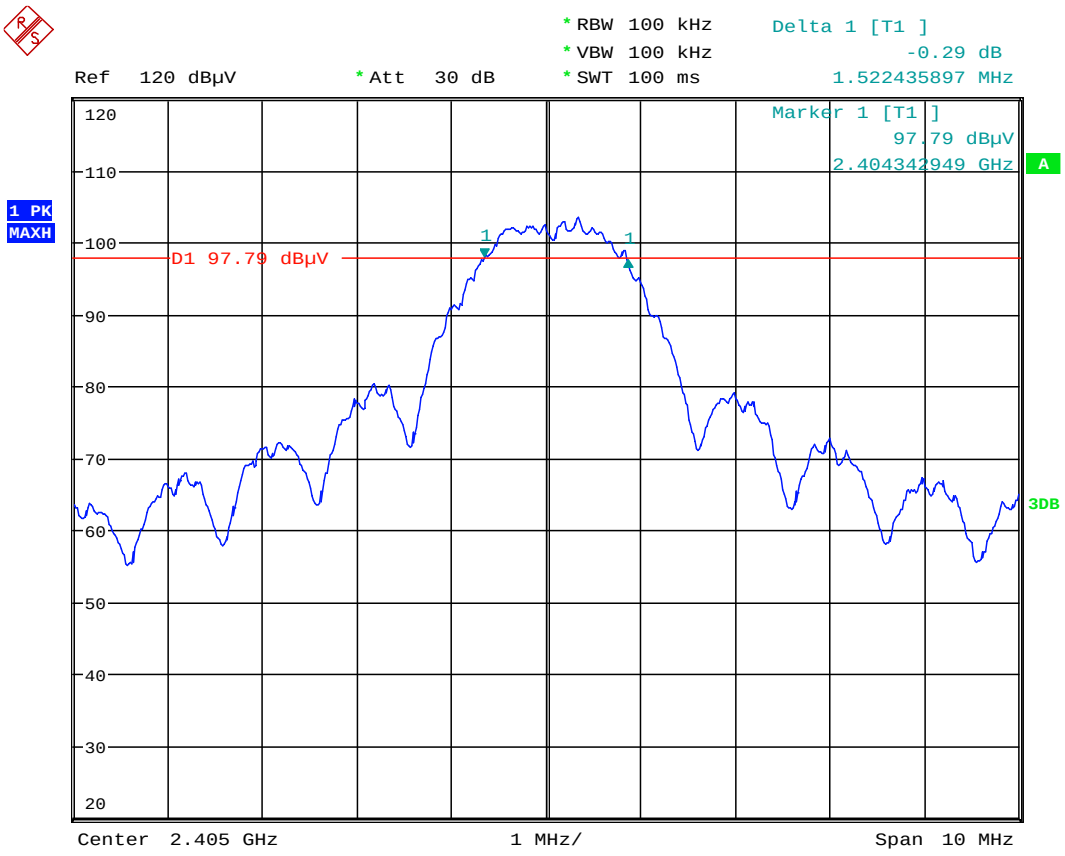
Occupied Bandwidth Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 13, 2010	15.247	1m	Horn	100 kHz	100 kHz	Peak

COMMENT	Transmitting Low Channel 6 dB Bandwidth – 1.522 MHz 20 dB Bandwidth – 2.612 MHz 26 dB Bandwidth – 4.246 MHz

Low Channel
6 dB



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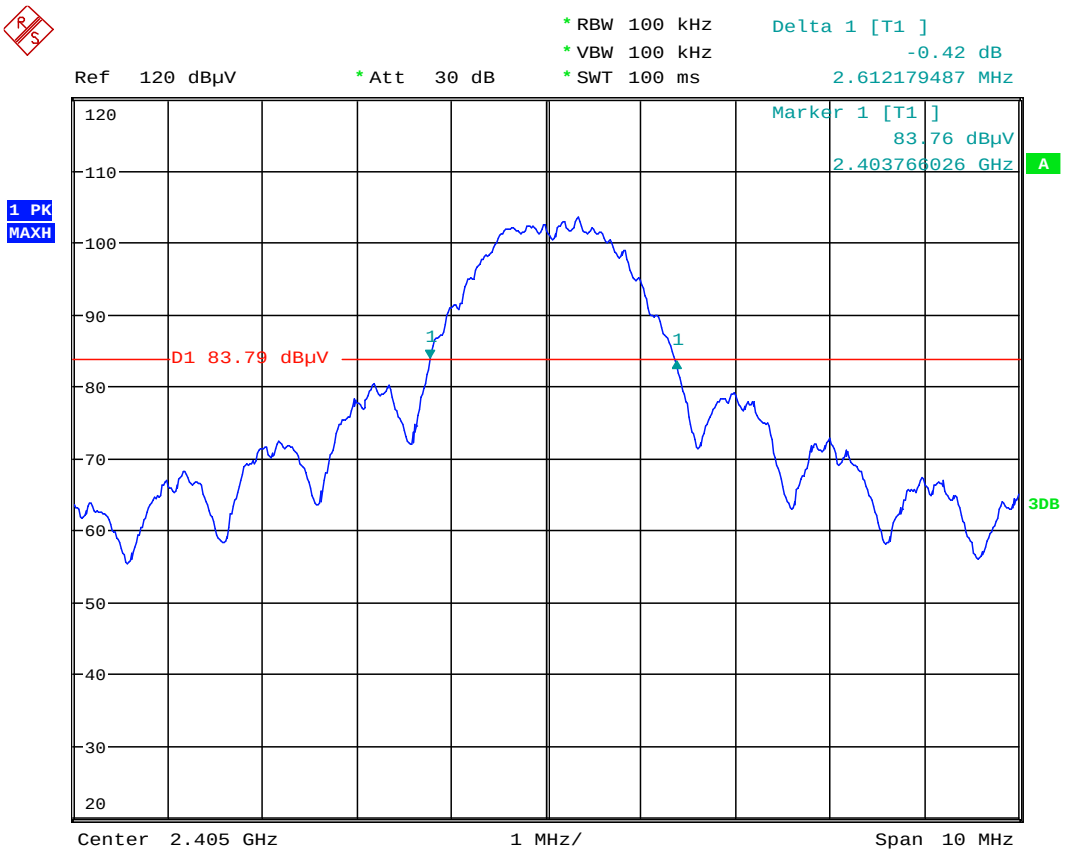
Low Channel
20 dB



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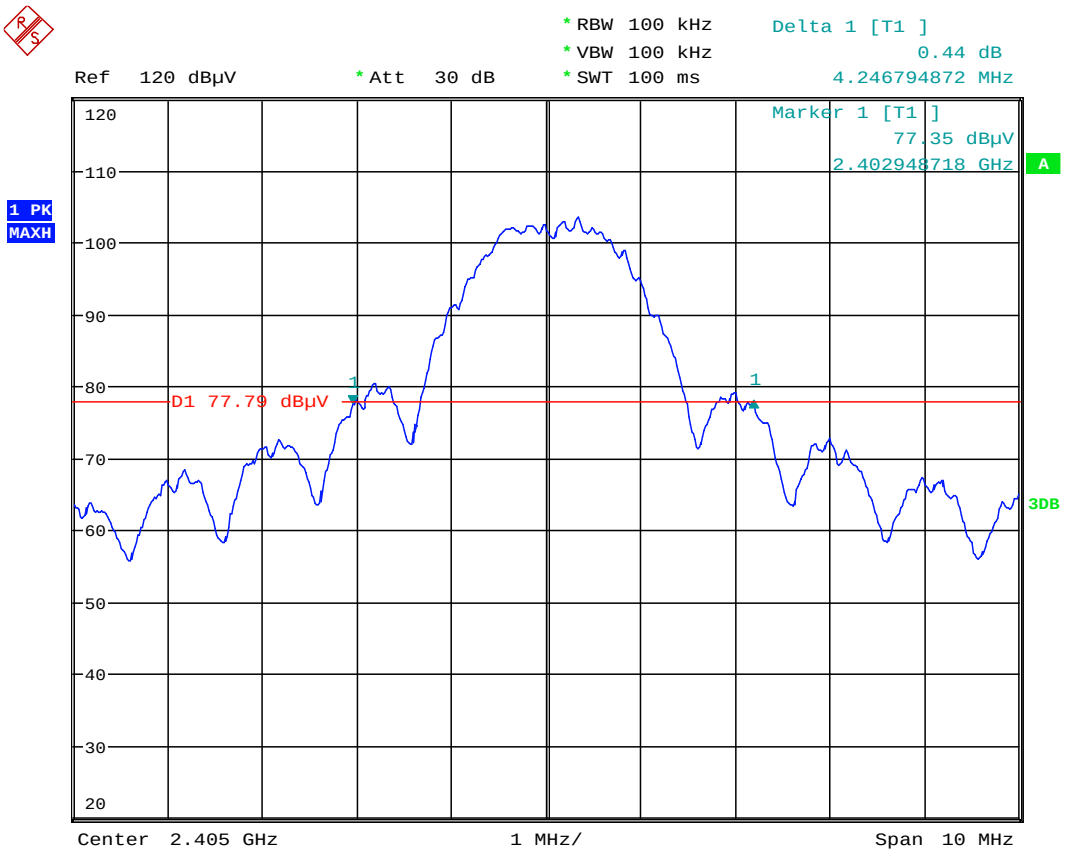
Low Channel
26 dB



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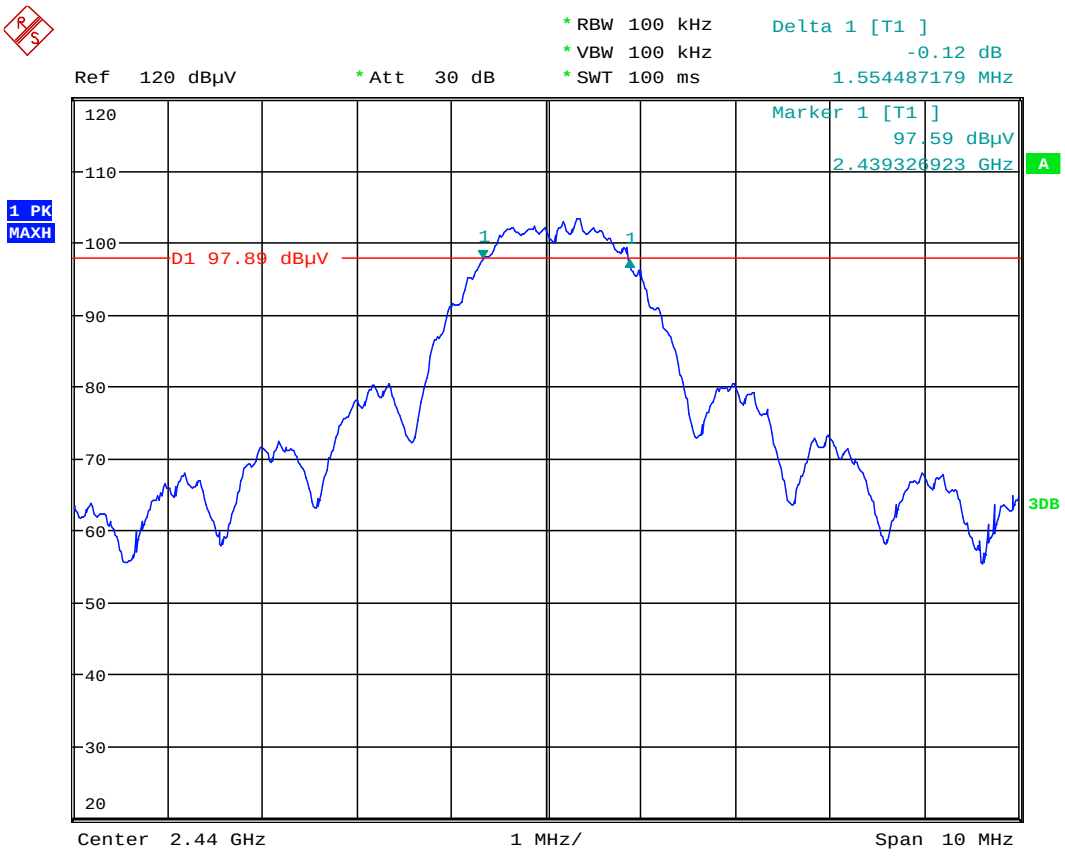
Result = Pass

Occupied Bandwidth Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 13, 2010	15.247	1m	Horn	100 kHz	100 kHz	Peak

COMMENT	Transmitting Middle Channel 6 dB Bandwidth – 1.554 MHz 20 dB Bandwidth – 2.628 MHz 26 dB Bandwidth – 4.262 MHz

Middle Channel
6dB



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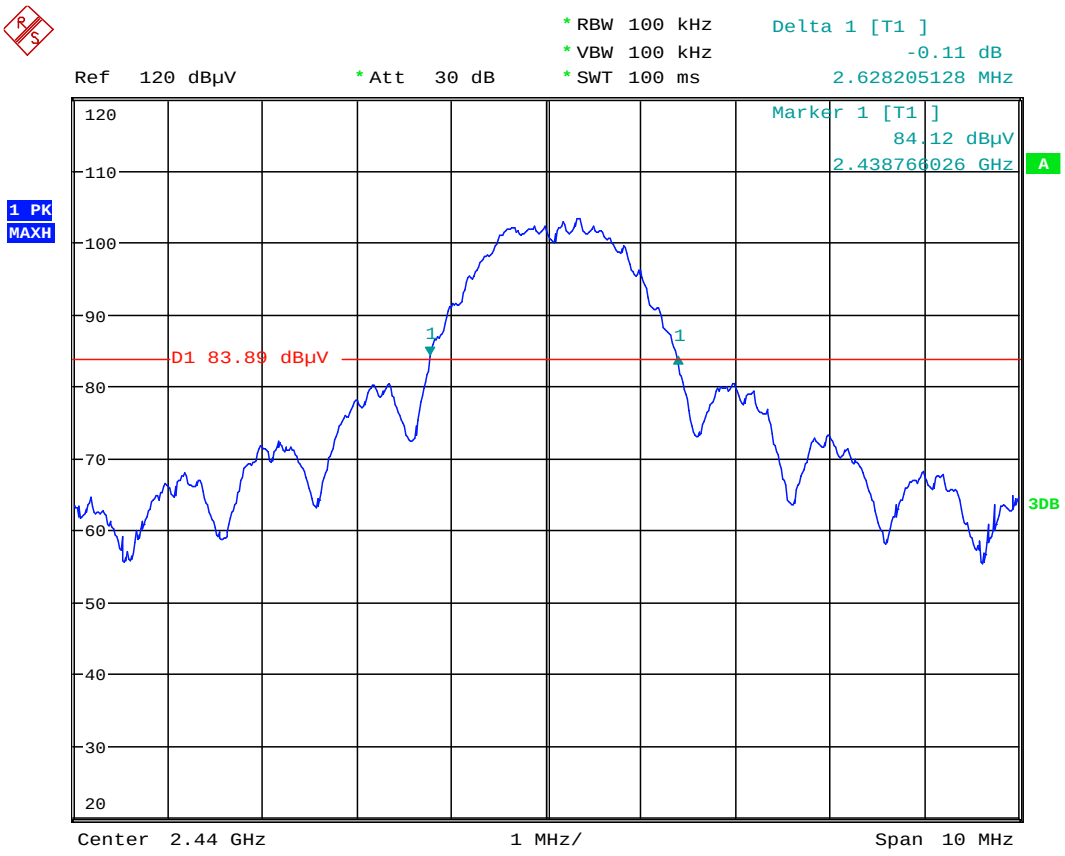
Middle Channel
20 dB



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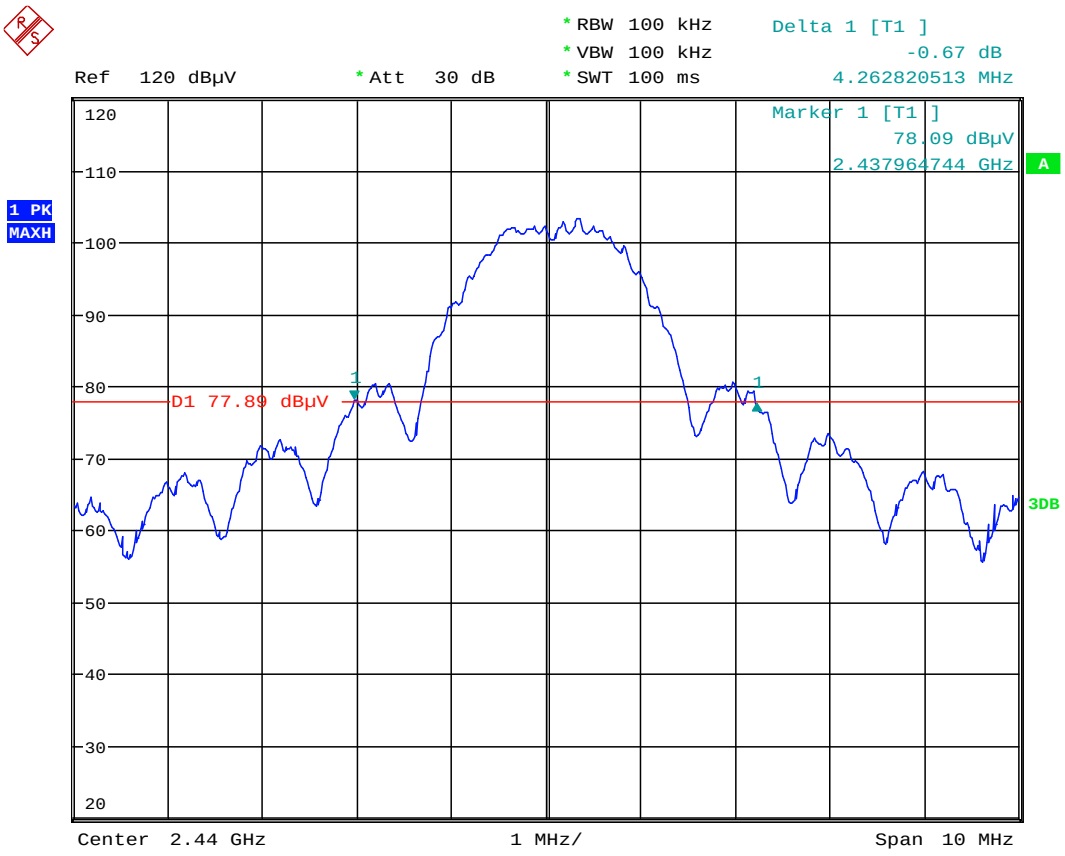
Middle Channel
26 dB



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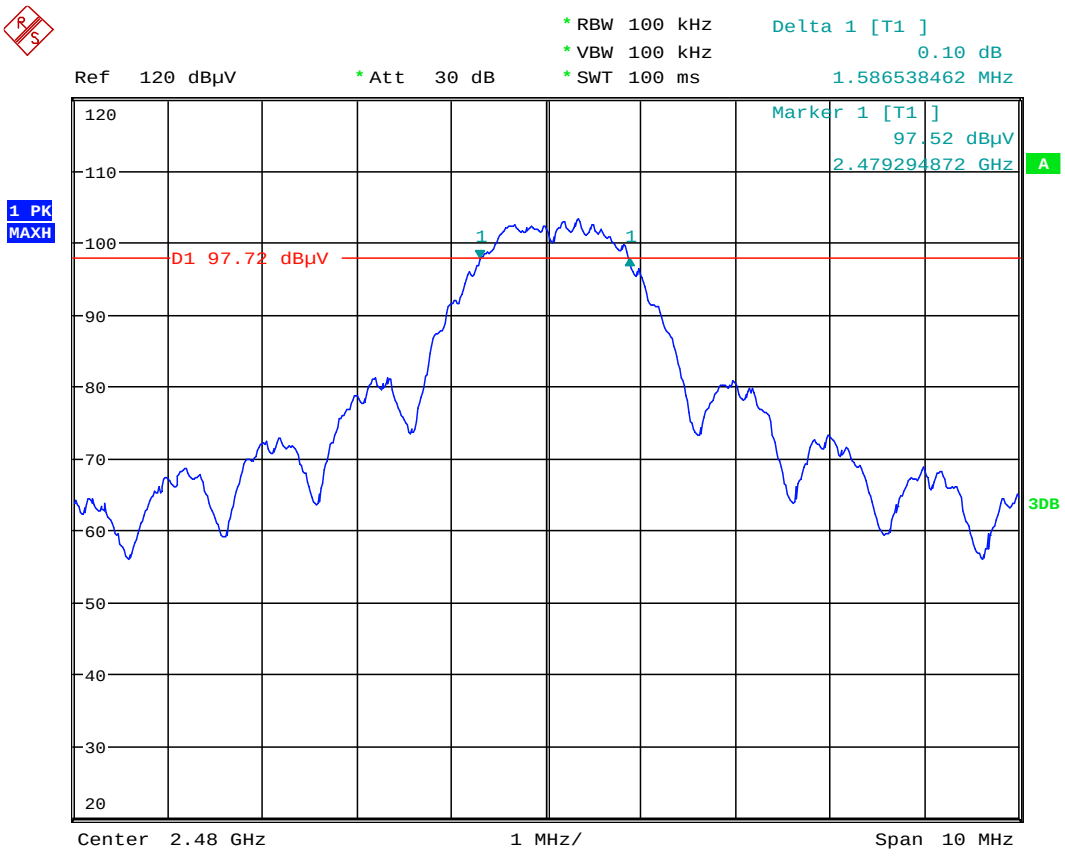
Result = Pass

Occupied Bandwidth Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 13, 2010	15.247	1m	Horn	100 kHz	100 kHz	Peak

COMMENT	Transmitting High Channel 6 dB Bandwidth – 1.586 MHz 20 dB Bandwidth –2.660 MHz 26 dB Bandwidth – 4.358 MHz

High Channel
6 dB



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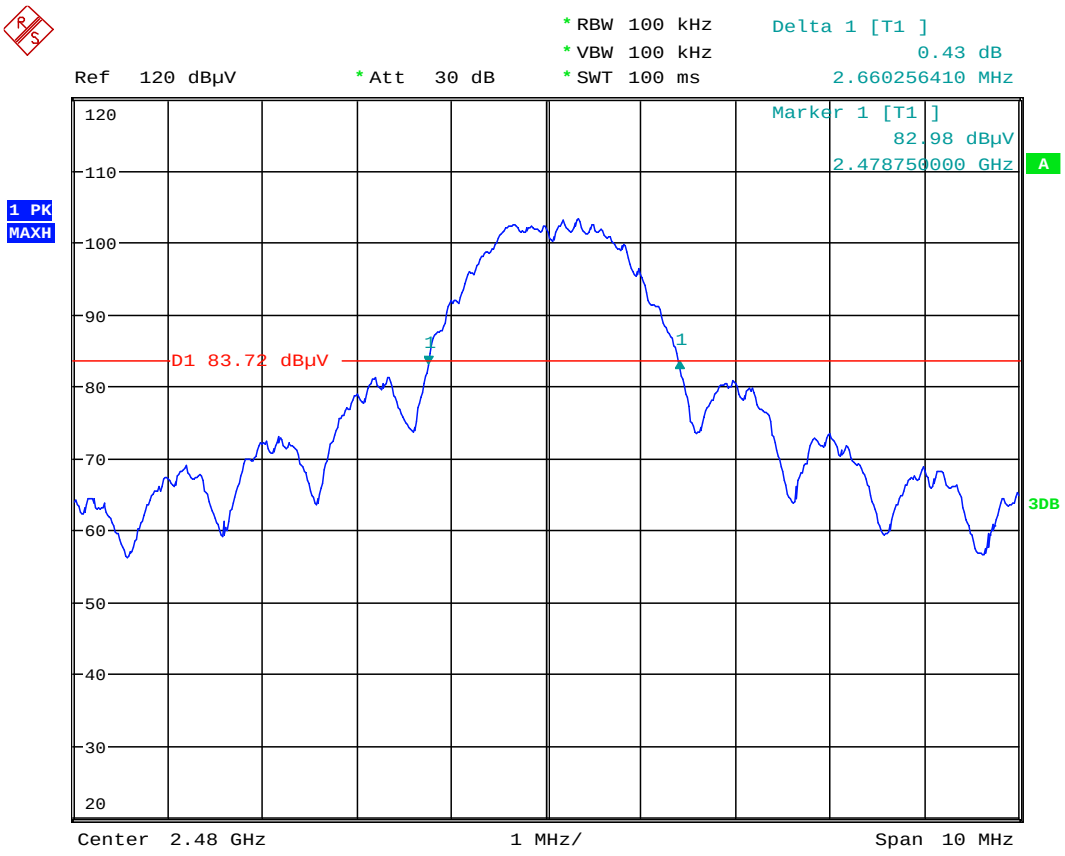
High Channel
20 dB



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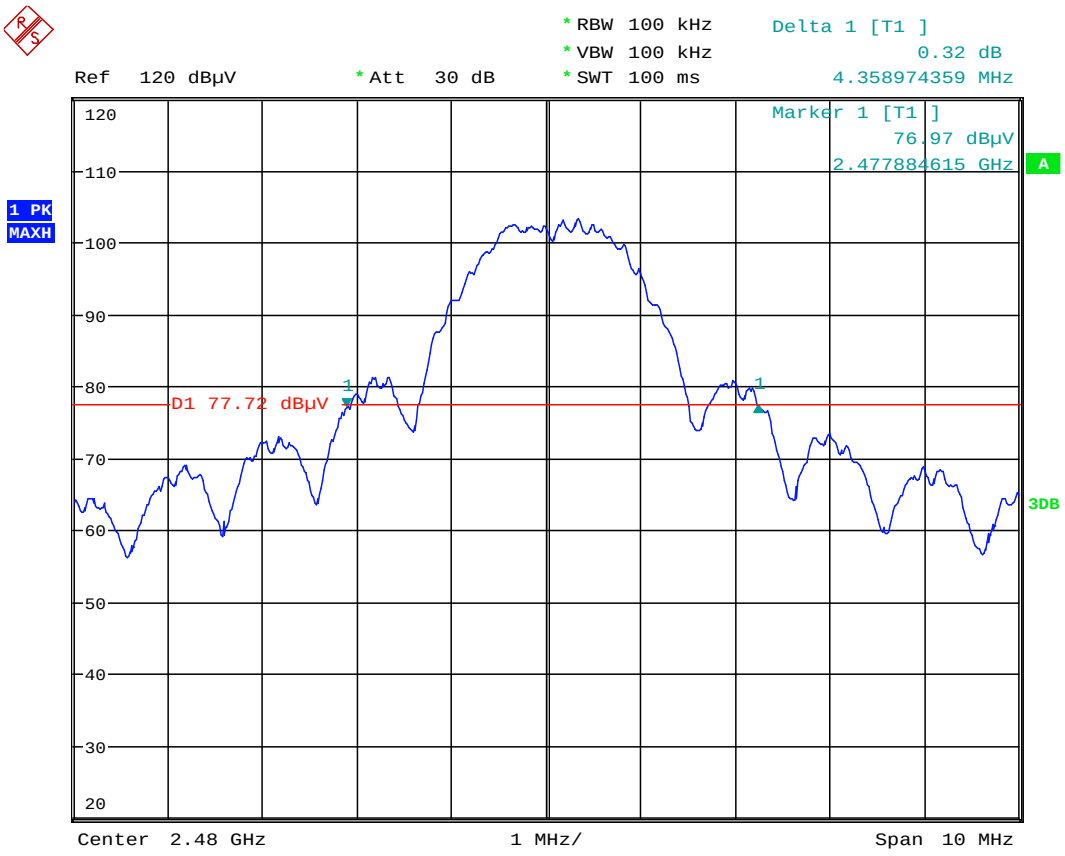
High Channel
26 dB



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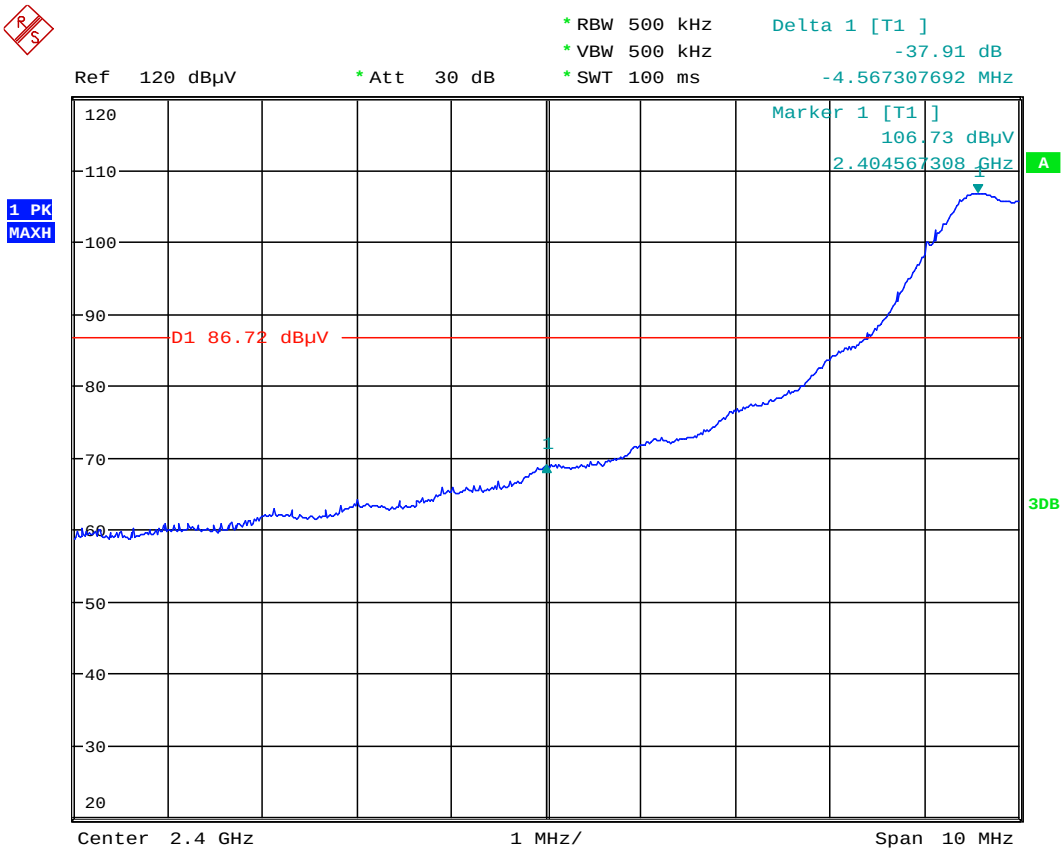
Band Edge Spurious Emissions Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 13, 2010	15.247	1m	Horn	500 kHz	500 kHz	Peak

COMMENT	Transmitting No spurs existed at the band edges by inspection of graphs; therefore no radiated measurement was made.

Frequency (MHz)	Recorded Level (dB)	Limit (dB) down from fundamental	Margin (dB)	Detector Function
2400	-37.91	-20.0	-17.91	Peak

Band Edge Low



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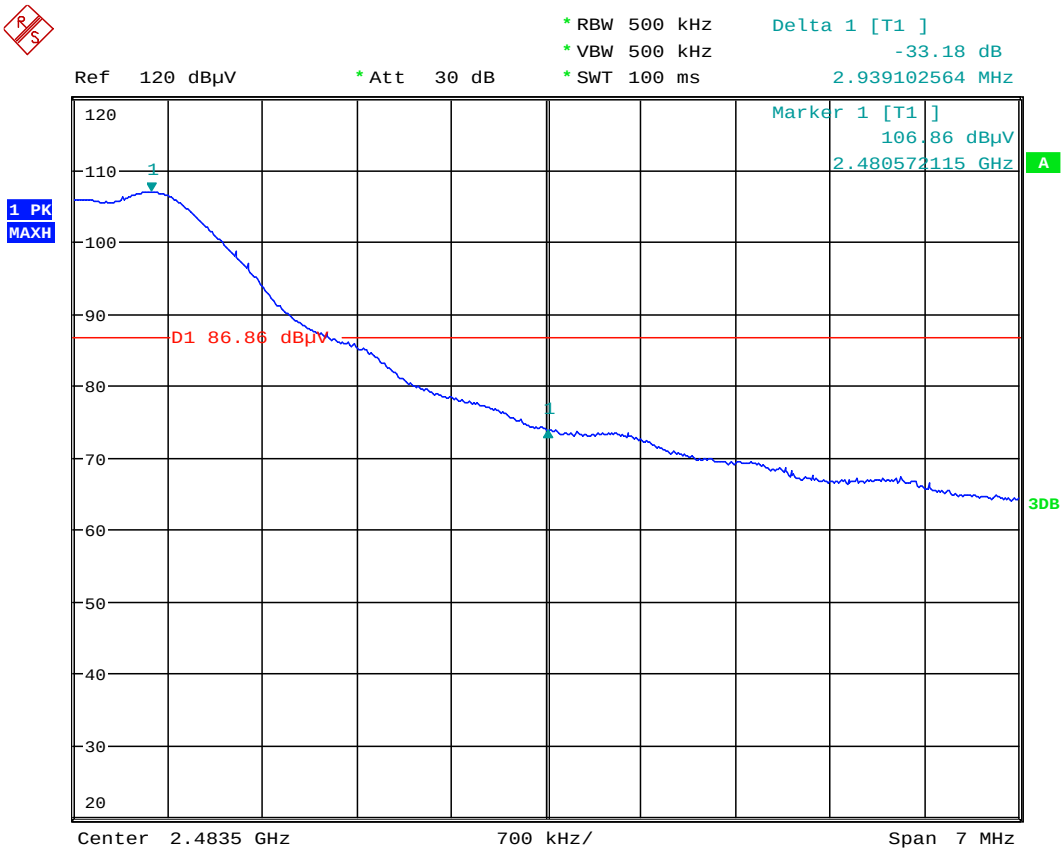
Band Edge Spurious Emissions Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 13, 2010	15.247	1m	Horn	500 kHz	500 kHz	Peak

COMMENT	Transmitting No spurs existed at the band edges by inspection of graphs; therefore no radiated measurement was made.

Frequency (MHz)	Recorded Level (dB)	Limit (dB) down from fundamental	Margin (dB)	Detector Function
2483.5	-33.18	-20.0	-13.18	Peak

Band Edge High



Date: 14.SEP.2010 00:14:44

Result = Pass

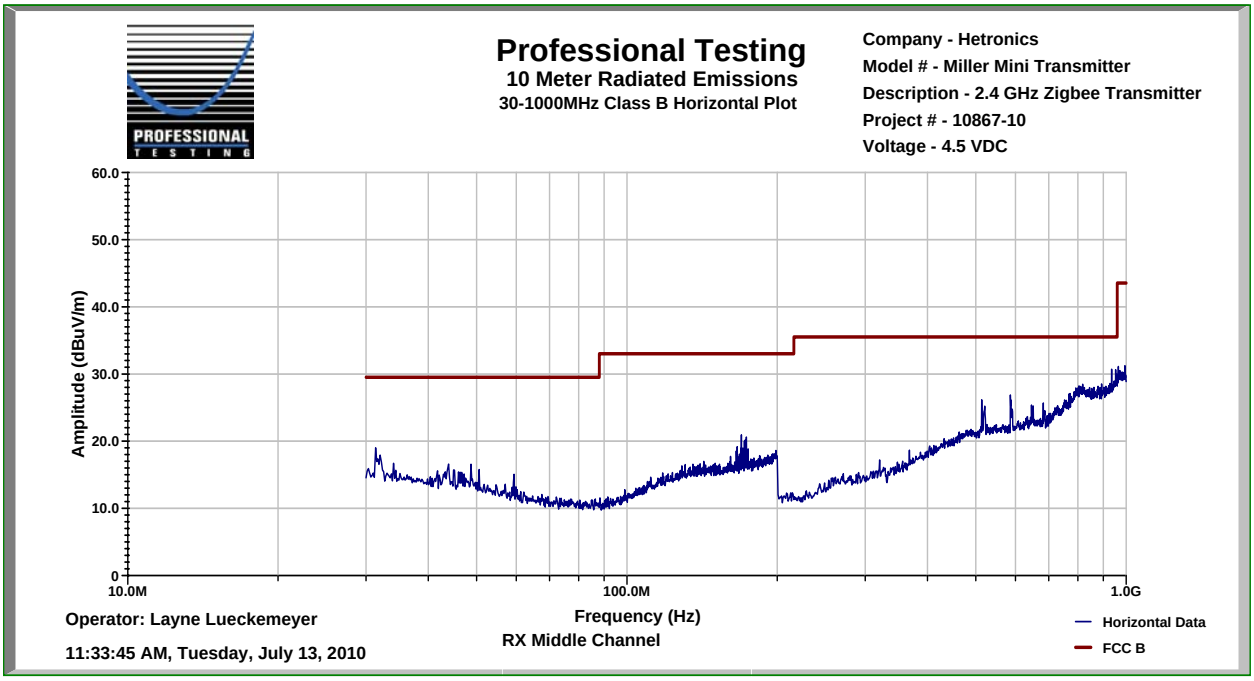
Spurious Radiated Emissions Data Sheet
Emissions 30 MHz … 1 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	10 m	Bicon | Log	CISPR 120 kHz	1 MHz	Quasi Peak

COMMENT	Transmitting Middle Channel

Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector
69.27	220	1	22.7	26.6	9.6	0.7	6.3	29.5	-23.2	QP
520	102	1	35.8	33.3	19.1	3.5	25.1	35.5	-10.4	QP
586.4	229	1.5	34.3	33.2	19.6	3.8	24.5	35.5	-11.0	QP



Result = Pass

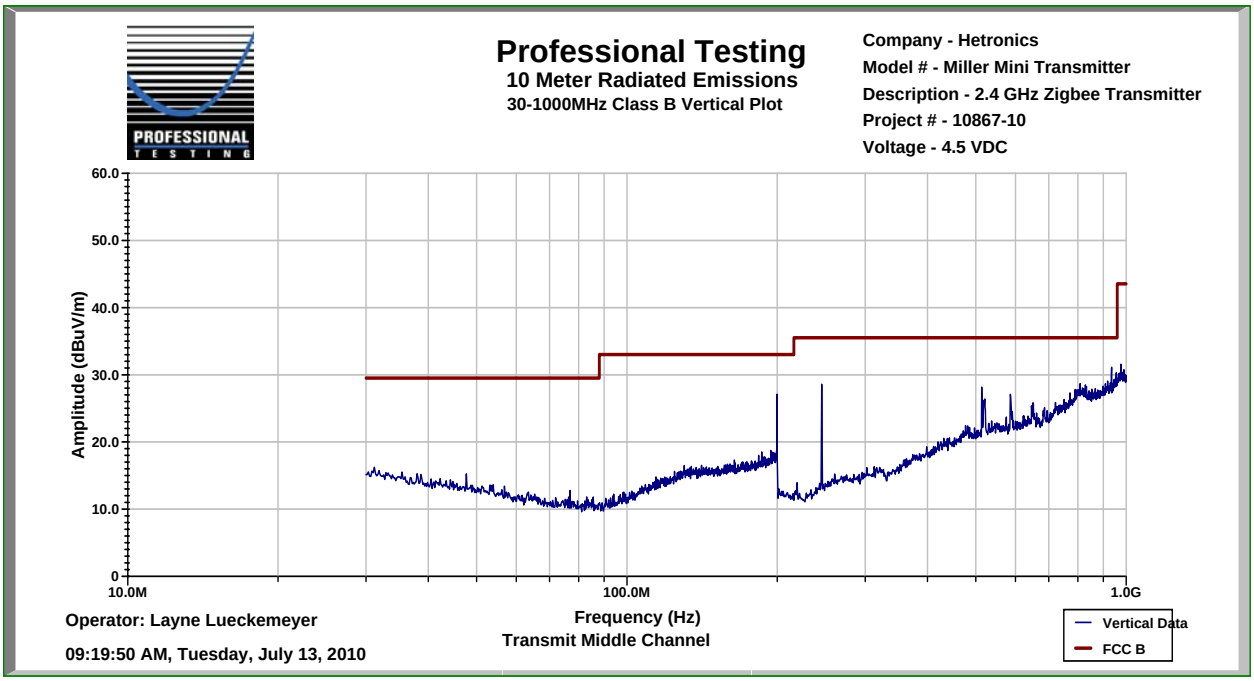
Spurious Radiated Emissions Data Sheet
Emissions 30 MHz … 1 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	10 m	Bicon | Log	CISPR 120 kHz	1 MHz	Quasi Peak

COMMENT	Transmitting Middle Channel

Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector
199.83	1	1	21.96	26.1	13.7	1.9	11.5	33	-21.5	QP
245.6	1	1	25.7	33.1	12.4	2.2	7.1	35.5	-28.4	QP
512.37	125	1.7	33.9	33.3	19.0	3.4	23.1	35.5	-12.4	QP



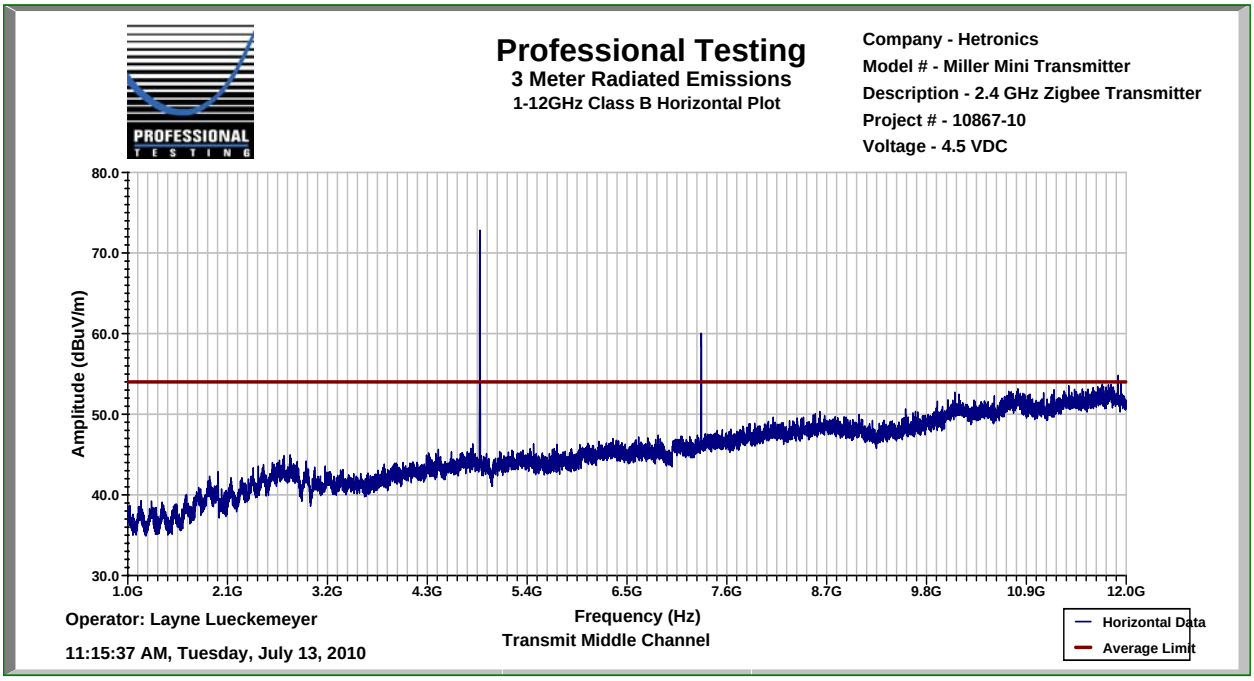
Result = Pass

Spurious Radiated Emissions Data Sheet
1 GHz…12 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	3 m	Horn	1 MHz	1 MHz	Average

COMMENT	Transmit Middle Channel

Horizontal



Result = Pass

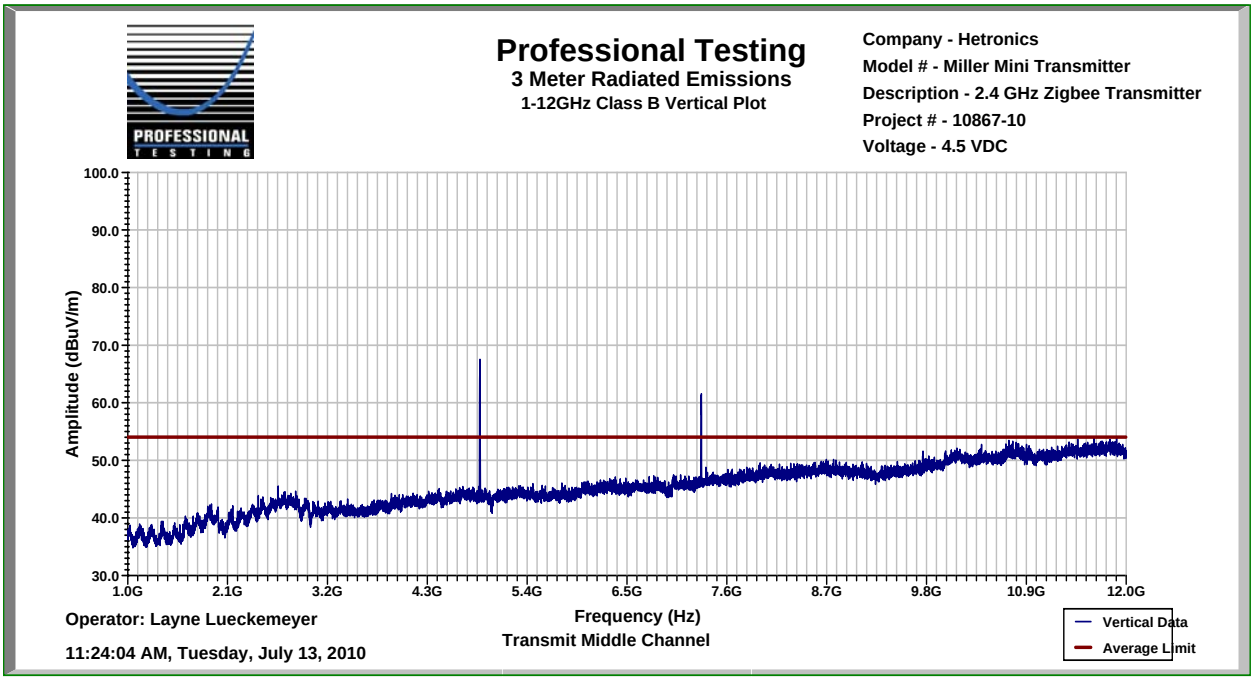
NOTE: Graphical Data for overview only. Pre scan used to determine if spurious signals other than harmonics were present.

Spurious Radiated Emissions Data Sheet
1 GHz…12 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	3 m	Horn	1 MHz	1 MHz	Average

COMMENT	Transmit Middle Channel

Vertical



Result = Pass

NOTE: Graphical Data for overview only. Pre scan used to determine if spurious signals other than harmonics were present.

Spurious/Harmonic Emissions
1 GHz … 25 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	FCC B	1 m	Horn	1 MHz	1 MHz	Average

COMMENT	Transmitting Low Channel Harmonics and spurious investigated up to 24.05 GHz.

Horizontal

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector Function
4.81	1	1	64.1	24.5	33.5	4.2	77.3	83.5	-6.2	Pk Hld
4.81	1	1	44.1	24.5	33.5	4.2	57.3	63.5	-6.2	Avg
7.215	1	1	44.2	24.4	36.8	5.0	61.7	63.5	-1.8	Avg
9.62	1	1	31.5	25.2	38.2	4.6	49.2	63.5	-14.3	Avg
12.025	1	1	33.2	24.3	40.3	7.1	56.3	63.5	-7.2	Avg
14.43	Noise	Floor	26.8	25.4	42.0	7.7	51.1	63.5	-12.4	Avg
16.835	Noise	Floor	26.9	24.1	41.0	7.6	51.4	63.5	-12.1	Avg
19.24	Noise	Floor	31.3	43.2	36.6	8.8	33.5	63.5	-30.0	Avg
21.645	Noise	Floor	31.9	41.8	36.9	9.5	36.5	63.5	-27.0	Avg
24.05	Noise	Floor	35.5	42.2	37.1	10.4	40.8	63.5	-22.7	Avg

Vertical

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector Function
4.81	1	1	58.6	24.5	33.5	4.2	71.8	83.5	-11.7	Pk Hld
4.81	1	1	38.6	24.5	33.5	4.2	51.8	63.5	-11.7	Avg
7.215	1	1	43.3	24.4	36.8	5.0	57.8	63.5	-2.7	Avg
9.62	1	1	34.6	25.2	38.2	4.6	52.3	63.5	-11.2	Avg
12.025	1	1	32.9	24.3	40.3	7.1	56.0	63.5	-7.5	Avg
14.43	Noise	Floor	26.5	25.4	42.0	7.7	50.8	63.5	-12.7	Avg
16.835	Noise	Floor	26.6	24.1	41.0	7.6	51.1	63.5	-12.4	Avg
19.24	Noise	Floor	31.5	43.2	36.6	8.8	33.7	63.5	-29.8	Avg
21.645	Noise	Floor	32.2	41.8	36.9	9.5	36.8	63.5	-26.7	Avg
24.05	Noise	Floor	35.3	42.2	37.1	10.4	40.6	63.5	-22.9	Avg

Result = Pass

NOTE: A correction factor of -20 dB was applied due to the duty cycle of the EUT being < 10 %. (See Pages 43-45 for timing data and calculation.)

Spurious/Harmonic Emissions
1 GHz … 25 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	FCC B	1 m	Horn	1 MHz	1 MHz	Average

COMMENT	Transmitting Middle Channel Harmonics and spurious investigated up to 24.4 GHz.

Horizontal

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector Function
4.88	1	1	62.8	24.4	33.5	4.2	76.2	83.5	-7.3	Pk Hld
4.88	1	1	42.8	24.4	33.5	4.2	56.2	63.5	-7.3	Avg
7.32	1	1	45.6	24.1	36.8	5.1	63.4	63.5	-0.1	Avg
9.76	1	1	29.7	23.6	38.2	5.0	49.2	63.5	-14.3	Avg
12.2	1	1	29.8	27.8	39.5	5.6	47.1	63.5	-16.4	Avg
14.64	Noise	Floor	27.6	23.5	41.4	6.1	51.6	63.5	-11.9	Avg
17.08	Noise	Floor	27.7	22.0	42.7	7.6	56.0	63.5	-7.5	Avg
19.52	Noise	Floor	31.4	43.5	36.5	6.7	31.1	63.5	-32.4	Avg
21.96	Noise	Floor	32.1	40.6	36.9	10.4	38.8	63.5	-24.7	Avg
24.4	Noise	Floor	34.9	42.2	37.2	10.3	40.1	63.5	-23.4	Avg

Vertical

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector Function
4.88	1	1	60.2	24.4	33.5	4.2	73.6	83.5	-9.9	Pk Hld
4.88	1	1	40.2	24.4	33.5	4.2	53.6	63.5	-9.9	Avg
7.32	1	1	45.1	24.1	36.8	5.1	62.9	63.5	-0.6	Avg
9.76	1	1	39.3	23.6	38.2	5.0	58.8	63.5	-4.7	Avg
12.2	1	1	30.7	27.8	39.5	5.6	48.0	63.5	-15.5	Avg
14.64	Noise	Floor	27.4	23.5	41.4	6.1	51.4	63.5	-12.1	Avg
17.08	Noise	Floor	27.3	22.0	42.7	7.6	55.6	63.5	-7.9	Avg
19.52	Noise	Floor	34.1	43.5	36.5	6.7	33.8	63.5	-29.7	Avg
21.96	Noise	Floor	32.7	40.6	36.9	10.4	39.4	63.5	-24.1	Avg
24.4	Noise	Floor	35.3	42.2	37.2	10.3	40.5	63.5	-23.0	Avg

Result = Pass

NOTE: A correction factor of -20 dB was applied due to the duty cycle of the EUT being < 10 %. (See Pages 43-45 for timing data and calculation.)

Spurious/Harmonic Emissions
1 GHz … 25 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	September 22, 2010	FCC B	1 m	Horn	1 MHz	1 MHz	Average

COMMENT	Transmitting High Channel Harmonics and spurious investigated up to 24.8 GHz.

Horizontal

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector Function
4.96	1	1	63.2	24.4	33.5	4.2	76.6	83.5	-6.9	Pk Hld
4.96	1	1	43.2	24.4	33.5	4.2	56.6	63.5	-6.9	Avg
7.44	1	1	45.5	24.1	37.3	4.5	63.2	63.5	-0.3	Avg
9.92	1	1	35.3	23.6	38.2	5.0	54.9	63.5	-8.6	Avg
12.4	1	1	25.6	27.8	39.9	6.2	43.9	63.5	-19.6	Avg
14.88	Noise	Floor	27.1	23.5	41.1	7.3	52.0	63.5	-11.5	Avg
17.36	Noise	Floor	26.8	22.0	44.6	8.7	58.1	63.5	-5.4	Avg
19.84	Noise	Floor	31.5	43.7	36.5	8.2	32.6	63.5	-30.9	Avg
22.32	Noise	Floor	32.7	40.5	37.1	9.4	38.7	63.5	-24.8	Avg
24.8	Noise	Floor	36.5	42.1	37.2	10.1	41.7	63.5	-21.8	Avg

Vertical

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector Function
4.96	1	1	59.8	24.4	33.5	4.2	73.2	83.5	-10.3	Pk Hld
4.96	1	1	39.8	24.4	33.5	4.2	53.2	63.5	-10.3	Avg
7.44	1	1	42.2	24.1	37.3	4.5	59.9	63.5	-3.6	Avg
9.92	1	1	31.1	23.6	38.2	5.0	50.7	63.5	-12.8	Avg
12.4	Noise	Floor	25.8	27.8	39.9	6.2	44.1	63.5	-19.4	Avg
14.88	Noise	Floor	26.6	23.5	41.1	7.3	51.5	63.5	-12.0	Avg
17.36	Noise	Floor	26.7	22.0	44.6	8.7	58.0	63.5	-5.5	Avg
19.84	Noise	Floor	31.8	43.7	36.5	8.2	32.9	63.5	-30.6	Avg
22.32	Noise	Floor	32.8	40.5	37.1	9.4	38.8	63.5	-24.7	Avg
24.8	Noise	Floor	36.3	42.1	37.2	10.1	41.5	63.5	-22.0	Avg

Result = Pass

NOTE: A correction factor of -20 dB was applied due to the duty cycle of the EUT being < 10 %. (See Pages 43-45 for timing data and calculation.)

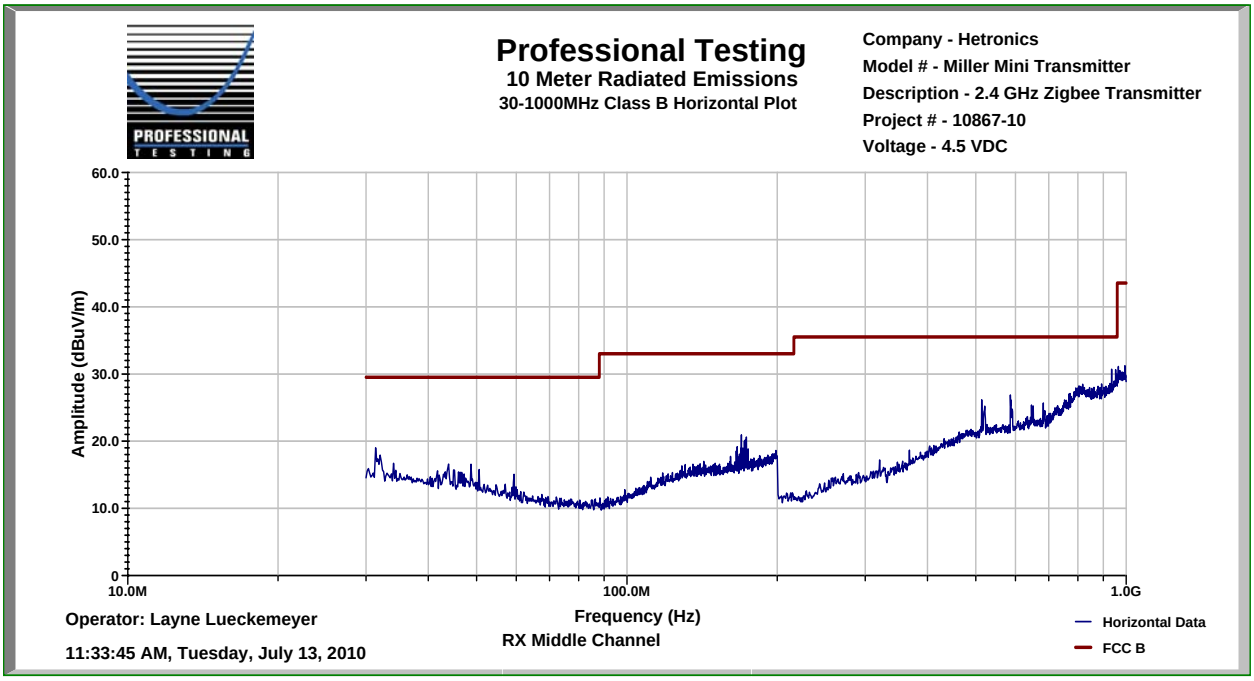
Receiver Radiated Spurious Emissions Data Sheet
30 MHz…1 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	10 m	Bicon | Log	CISPR 120 kHz	1 MHz	Quasi Peak

COMMENT	Receive Mode Only

Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector
169.57	226	1	20.9	26.3	12.5	1.7	8.8	33	-24.2	QP
513.6	119	1	26.1	33.3	19.0	3.5	15.3	35.5	-20.2	QP
586.4	230	1	26.9	33.2	19.6	3.8	17.1	35.5	-18.4	QP



Result = Pass

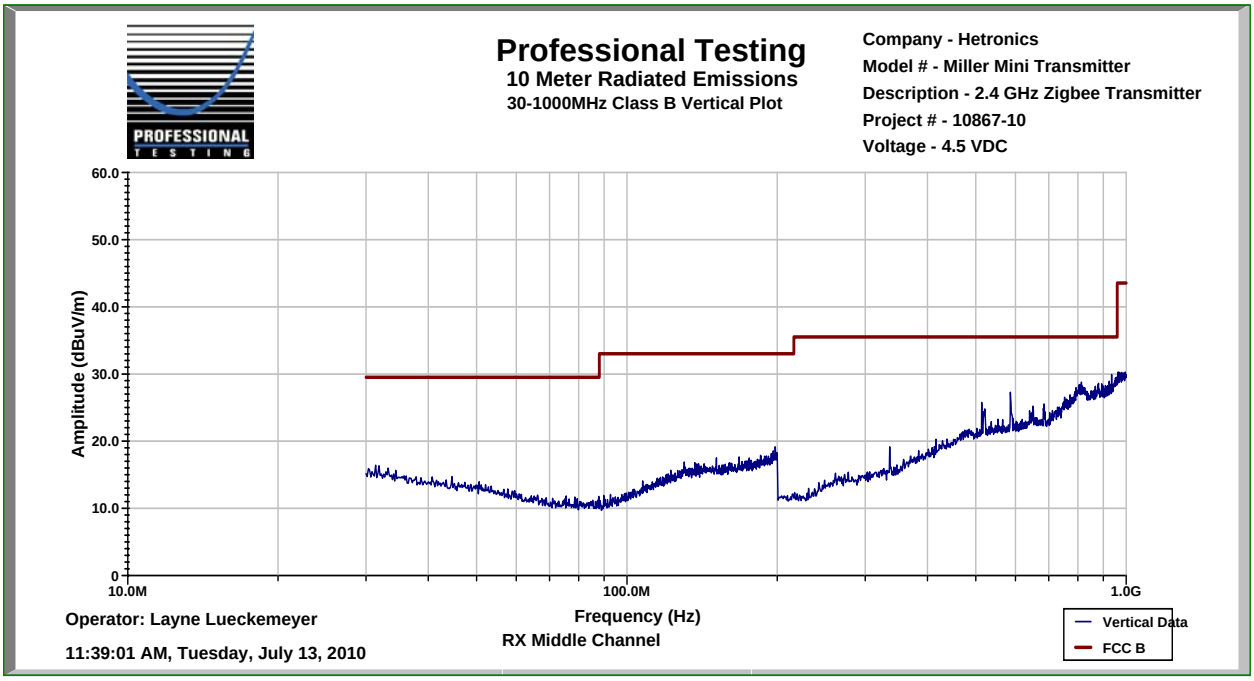
Receiver Radiated Spurious Emissions Data Sheet
30 MHz…1 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	10 m	Bicon | Log	CISPR 120 kHz	1 MHz	Quasi Peak

COMMENT	Receive Mode Only

Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector
336	1	1	19.1	33.4	14.5	2.8	3	35.5	-32.5	QP
513.6	1	1	25.7	33.3	19.0	3.5	14.9	35.5	-20.6	QP
586.4	1	1.7	27.3	33.2	19.6	3.8	17.5	35.5	-18	QP



Result = Pass

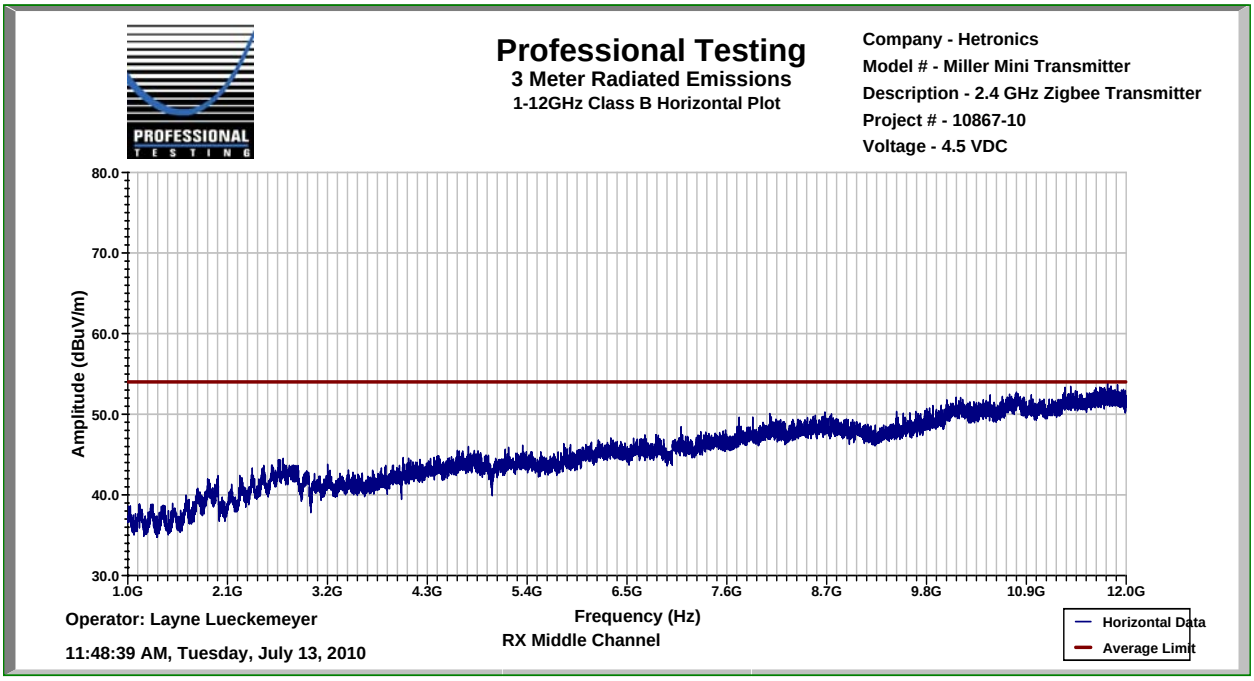
Receiver Radiated Spurious Emissions Data Sheet
1 GHz … 12 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	3 m	Horn	1 MHz	1 MHz	Peak/Avg

COMMENT	Receive Mode only

Horizontal

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector
5196	Noise	Floor	45.9	52.7	35.3	8.0	36.5	54	-17.5	Avg
6322	Noise	Floor	47.1	53.4	36.5	9.0	39.1	54	-14.9	Avg
10176	Noise	Floor	52.1	50.9	38.8	11.0	51.1	54	-2.9	Avg



Result = Pass

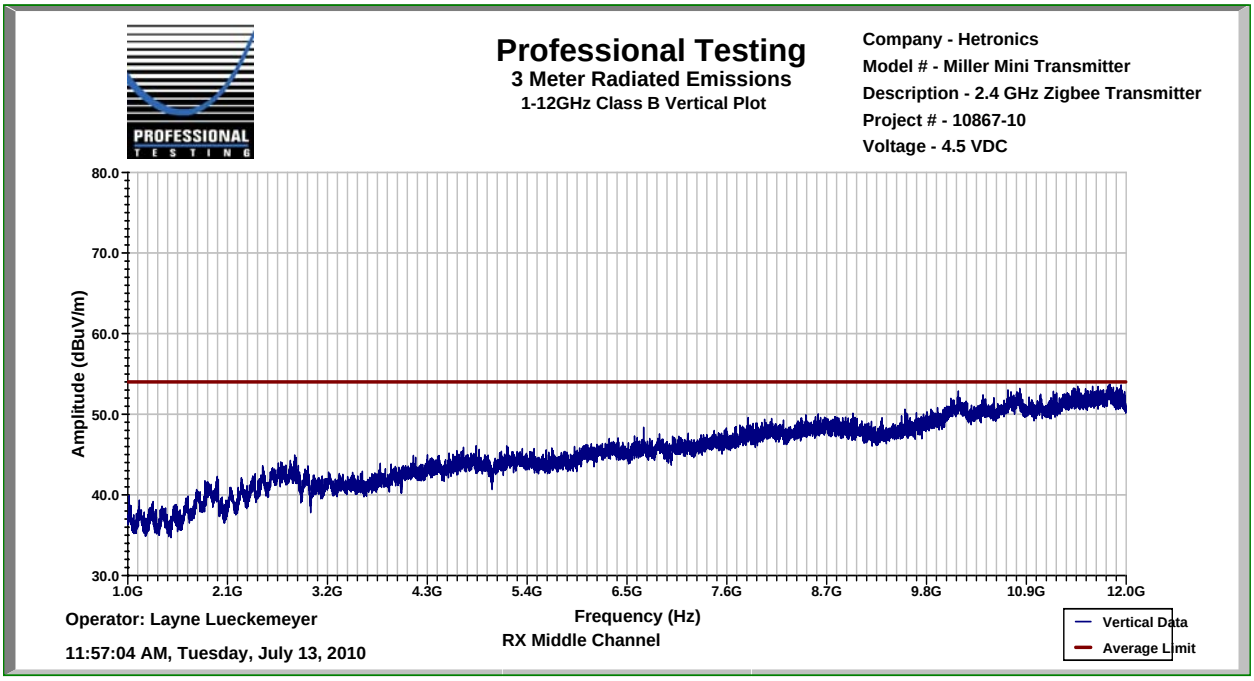
Receiver Radiated Spurious Emissions Data Sheet
1 GHz … 12 GHz

PROJECT #	DATE	CLASS	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	July 13, 2010	FCC B	3 m	Horn	1 MHz	1 MHz	Peak/Avg

COMMENT	Receive Mode only

Vertical

Frequency (MHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBµV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Level (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Detector
4839	Noise	Floor	46.1	52.7	35.0	7.8	36.2	54	-17.8	Avg
6684	Noise	Floor	48.3	52.0	36.6	9.3	42.3	54	-11.7	Avg
9563	Noise	Floor	50.6	51.0	38.0	10.0	47.6	54	-6.4	Avg

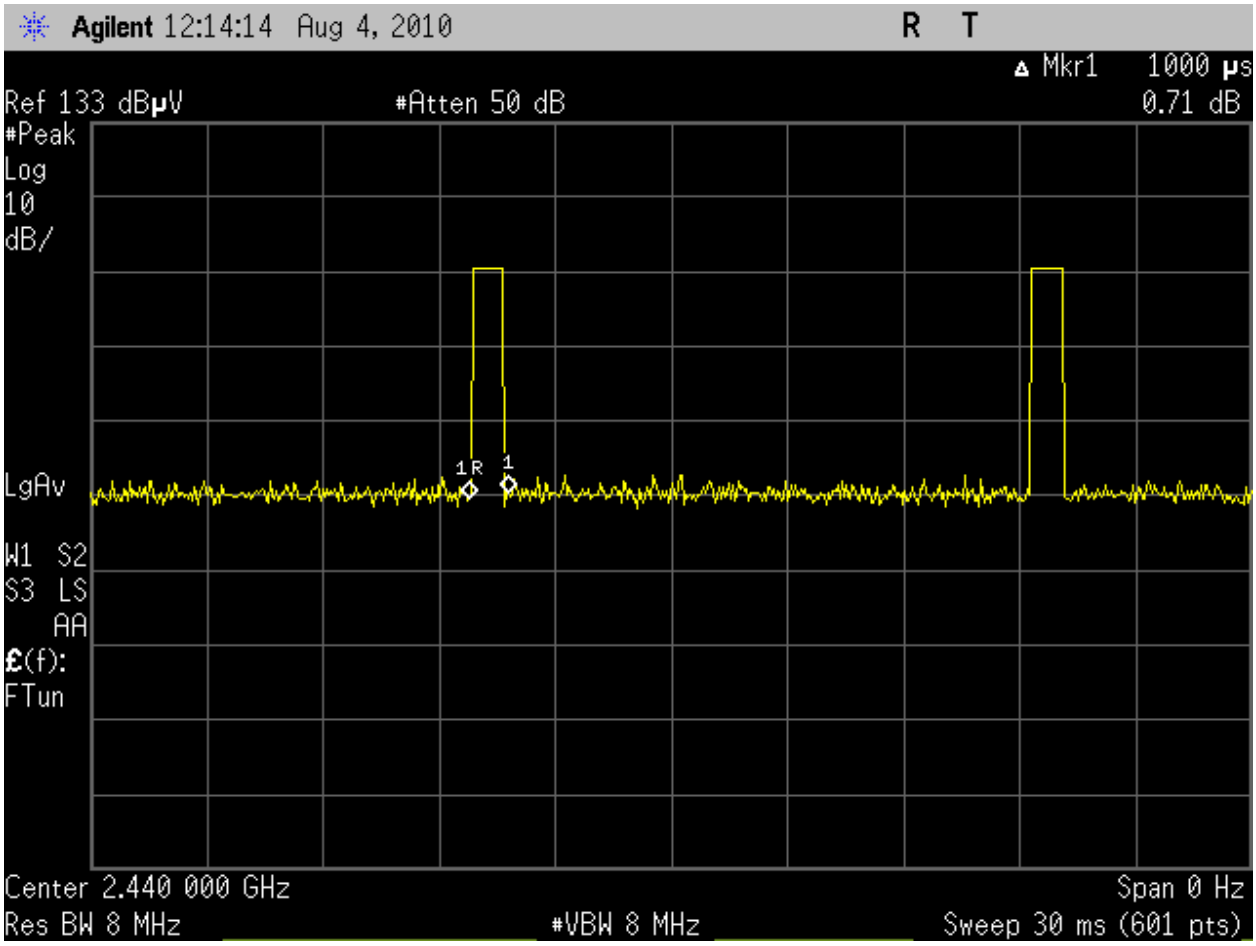


Result = Pass

Timing Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	August 4, 2010	15.247	1 m	Horn	1 MHz	1 MHz	Average

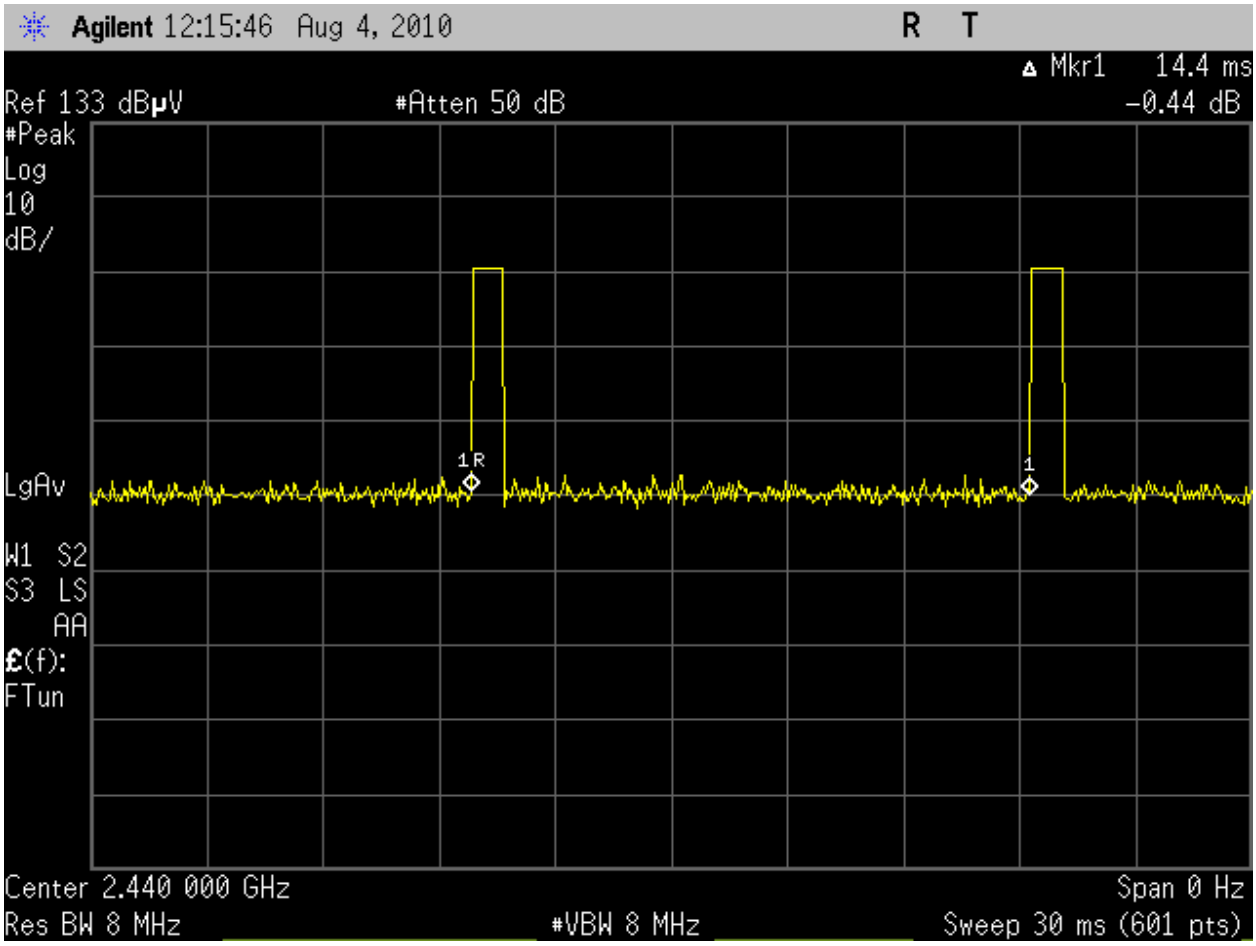
COMMENT	Timing data is used to calculate duty cycle of Miller Hand Control



Timing Data Sheet

PROJECT #	DATE	RULE	DISTANCE	ANTENNA	RBW	VBW	DETECTOR
10867-10	August 4, 2010	15.247	1 m	Horn	1 MHz	1 MHz	Average

COMMENT	Timing data is used to calculate duty cycle of Miller Hand Control



Duty Cycle is calculated at < 10%

Timing Calculation

Duty Cycle = 10%
Peak to Average Factor = 20*log(Duty Cycle)
Peak to Average Factor = 20*log(0.10)

Peak to Average Factor = -20 dB