Project 10366-10

Prepared for:
Hubbell Building Automation, Inc.
9601 Dessau Road, Suite 100
Austin, Texas 78754

By

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

September 9, 2010

# CERTIFICATION
# Wireless Test Report
# Hubbell Building Automation, Inc.
# WiHubb

**Revision History**

| Revision History | | |
|---|---|---|
| **Revision Number** | **Description** | **Date** |
| 00 | First Revision of Test Report | July 7, 2010 |
| 01 | Amend to add Conducted Emissions Data | August 2, 2010 |
| 02 | Amend to correct Peak Power, Occupied Bandwidth, Harmonic Emissions data, Band Edge measurements | August 12, 2010 |
| 03 | Amend to correct Occupied Bandwidth, Number of channels /Channel Separation, Timing | September 9, 2010 |

## Table of Contents

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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: | Hubbell Building Automation, Inc. |
| Applicant's Address: | 9601 Dessau Road, Suite 100 |
| | Austin, TX 78754 |
| FCC ID: | YH9WIHUBB |
| IC Number: | 9044AWIHUBB |
| Project Number: | 10366-10 |
| Test Dates: | July 29, August 11- 12, September 2, 2010 |

The **Hubbell Building Automation, Inc. WiHubb** 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) |
|---|---|---|---|---|---|
| Mains Conducted | N/A | N/A | | N/A | N/A |
| Radiated Spurious | 1855 | 42.9 dBµV/m | | 63.5 dBµV/m | -20.6 |
| Peak Power | 902.74 | 19.7 dBm | 93.33 mW | +30 dBm | -10.3 |

| Occupied Bandwidth | | Emission Designator | Channel Separation | Number of Hopping Channels |
|---|---|---|---|---|
| 20 dB | 26 dB | | | |
| 374.9 kHz | 424.3 kHz | 424KFXD | 500 kHz | 50 |

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
EMC Engineer

This report has been reviewed and accepted by Hubbell Building Automation, 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 WiHubb RF Module is the basis for Hubbell Building Automation's next generation of networked lighting controls. The WiHubb RF Module combines a highly integrated CMOS ISM transceiver operating from 902.74MHz to 927.74MHz with a CIP-51 microcontroller core and 19 pins of digital and analog I/O. A 30MHz onboard crystal is included for the RF section and a 32.768KHz crystal is included for real time clock control. Board-level connections to a simple wire antenna or a board-edge SMA connector are provided. Two 12-pin, 1.27mm-pitch male headers are provided for integration of the module with various carrier boards to create wirelessly networked lighting controls products that include switchstations, power-packs, photocells (for daylight harvesting), occupancy sensors, and relay modules.

## 1.3 EUT Operation

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, and spurious/harmonic tests. The EUT was tested in 3 orthogonal axes to maximize emissions as required by ANSI 63.4. For conducted emissions the device was tuned to its center frequency. The EUT continuously transmitted at maximum power. The system tested consisted of the following:

| Manufacturer | Model | FCC ID Number | IC Identifier |
|---|---|---|---|
| Hubbell Building Automation, Inc. | WiHubb | YH9WIHUBB | 9044A-WIHUBB |

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 | |

## 1.4 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 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 C63.4:2009 and FCC Public Notice DA 00-705 were utilized for making all emissions measurements.

## 1.5 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 |
| 47 CFR | Part 15 – Radio Frequency Devices<br>Subpart C -Intentional Radiators | |
| FCC Public Notice DA 00-705 | Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems | March 30, 2000 |
| 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

### 2.1 Test Procedure

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

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

### 2.2 Test Criteria

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

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

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

## 3.0 Peak Output Power

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

### 3.1 Test Procedure

The EUT was directly connected to a spectrum analyzer with a calibrated measurement cable. The RBW of the Spectrum analyzer was 1 MHz and the peak detector was employed.

### 3.2 Test Criteria

The maximum peak output power is 1 W for FHSS devices operating in the frequency range 902-928 MHz employing at least 50 hopping channels 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.

## 4.2 Test Criteria

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 Timing, Channel Separation and Number of Hopping Channels

Plots were captured of the all hopping channels and the time occupied on each channel. The bandwidth between the channels was measured from the plot of all the hopping channels in order to determine compliance with FCC 15.247and RSS-210.

## 5.1 Test Procedure

In order to measure the number of channels and the channel separation the EUT was transmitting in its normal mode the spectrum analyzer was set to max hold while being tuned across the entire band.. Approximately 10 minutes is given to allow all of the channels to be captured. Delta markers were used to measure the channel separation.

In order to measure the timing the spectrum analyzer was set to the frequency of one of the channels while in zero span. The occupancy time on the channel was also monitored for a total of 30 seconds to ensure all transmissions in a 20 second period are accounted for. Plots are given in Appendix B.

## 5.2 Test Criteria

According to section FCC 15.247 and RSS-210 the system must use at least 25 hopping channels since the channel bandwidth is greater than 250 kHz (determined by the 20 dB occupied bandwidth). The channels must be separated by at least the channel bandwidth. The maximum occupancy time on nay channel may not exceed 0.4 seconds in any 10 second period.

# 6.0 Conducted Spurious Emissions

Peak spurious measurements were made in the frequency range of 500 MHz to 10 GHz while the EUT was tuned to the lowest, middle, and highest channels.

### 6.1 Test Procedure

The EUT was directly connected to a spectrum analyzer with a calibrated measurement cable. The RBW of the Spectrum analyzer was 1 MHz and the peak detector was employed.

### 6.2 Test Criteria

All spurious emissions emanating from the antenna port of the EUT must be 20 dB below the fundamental.

## 7.0 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.

### 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.

### 7.2 Test Criteria

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. For this test the adjacent restricted band measurement included measurements of the band edge emissions and compared to 15.209.

## 8.0 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.

### 8.1 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.

### 8.2 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 | Test Distance (Meters) | Field Strength (µV/m) | (dBµV/m) |
|---|---|---|---|
| 30 to 88 | 3 | 100 | 40.0 |
| 88 to 216 | 3 | 150 | 43.5 |
| 216 to 960 | 3 | 200 | 46.0 |
| Above 960 | 3 | 500 | 54.0 |

## 9.0 Antenna Requirements

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

### 9.1 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.

### 9.2 Evaluation Criteria

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

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

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.

## 10.0 Limit for SAR Waiver

The peak power was evaluated for exemption with the SAR limits.

## 11.0 Receiver Spurious Emissions

This device does not contain a separate receive function. The nature of this RFID system is that it will only receive while transmitting. Therefore, the spurious emissions produced in transmit mode are the spurious emissions produced in receive mode.

## 12.0 Modifications

N/A

## 13.0 Test Equipment

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

**Conducted Test Equipment**

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| 1277 | HP | 85650A | Quasi-peak Adapter | October 27, 2010 |
| 0045 | HP | 85662A | Spectrum Analyzer Display | NCR |
| 1284 | HP | 8568B | Spectrum Analyzer | January 13, 2011 |
| 1088 | PTI | PTI-ALF4 | Attenuator, Limiter, Filter | March 31, 2011 |
| 0027 | Emco | 3825/2 | Line Impedance Stabilization Network | November 4, 2010 |
| 0081 | ELGAR | 1751SL | AC Power Supply | NCR |
| 1683 | TESEQ | T800 | ISN | November 24, 2010 |
| 1173 | PTI | 100KHz HPF | High Pass Filter | February 5, 2011 |

**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) | September 5, 2010 |
| 1035 | HP | 85685A | RF Preselector (low band) | March 3, 2011 |
| 1454 | HP | 8447D | RF Preamplifier | July 06, 2011 |
| 1497 | Emco | 3108 | Biconical Antenna | August 4, 2011 |
| 1486 | Emco | 3147 | Log Periodic Dipole Array Antenna | August 4, 2011 |
| C026 | none | none | Coaxial Cable (low band) | August 02, 2011 |
| C027 | none | none | Coaxial Cable (high band) | August 02, 2011 |

| 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 |
|---|---|---|---|---|
| 0582 | 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 |

| Asset # | Manufacturer | Model # | Description | Calibration Due |
|---|---|---|---|---|
| XXXX | Pasternack | LLS | 2 sections, total 12ft | June 21, 2011 |
| 0582 | EMCO | 3115 | Ridge Guide Antenna | October 19, 2010 |
| 1594 | Miteq | AFS44-00102650 | Microwave Preamplifier (preamp 1) | March 2, 2011 |
| 1342 | Rohde & Schwarz | ESMI | EMI Test Receiver | December 4, 2010 |
| 1343 | Rohde & Schwarz | ESMI | EMI Test Receiver Display | December 4, 2010 |
| Rental Unit | Rohde & Schwarz | FSQ40 | Spectrum Analyzer | August 24, 2011 |

# Appendix A Test Setup Diagrams

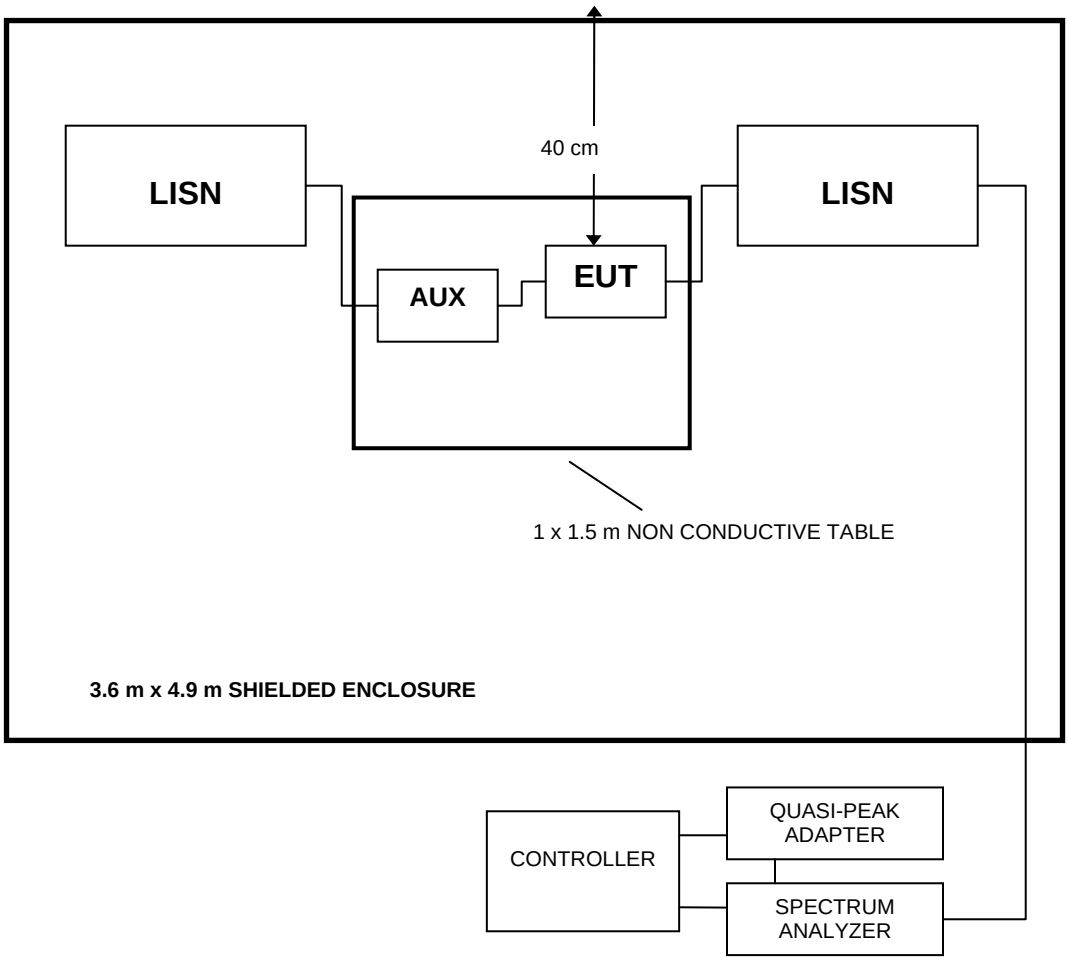



**FIGURE 1: Conducted Emissions Test Setup**

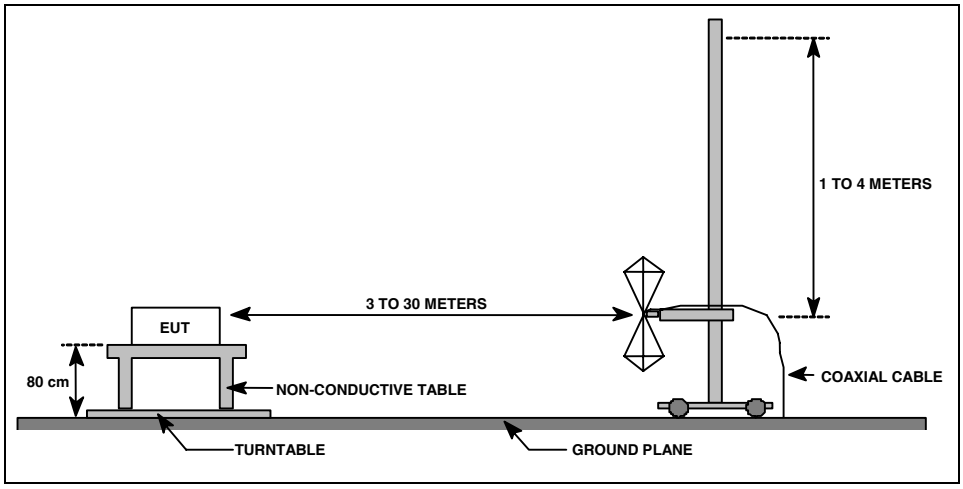



**FIGURE 2: Radiated Emissions Test Setup**

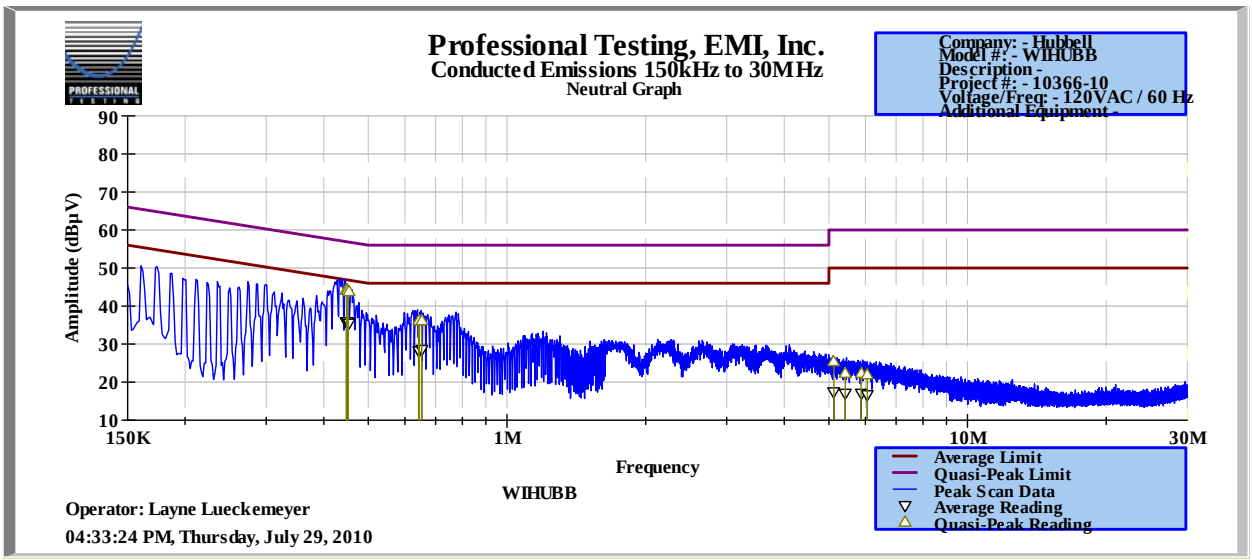
# Appendix B Test Results

## Mains Conducted Emissions Data Sheet
## 150 kHz … 30 MHz

| PROJECT # | DATE | CLASS | LINE | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|
| 10366-10 | July 29, 2010 | FCC B | Neutral | CISPR 9 kHz | 100 kHz | Quasi-Peak/Avg |

| COMMENT | Transmitting |
|---|---|

| Frequency Reading (MHz) | Quasi-peak Reading (dBuV) | Average Reading (dBuV) | Quasi-peak Limit (dBuV) | Quasi-peak Margin (dB) | Average Limit (dBuV) | Average Margin (dB) |
|---|---|---|---|---|---|---|
| 0.44817 | 44.3 | 35.6 | 56.9 | -12.7 | 46.9 | -11.3 |
| 0.44966 | 44.4 | 35.7 | 56.9 | -12.5 | 46.9 | -11.1 |
| 0.45215 | 44 | 35.4 | 56.8 | -12.9 | 46.8 | -11.5 |
| 0.6431 | 36.1 | 28.3 | 56 | -19.9 | 46 | -17.7 |
| 0.6452 | 36.3 | 28.3 | 56 | -19.7 | 46 | -17.7 |
| 0.653 | 36.4 | 28.5 | 56 | -19.6 | 46 | -17.5 |
| 5.1242 | 25.3 | 17.5 | 60 | -34.7 | 50 | -32.5 |
| 5.4267 | 22.5 | 16.8 | 60 | -37.5 | 50 | -33.2 |
| 5.8712 | 22.3 | 16.9 | 60 | -37.7 | 50 | -33.1 |
| 6.0604 | 22.1 | 16.6 | 60 | -37.9 | 50 | -33.4 |

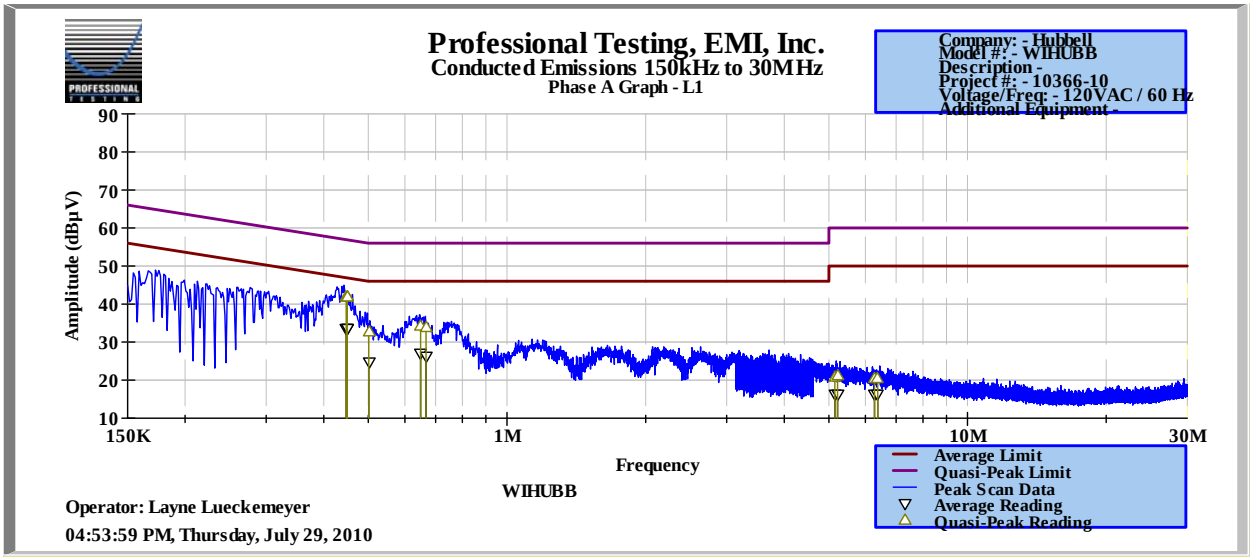


## Mains Conducted Emissions Data Sheet
## 150 kHz … 30 MHz

| PROJECT # | DATE | CLASS | LINE | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|
| 10366-10 | July 29, 2010 | FCC B | Phase | CISPR 9 kHz | 100 kHz | Quasi-Peak/Avg |

| COMMENT | Transmitting |
|---|---|

| Frequency Reading (MHz) | Quasi-peak Reading (dBuV) | Average Reading (dBuV) | Quasi-peak Limit (dBuV) | Quasi-peak Margin (dB) | Average Limit (dBuV) | Average Margin (dB) |
|---|---|---|---|---|---|---|
| 0.44759 | 41.8 | 33.5 | 56.9 | -15.1 | 46.9 | -13.4 |
| 0.4494 | 41.9 | 33.3 | 56.9 | -15 | 46.9 | -13.6 |
| 0.44963 | 41.8 | 33.4 | 56.9 | -15 | 46.9 | -13.5 |
| 0.500938 | 32.7 | 24.7 | 56 | -23.3 | 46 | -21.3 |
| 0.6491 | 34.2 | 26.8 | 56 | -21.8 | 46 | -19.2 |
| 0.6671 | 33.8 | 26.3 | 56 | -22.2 | 46 | -19.7 |
| 5.1527 | 21 | 16.3 | 60 | -39 | 50 | -33.7 |
| 5.2218 | 21.1 | 16.2 | 60 | -38.9 | 50 | -33.8 |
| 6.2833 | 20.5 | 16.1 | 60 | -39.5 | 50 | -33.9 |
| 6.3811 | 20.4 | 16.1 | 60 | -39.6 | 50 | -33.9 |



## Peak Power Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | 15.247 | N/A | Direct | 1 MHz | 1 MHz | Peak |

| COMMENT | Transmitting |
|---|---|

## Conducted

| Frequency (MHz) | Recorded Level (dBm) | Cable Loss (dB) | Corrected Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 902.74 | 17.4 | 2.3 | 19.7 | 30 | -10.3 |
| 915 | 17.3 | 2.3 | 19.6 | 30 | -10.4 |
| 927.74 | 17 | 2.3 | 19.3 | 30 | -10.7 |

**Result: PASS**

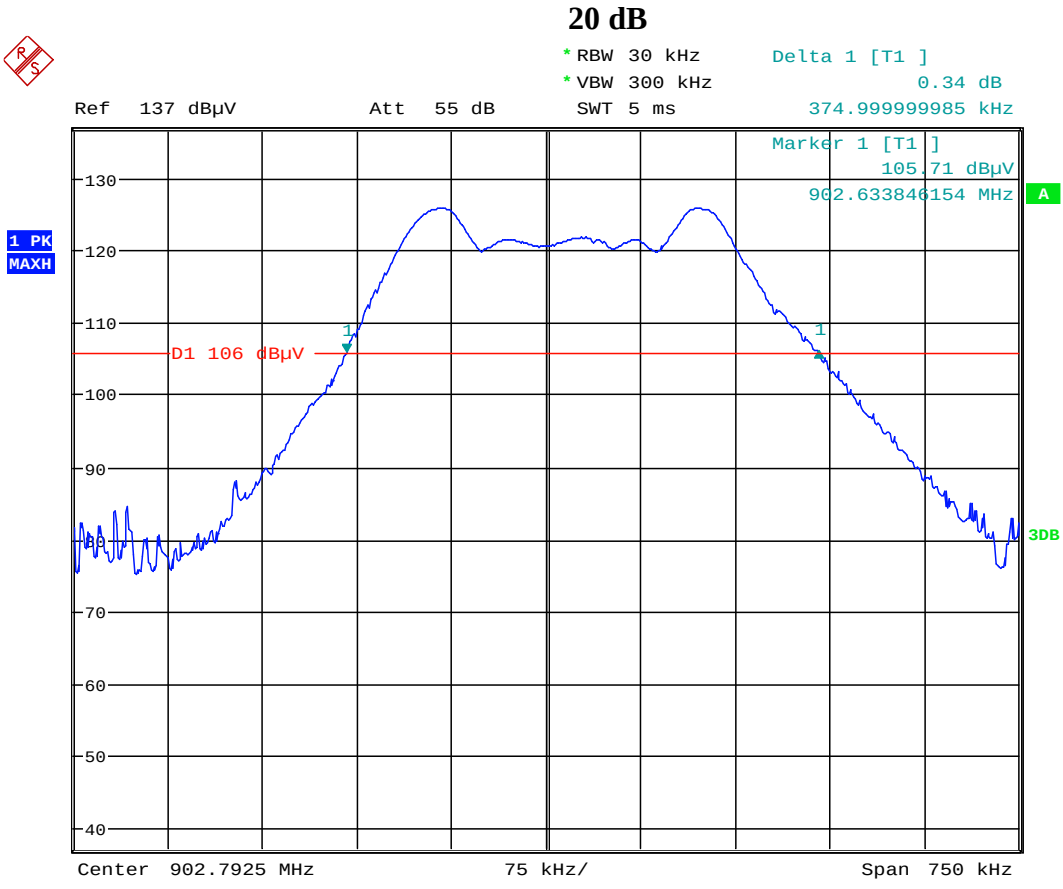
**NOTE: An investigation of the peak power indicated no changes from the previous recorded data.**

## Occupied Bandwidth Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 300 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>20 dB Bandwidth – 374.99 kHz |

### Low Channel

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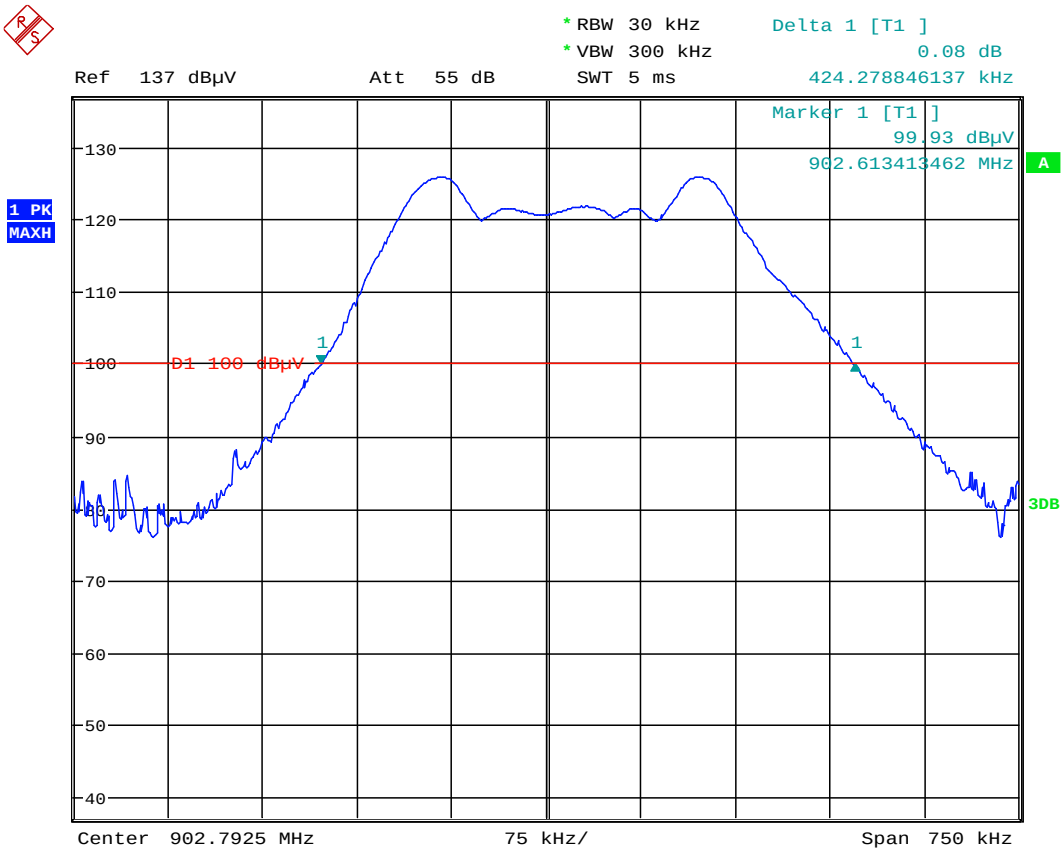
# Occupied Bandwidth Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 300 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>26 dB Bandwidth – 424.27 kHz |

## Low Channel

### 26 dB

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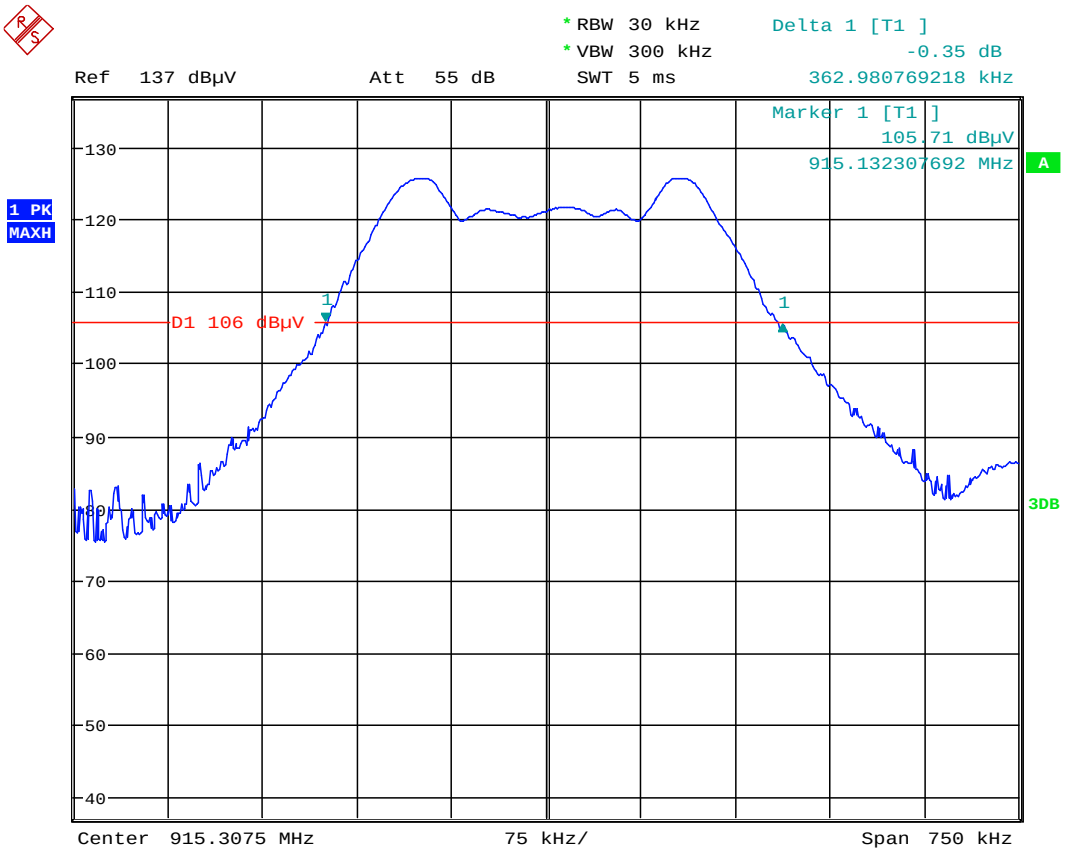
# Occupied Bandwidth Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 300 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>20 dB Bandwidth – 362.98 kHz |

## Middle Channel

### 20 dB

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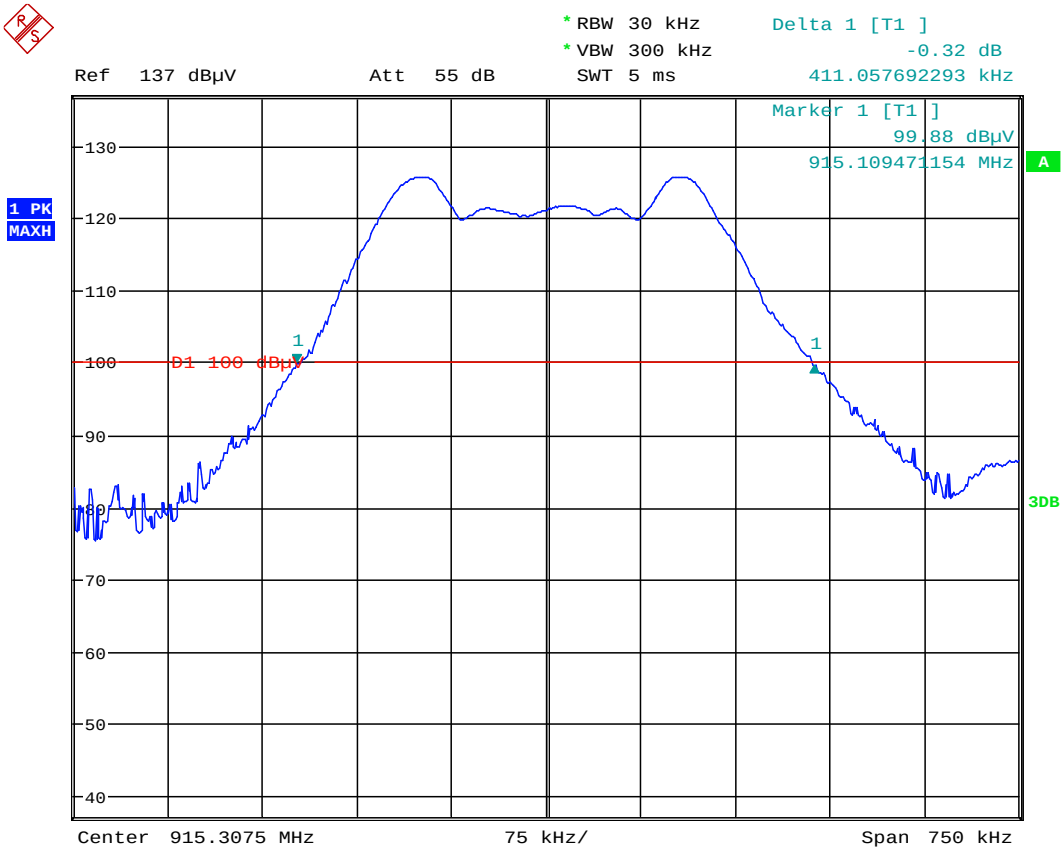
# Occupied Bandwidth Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 300 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>26 dB Bandwidth – 411.06 kHz |

## Middle Channel

## 26 dB

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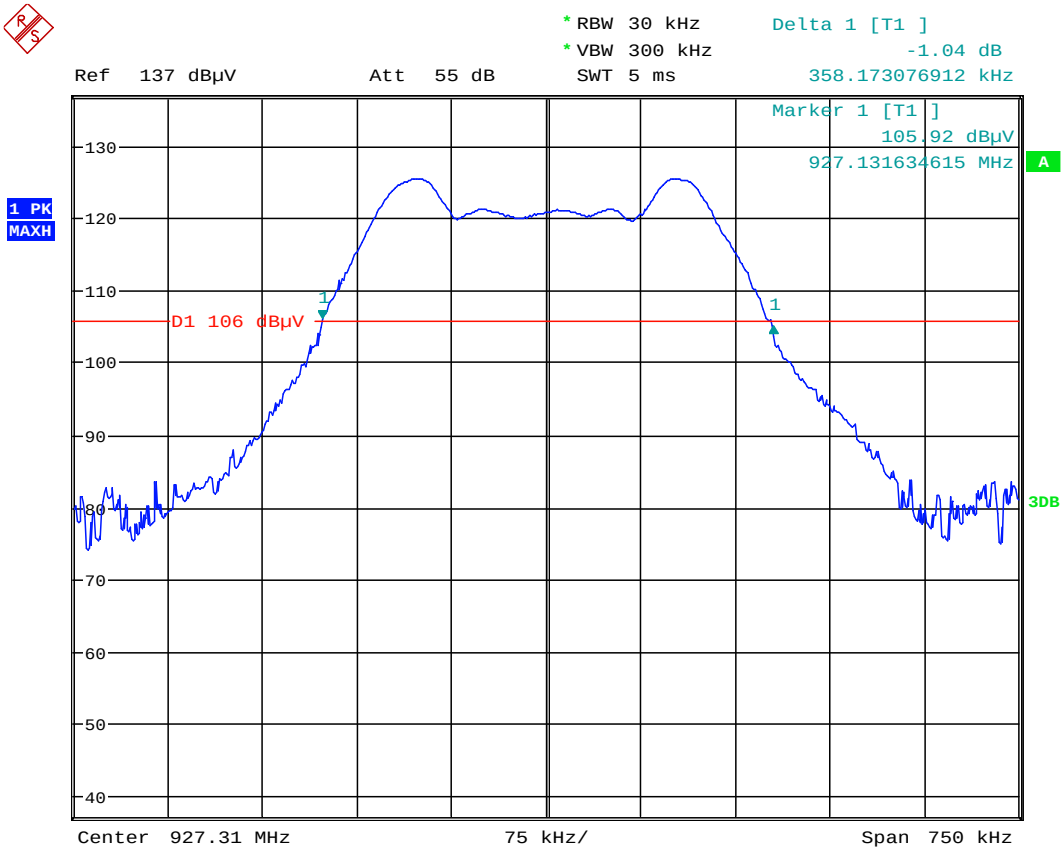
# Occupied Bandwidth Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 300 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>20 dB Bandwidth – 358.17 kHz |

## High Channel

## 20 dB




Date: 2.SEP.2010 18:38:28

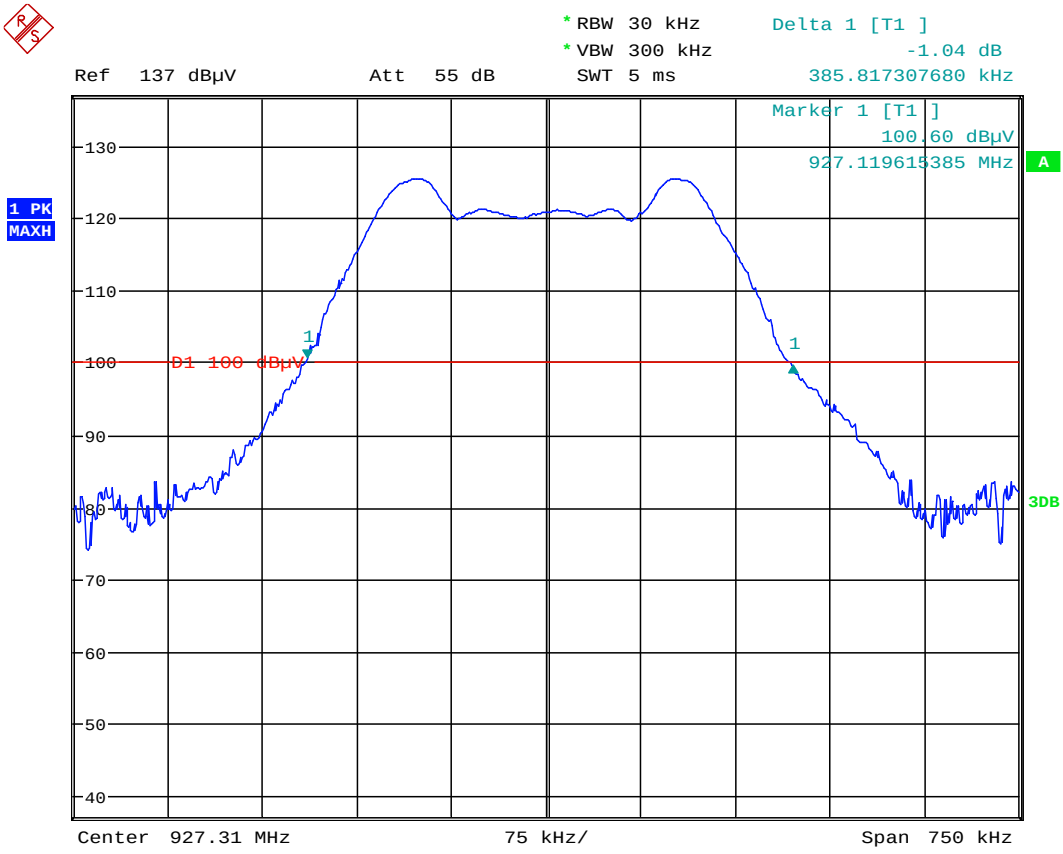
# Occupied Bandwidth Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 300 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>26 dB Bandwidth – 385.82 kHz |

## High Channel

## 26 dB

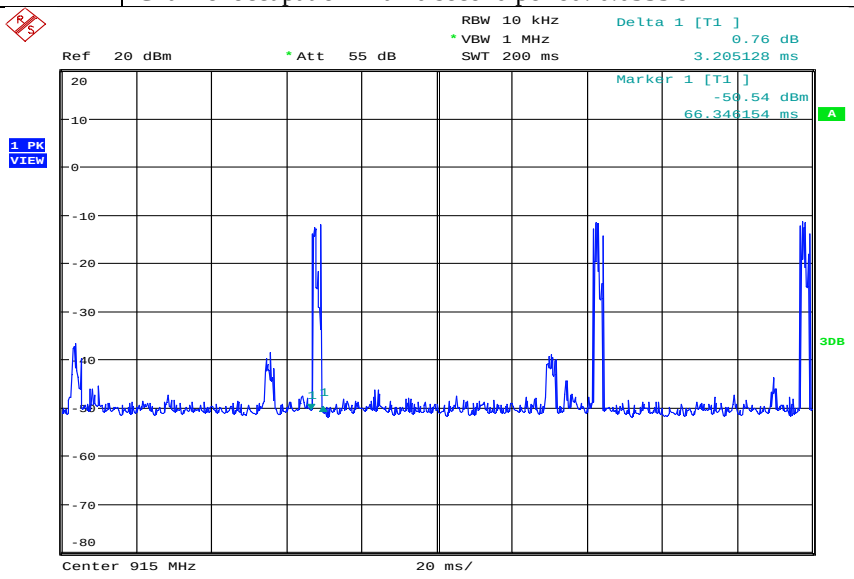



Date: 2.SEP.2010 18:39:17

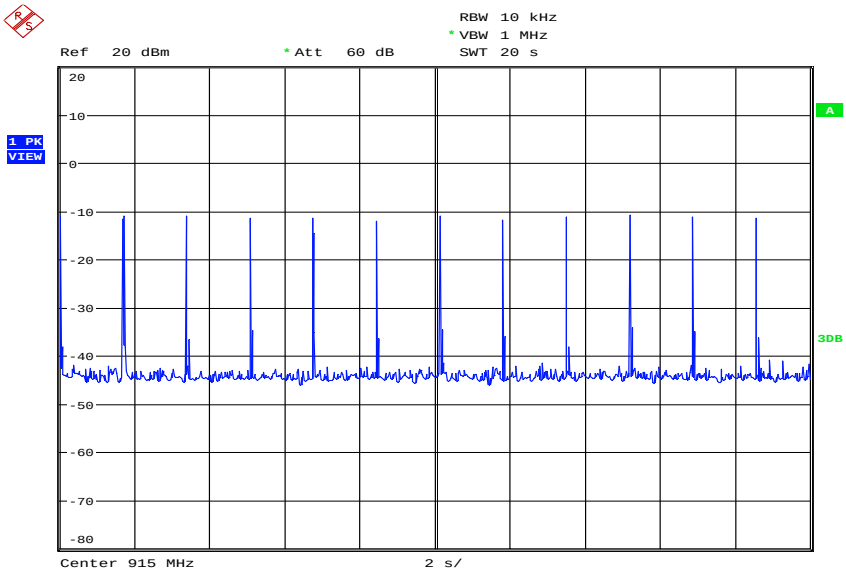
# Timing Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | 15.247 | N/A | Direct | 10 kHz | 1 MHz | Peak |

| COMMENT | Transmitting<br>Channel occupation in a 20 second period: 0.0353 s |
|---|---|




Date: 2.SEP.2010 17:59:52



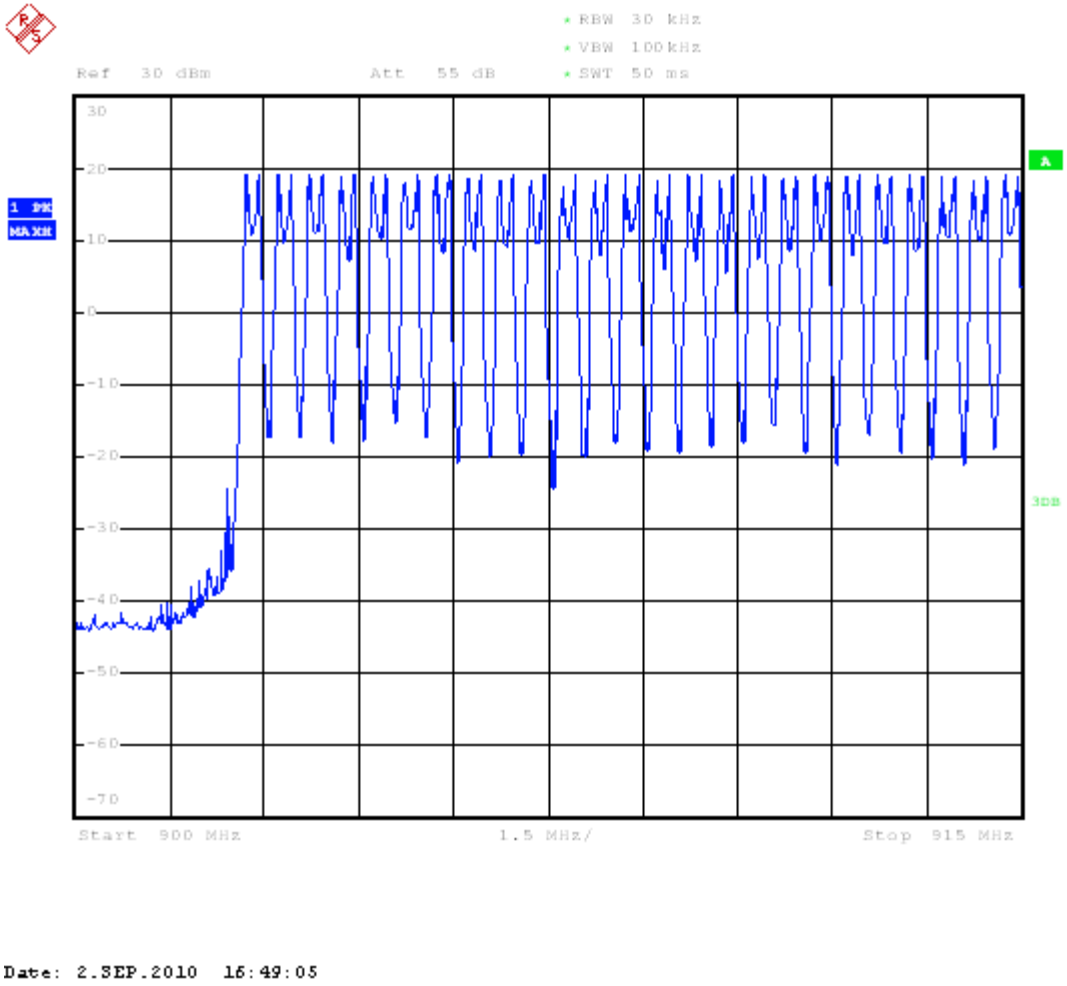

Date: 2.SEP.2010 17:53:59

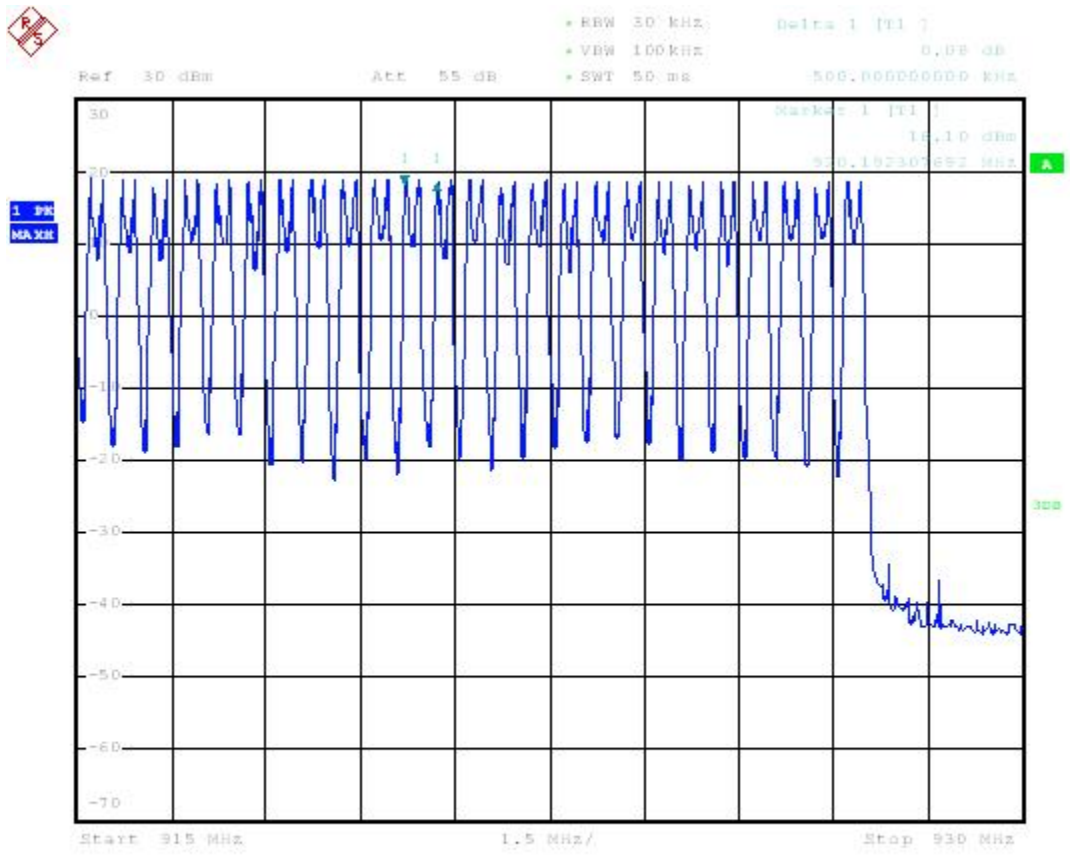
## Result: PASS

# Number of Hopping Channels and Channel Separation Data Sheet

| PROJECT # | DATE | RULE | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | September 2, 2010 | 15.247 | N/A | Direct | 30 kHz | 100 kHz | Peak |

| | |
|---|---|
| **COMMENT** | Transmitting<br>Number of Channels: 50<br>Channel Separation: 500 kHz |





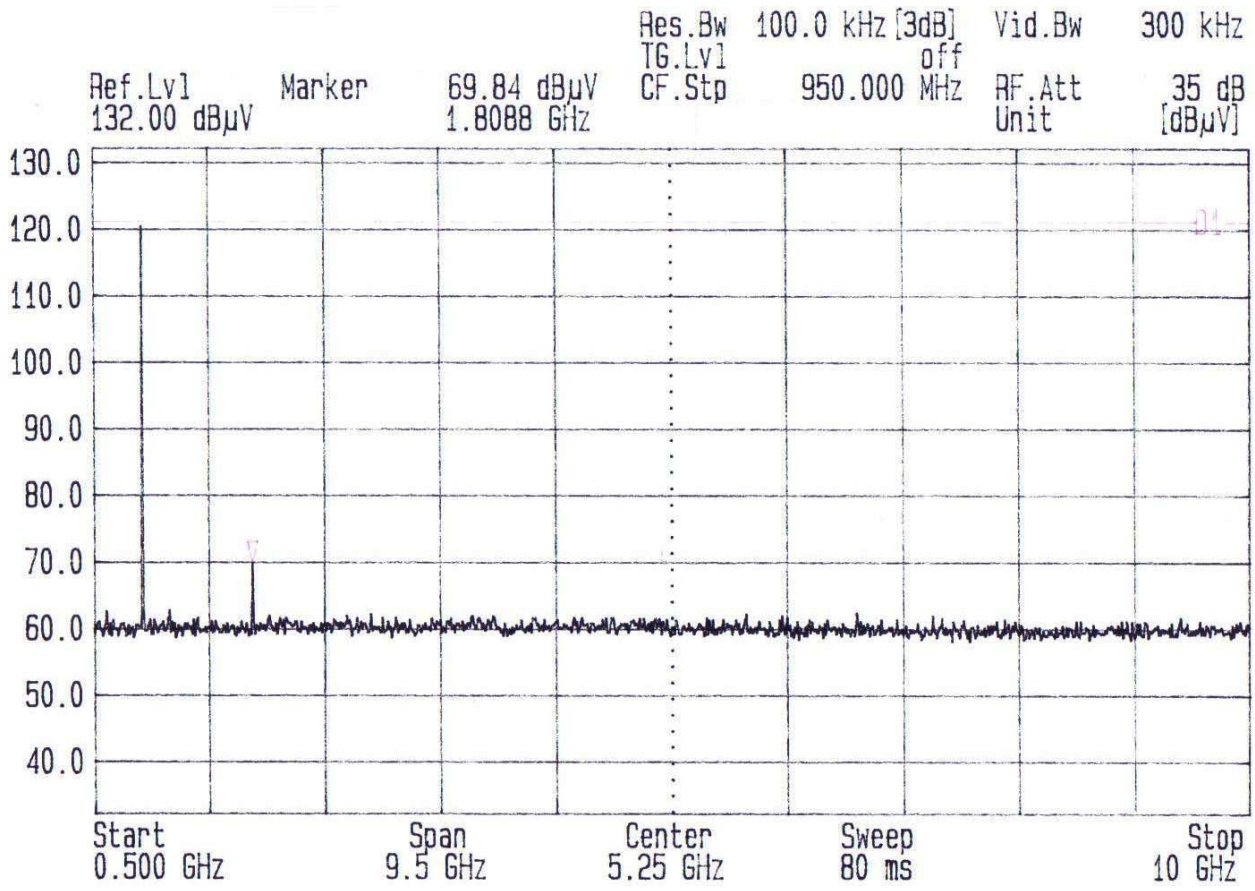

Date: 2.SEP.2010 17:01:47

**Result: PASS**

## Conducted Spurious Emissions Data Sheet
## 500 MHz … 10 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | N/A | Direct Connect | N/A | 100 kHz | 300 kHz | Peak |

| COMMENT | Transmitting<br>Low Channel |
|---|---|



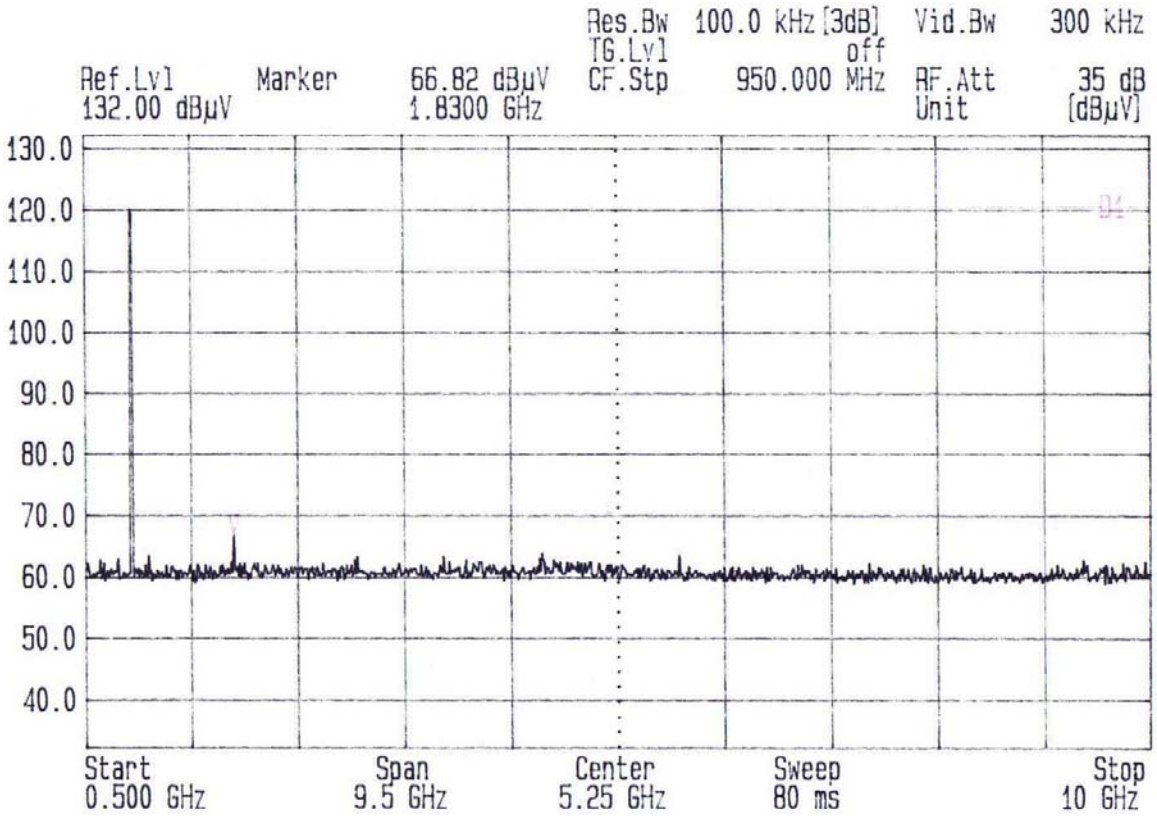

**NOTE: An investigation of the conducted spurious emissions indicated no changes from the previous recorded data.**

**Conducted Spurious Emissions Data Sheet**

**500 MHz … 10 GHz**

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | N/A | Direct Connect | N/A | 100 kHz | 300 kHz | Peak |

| COMMENT | Transmitting<br>Middle Channel |
|---|---|

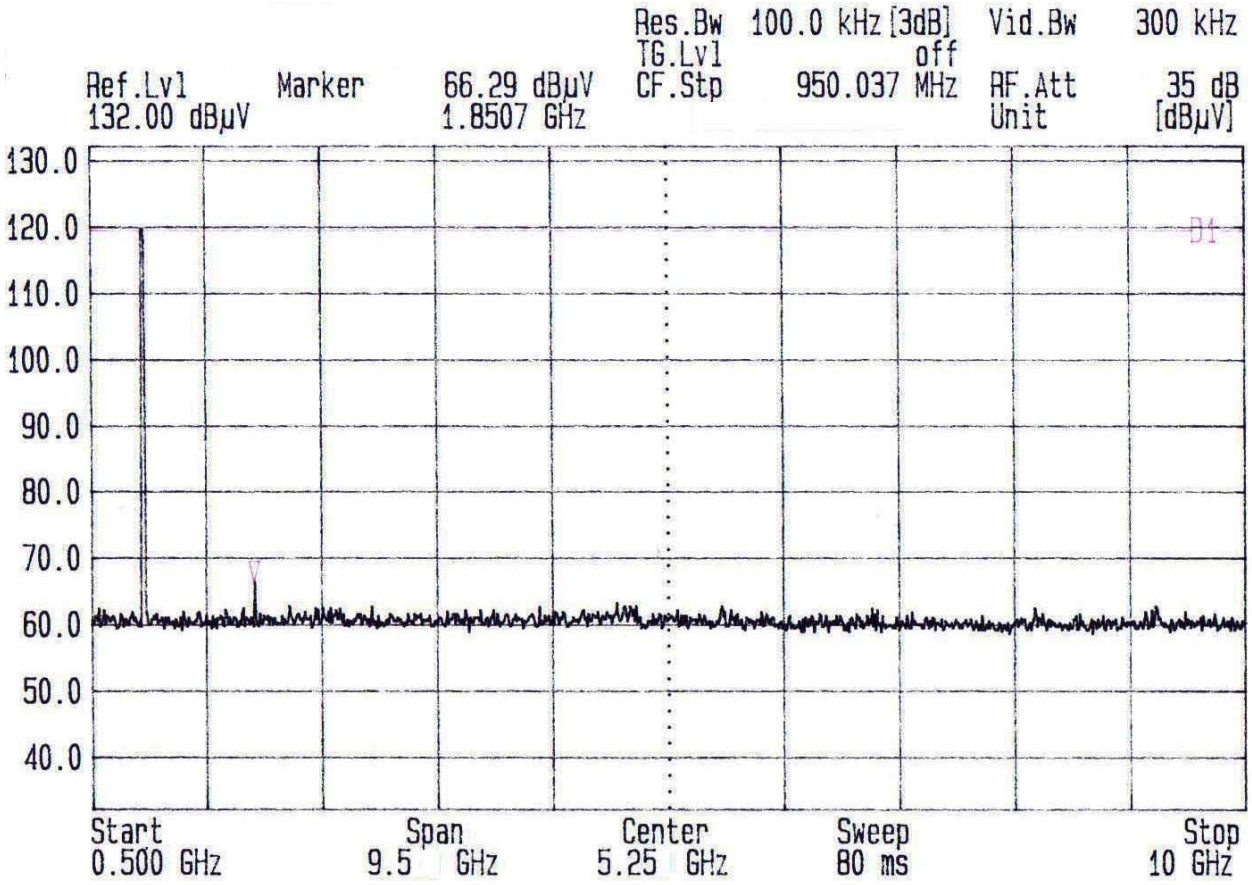



**NOTE: An investigation of the conducted spurious emissions indicated no changes from the previous recorded data.**

## Conducted Spurious Emissions Data Sheet
## 500 MHz … 10 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | N/A | Direct Connect | N/A | 100 kHz | 300 kHz | Peak |

| COMMENT | Transmitting<br>High Channel |
|---|---|




**NOTE: An investigation of the conducted spurious emissions indicated no changes from the previous recorded data.**

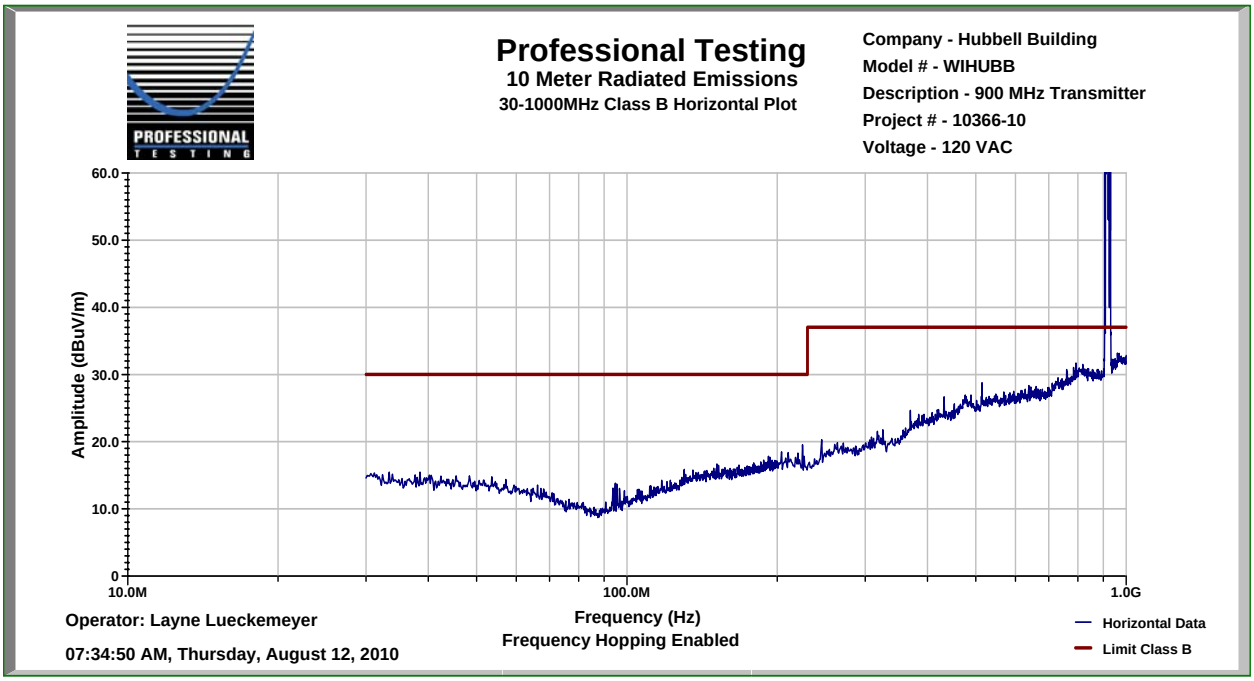
## Spurious Radiated Emissions Data Sheet
## 30 MHz … 1 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 12, 2010 | FCC B | 10 m | Bicon \| Log | CISPR 120 kHz | 1 MHz | Quasi-Peak |

| COMMENT | Transmitting |
|---|---|

### Horizontal

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 245.6 | 123 | 4 | 20.3 | 31.0 | 12.4 | 2.2 | 3.8 | 37 | -33.2 |
| 369.6 | 185 | 4 | 24.6 | 30.9 | 15.3 | 2.8 | 11.8 | 37 | -25.2 |
| 432 | 166 | 4 | 26.6 | 31.2 | 17.6 | 3.1 | 16.1 | 37 | -20.9 |




**NOTE: An investigation of the radiated spurious emissions indicated no changes from the previous recorded data.**

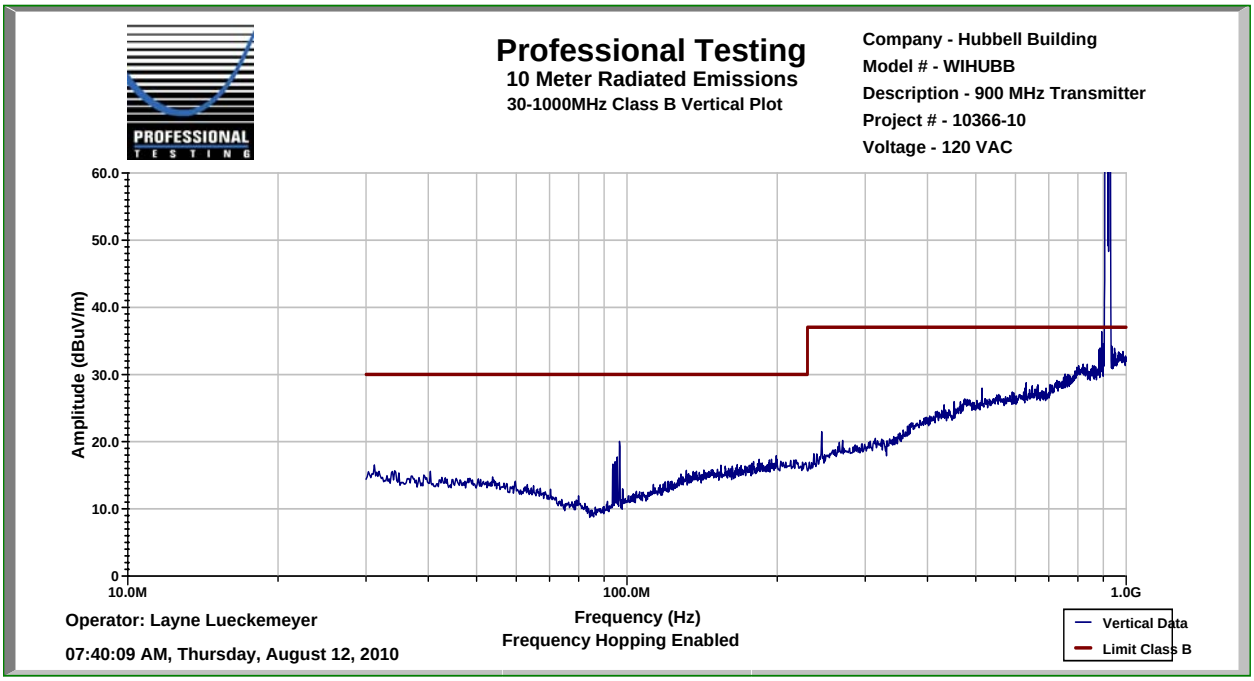
## Spurious Radiated Emissions Data Sheet
## 30 MHz … 1 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 12, 2010 | FCC B | 10 m | Bicon \| Log | CISPR 120 kHz | 1 MHz | Quasi-Peak |

| COMMENT | Transmitting |
|---|---|

### Vertical

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 96.64 | 105 | 1 | 20 | 26.2 | 8.5 | 1.0 | 3.3 | 30 | -26.7 |
| 245.6 | 164 | 1 | 21.5 | 31.0 | 12.4 | 2.2 | 5.0 | 37 | -32.0 |
| 514.4 | 157 | 1 | 27.9 | 31.1 | 19.0 | 3.5 | 19.3 | 37 | -17.7 |




**NOTE: An investigation of the radiated spurious emissions indicated no changes from the previous recorded data.**

## Band Edge Spurious Emissions Data Sheet
## 902 to 928 MHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | FCC B | 10 m | Log | CISPR 120 kHz | 1 MHz | Peak |

| COMMENT | Transmitting |
|---|---|

### Horizontal

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Correction (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 902 | 18 | 2 | 27.1 | 31.9 | 23.1 | 5.2 | 10.5 | 34 | 46 | -12 |
| 928 | 285 | 3 | 29.2 | 31.9 | 23.8 | 5.3 | 10.5 | 36.9 | 46 | -9.1 |

### Vertical

| Frequency (MHz) | EUT Direction (degrees) | Antenna Elevation (Meters) | Recorded Level (dBuV) | Amplifier Gain (dB) | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Correction (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 902 | 105 | 1.2 | 27.9 | 31.9 | 23.1 | 5.2 | 10.5 | 34.8 | 46 | -11.2 |
| 928 | 56 | 1.2 | 27.7 | 31.9 | 23.8 | 5.3 | 10.5 | 35.4 | 46 | -10.6 |

## Spurious/Harmonic Emissions Data Sheet
## 1 GHz … 10 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | FCC B | 1 m | Horn | 1 MHz | 1 MHz | Peak |

| COMMENT | Transmitting Low Channel |
|---|---|

### 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.80568 | Max | 1 | 59.6 | 40.2 | 27.6 | 2.9 | 49.9 | 63.5 | -13.6 |
| 2.70852 | Max | 1 | 52.1 | 40.6 | 29.4 | 3.0 | 43.9 | 63.5 | -19.6 |
| 3.61136 | noise | floor | 51.9 | 40.7 | 32.1 | 3.3 | 46.6 | 63.5 | -16.9 |
| 4.5142 | noise | floor | 51.9 | 41.5 | 32.0 | 3.9 | 46.3 | 63.5 | -17.2 |
| 5.41704 | noise | floor | 52.2 | 42.3 | 34.7 | 4.7 | 49.3 | 63.5 | -14.2 |
| 6.31988 | noise | floor | 50.6 | 42.9 | 35.4 | 4.7 | 47.8 | 63.5 | -15.7 |
| 7.22272 | noise | floor | 49.5 | 42.5 | 36.8 | 5.1 | 48.9 | 63.5 | -14.6 |
| 8.12556 | noise | floor | 50.6 | 41.9 | 37.4 | 4.7 | 50.8 | 63.5 | -12.7 |
| 9.0284 | noise | floor | 51.1 | 40.5 | 37.6 | 4.9 | 53.1 | 63.5 | -10.4 |

### 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.80568 | Max | 1 | 65.3 | 40.2 | 27.6 | 2.9 | 55.6 | 63.5 | -7.9 |
| 2.70852 | Max | 1 | 55.6 | 40.6 | 29.4 | 3.0 | 47.4 | 63.5 | -16.1 |
| 3.61136 | noise | floor | 52.3 | 40.7 | 32.1 | 3.3 | 47.0 | 63.5 | -16.5 |
| 4.5142 | noise | floor | 51.82 | 41.5 | 32.0 | 3.9 | 46.2 | 63.5 | -17.3 |
| 5.41704 | noise | floor | 51.4 | 42.3 | 34.7 | 4.7 | 48.5 | 63.5 | -15.0 |
| 6.31988 | noise | floor | 51.2 | 42.9 | 35.4 | 4.7 | 48.4 | 63.5 | -15.1 |
| 7.22272 | noise | floor | 49.3 | 42.5 | 36.8 | 5.1 | 48.7 | 63.5 | -14.8 |
| 8.12556 | noise | floor | 50.7 | 41.9 | 37.4 | 4.7 | 50.9 | 63.5 | -12.6 |
| 9.0284 | noise | floor | 52.2 | 40.5 | 37.6 | 4.9 | 54.2 | 63.5 | -9.3 |

**NOTE: An investigation of the spurious / harmonic emissions indicated no changes from the previous recorded data.**

## Spurious/Harmonic Emissions Data Sheet
## 1 GHz … 10 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | FCC B | 1 m | Horn | 1 MHz | 1 MHz | Peak |

| COMMENT | Transmitting Middle Channel |
|---|---|

### 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.83168 | max | 1 | 56.9 | 40.2 | 27.7 | 2.9 | 47.2 | 63.5 | -16.3 |
| 2.74752 | max | 1 | 55 | 40.6 | 29.4 | 3.0 | 46.8 | 63.5 | -16.7 |
| 3.66336 | max | 1 | 55.6 | 40.7 | 32.1 | 3.3 | 50.3 | 63.5 | -13.2 |
| 4.5792 | noise | floor | 52.6 | 41.5 | 32.0 | 3.9 | 47.0 | 63.5 | -16.5 |
| 5.49504 | noise | floor | 52.9 | 42.3 | 34.7 | 4.7 | 50.0 | 63.5 | -13.5 |
| 6.41088 | noise | floor | 50.9 | 42.9 | 35.6 | 4.5 | 48.0 | 63.5 | -15.5 |
| 7.32672 | noise | floor | 50.2 | 42.5 | 36.8 | 5.1 | 49.6 | 63.5 | -13.9 |
| 8.24256 | noise | floor | 49.5 | 41.4 | 37.2 | 5.0 | 50.2 | 63.5 | -13.3 |
| 9.1584 | noise | floor | 51.1 | 40.5 | 37.6 | 4.9 | 53.1 | 63.5 | -10.4 |

### 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.83168 | max | 1 | 62.5 | 40.2 | 27.7 | 2.9 | 52.8 | 63.5 | -10.7 |
| 2.74752 | max | 1 | 54.3 | 40.6 | 29.4 | 3.0 | 46.1 | 63.5 | -17.4 |
| 3.66336 | noise | floor | 53.1 | 40.7 | 32.1 | 3.3 | 47.8 | 63.5 | -15.7 |
| 4.5792 | noise | floor | 51.3 | 41.5 | 32.0 | 3.9 | 45.7 | 63.5 | -17.8 |
| 5.49504 | noise | floor | 53.4 | 42.3 | 34.7 | 4.7 | 50.5 | 63.5 | -13.0 |
| 6.41088 | noise | floor | 51.5 | 42.9 | 35.6 | 4.5 | 48.6 | 63.5 | -14.9 |
| 7.32672 | noise | floor | 50.9 | 42.5 | 36.8 | 5.1 | 50.3 | 63.5 | -13.2 |
| 8.24256 | noise | floor | 49.7 | 41.4 | 37.2 | 5.0 | 50.4 | 63.5 | -13.1 |
| 9.1584 | noise | floor | 50.5 | 40.5 | 37.6 | 4.9 | 52.5 | 63.5 | -11.0 |

**NOTE: An investigation of the spurious / harmonic emissions indicated no changes from the previous recorded data.**

## Spurious/Harmonic Emissions Data Sheet
## 1 GHz … 10 GHz

| PROJECT # | DATE | CLASS | DISTANCE | ANTENNA | RBW | VBW | DETECTOR |
|---|---|---|---|---|---|---|---|
| 10366-10 | August 11, 2010 | FCC B | 1 m | Horn | 1 MHz | 1 MHz | Peak |

| COMMENT | Transmitting High Channel |
|---|---|

### 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.85568 | max | 1 | 59.1 | 40.2 | 27.7 | 2.9 | 49.4 | 63.5 | -14.1 |
| 2.78352 | noise | floor | 52.3 | 40.6 | 29.5 | 3.0 | 44.1 | 63.5 | -19.4 |
| 3.71136 | noise | floor | 53.4 | 40.7 | 32.1 | 3.3 | 48.1 | 63.5 | -15.4 |
| 4.6392 | noise | floor | 55.1 | 41.6 | 32.7 | 4.2 | 50.3 | 63.5 | -13.2 |
| 5.56704 | noise | floor | 51.7 | 42.3 | 34.7 | 4.7 | 48.8 | 63.5 | -14.7 |
| 6.49488 | noise | floor | 51.6 | 42.9 | 35.6 | 4.5 | 48.8 | 63.5 | -14.7 |
| 7.42272 | noise | floor | 48.9 | 42.6 | 37.3 | 4.5 | 48.1 | 63.5 | -15.4 |
| 8.35056 | noise | floor | 48.3 | 41.4 | 37.2 | 5.0 | 49.0 | 63.5 | -14.5 |
| 9.2784 | noise | floor | 51.2 | 40.4 | 37.6 | 5.2 | 53.6 | 63.5 | -9.9 |

### 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.85568 | max | 1 | 66.9 | 40.2 | 27.7 | 2.9 | 57.2 | 63.5 | -6.3 |
| 2.78352 | noise | floor | 56.2 | 40.6 | 29.5 | 3.0 | 48.0 | 63.5 | -15.5 |
| 3.71136 | noise | floor | 55.8 | 40.7 | 32.1 | 3.3 | 50.5 | 63.5 | -13.0 |
| 4.6392 | noise | floor | 54.6 | 41.6 | 32.7 | 4.2 | 49.8 | 63.5 | -13.7 |
| 5.56704 | noise | floor | 54.4 | 42.3 | 34.7 | 4.7 | 51.5 | 63.5 | -12.0 |
| 6.49488 | noise | floor | 50 | 42.9 | 35.6 | 4.5 | 47.2 | 63.5 | -16.3 |
| 7.42272 | noise | floor | 49.8 | 42.6 | 37.3 | 4.5 | 49.0 | 63.5 | -14.5 |
| 8.35056 | noise | floor | 50 | 41.4 | 37.2 | 5.0 | 50.7 | 63.5 | -12.8 |
| 9.2784 | noise | floor | 51.7 | 40.4 | 37.6 | 5.2 | 54.1 | 63.5 | -9.4 |

**NOTE: An investigation of the spurious / harmonic emissions indicated no changes from the previous recorded data.**

## Antenna Assessment

| PROJECT # | DATE |
|---|---|
| 10366-10 | August 11, 2010 |

| | |
|---|---|
| **COMMENT** | Reverse Polarity SMA connector |

## Result: Pass