# COMPLIANCE WORLDWIDE INC.
# TEST REPORT 286-06R3

**In Accordance with the Requirements of**

## FCC PART 15, SUBPART C
## INDUSTRY CANADA RSS 210, ISSUE 6
**Low Power License-Exempt Radio Communication Devices**
**Intentional Radiators**

**Issued to**

**Philips Medical Systems**
**3000 Minuteman Drive**
**Andover, MA 01810**
**978-659-2800**

**for**

**MDL4851 ITS Module**
**with the**
**Radiall/Larsen model SPDA17RP2400,**
**M8100-66490 Tri-band antenna,**
**and Dual Band Antenna, Part # M3002-66493**

**FCC ID: PQC-MDL4851**
**IC: 3549B-MDL4851**

**Report Issued on June 8 2007**

**Tested by**

Brian F. Breault

Reviewed by

Larry K. Stillings

## Table of Contents





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## 1. Scope

This test report certifies that the Philips MDL4851 2.4 GHz ROW ITS Radio Module with the either of the two antennas outlined in Section 5, Note 1, as tested, meets the FCC Part 15, Subpart C and Industry Canada RSS 210 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required. This report replaces in full CW Test Report #286-06R2 to add the data for the Dual Band Antenna, Part # M3002-66493.

## 2. Product Details

**2.1. Manufacturer:** Philips Medical Systems

**2.2. Model Number:** MDL4851 ITS Module / ROW PP2

**2.3. Serial Number:** US42300566

**2.4. Description:** The MDL4851 ROW ITS Module with either the External Antenna or alternative Dual-band or Tri-band antenna is a radio module which transmits patient physiological ECG and SpO2 data and waveforms in the 2.4 GHz ISM bands to the M4852A 2.4 GHz ROW Access Point. The EUT has no display or method to monitor itself. The monitoring will be done on the IntelliVue Information Center and also on the MP50 bedside patient monitor.

**2.5. Power Source:** DC 12 volts – Provided by the MP50 bedside patient monitor

**2.6. EMC Modifications:** None

## 3. Product Configuration

### 3.1. Operational Characteristics & Software

The MDL4851 2.4 GHz Instrument Telemetry System radio module is based on the M4841-65708 1.4 GHz Philips Telemetry II System's 1.4 GHz radio module. The MDL4851 2.4 GHz module combines a 2.4 GHz radio module with the M8090-66491 PCA, which is the interface for data and power from the Patient Monitor to which it connects, is a single housing, M8003-45201. It can be connected to the MPXX series of monitors through a short pigtail "Y" cable. The pigtail cable has a round DIN connector which plugs into the 12V/LAN/Serial port on the MPXX monitor. On the ITS end, the cable has an RJ45 plug for data and a 5 mm coaxial power connector for the 12 V DC power input. For the Radiated Emissions testing, the connections to the ITS for power and data are made through the custom cable, Item E in the System Configuration Block Diagram in Section 3.7.
An MP50 Patient Bedside Monitor will be connected to the MDL4851 ITS module. The MP50 will have ECG and SpO2 simulators connected to generate the patient physiological data signals.

The MDL4851 is also qualified with an alternative Tri-band antenna, Model #M8100-66490.



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# 3. Product Configuration (continued)

## 3.2. EUT Hardware

| Blk Diag # | Manufactr | Model/Part # / Options | Serial Number | Input Voltage | Frq (Hz) | Description/Function |
|---|---|---|---|---|---|---|
| **1** | Philips | M2638A/ MDL4851A Equivalent to M4851-60001 | DE505Y0033 | +12 V | DC | 2.4 GHz ROW ITS Radio Module |
| **2** | Philips | M2638A | NSN | +12 V | DC | 1.4 GHz WMTS ITS Radio Module |
| **17** | Philips | M3002-66493 | NSN | NA | NA | Dual band PCB antenna |
| **18** | Philips | M8100-66490 | NSN | NA | NA | Tri band PCB antenna |

## 3.3. EUT Hardware/Software/Firmware Revision Level

| EUT Model# | PCA# | Description | HW | SW | FW |
|---|---|---|---|---|---|
| MDL4851A | NA | 2.4 GHz ITS ROW radio module | unknown | unknown | A.01.03 |
| MDL4851A | M8090-66491 | Data/Power PCA | unknown | unknown | Unknown |
| M2638A | M4840-63100 | 1.4 GHz WMTS Radio PCA Set | Unknown | Unknown | unknown |

## 3.4. EUT Cables/Transducers

| Blk Diag Ltr | Manufacturer | Model/Part # | Length (m) | Shield Y/N | Description/Function |
|---|---|---|---|---|---|
| **NA** | OEM-unknown | M8058-61001 | 0.1 | N | 6 conductor ribbon cable-internal |
| **C** | OEM-unknown | | 0.3 | N | Data/power pigtail cable from Bedside monitor to the radio module |
| **E** | Philips R&D | N/A | 0.9 | N | Data/power assembly-provided by PMD R&D- custom cable connecting Optical isolator DB9 to the ITS through a "Y" cable with additional leads from the ITS to the +12 V DC supply |

## 3.5. Support Equipment

| Blk Diag # | Manufctr | Model/Part # Options | Serial Number | Input Voltage | Input Frq. | Description/Function |
|---|---|---|---|---|---|---|
| **3** | HP | 6205C | 2411A-08043 | 104-127 V | 48-440 Hz | Power Supply for ITS Radio Module |
| **4** | Philips | M4852A/ 862232/ NA Ref #453564039961 | US52400262 | 48 V | DC | 2.4 GHz ROW Access Point |
| **5** | Philips | M4843AA/ 862232/ NA Ref #453564036551 | RO71000231 | 48 V | DC | 1.4 GHz WMTS Access Point |
| **6** | Philips | M4844A/ 862114/ NA | US34300035 | 100-240 V | 50-60 Hz | Philips Telemetry II Synchronization box |
| **7** | Power Dsine | M4845A/ 862152/ NA | MO438680955 7276003 | 100-240 V | 50-60 Hz | Power-Over-Ethernet hub |
| **8** | Cisco | 2950 Catalyst | F0C0816X1S4 | 100-240 V | 50-60 Hz | 10/100 Base-T switch |
| **9** | Philips | M3171A/ 862117 | 756005AG-520D03 | 100-240 V | 50-60 Hz | Access Point Controller |



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# 3 Product Configuration (continued)

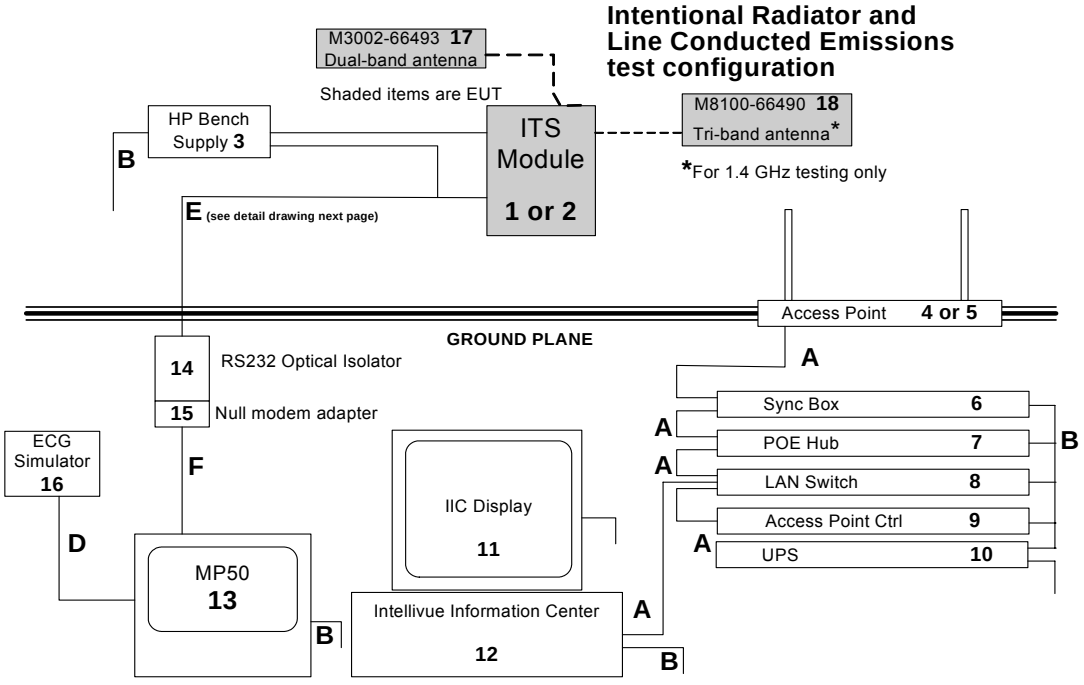
## 3.5. Support Equipment (continued)

| Blk Diag # | Manufctr | Model/Part # Options | Serial Number | Input Voltage | Input Frq. | Description/Function |
|---|---|---|---|---|---|---|
| **10** | Tripplite | SMART500RT1U | | 120 V | 60 Hz | UPS |
| **11** | HP | 109P20/74H | 47517133 | 100-240 V | 50-60 Hz | Display for IntelliVue Information Center |
| **12** | Philips | M3167-60003 | USU32301H2 | 100-240 V | 50-60 Hz | INTELLIvUE Information Center (HP PC) |
| **13** | Philips | MP50 | DE44010453 | 100-240 V | 50-60 Hz | Bedside Patient Monitor |
| **14** | BB electronics | 9POP4 | NA | 15 V | DC | RS 232 optical isolator |
| **15** | NA | NA | NA | NA | NA | Null modem adapter |
| **16** | Bio-Tek | Lionheart 2 | 125006 | 9 V | DC | Multi-parameter patient simulator |

## 3.6. Support Equipment Cables/Transducers

| Blk Diag Ltr | Manufactr | Model/Part # | Length (m) | Shield Y/N | Description/Function |
|---|---|---|---|---|---|
| **A** | **N/A** | **N/A** | Various | N | Category 5 UTP LAN cable |
| **B** | **N/A** | **N/A** | 2 | N | AC power cords |
| **D** | **Philips** | | 2 | N | ECG lead set |

## 3.7. Block Diagram 1 – Intentional Radiator and Line Conducted Configuration



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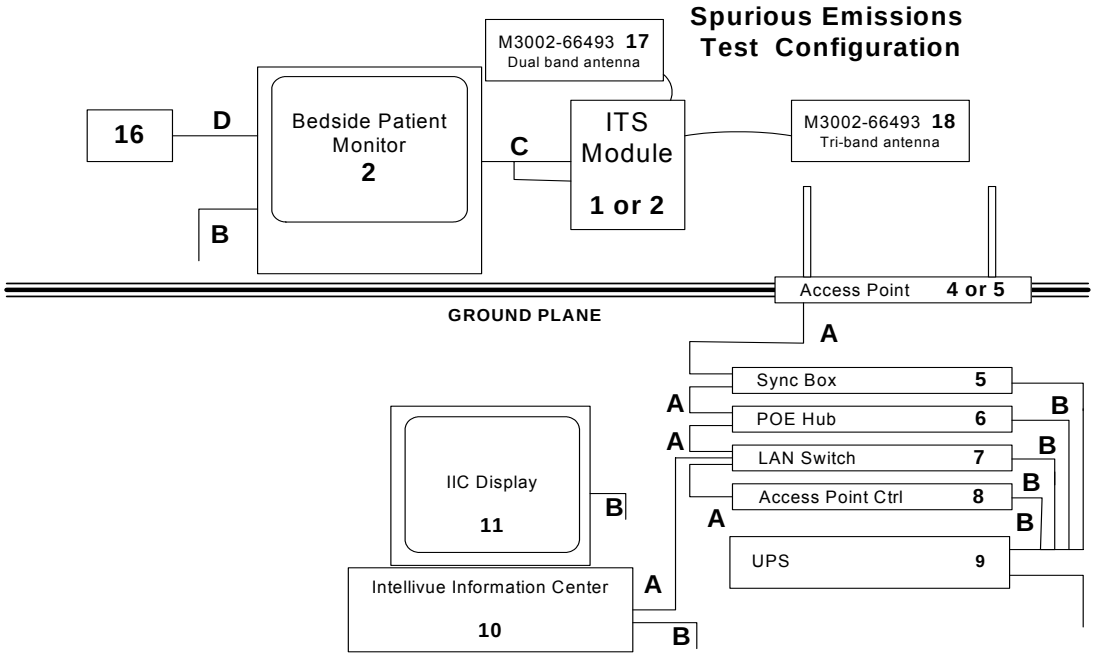
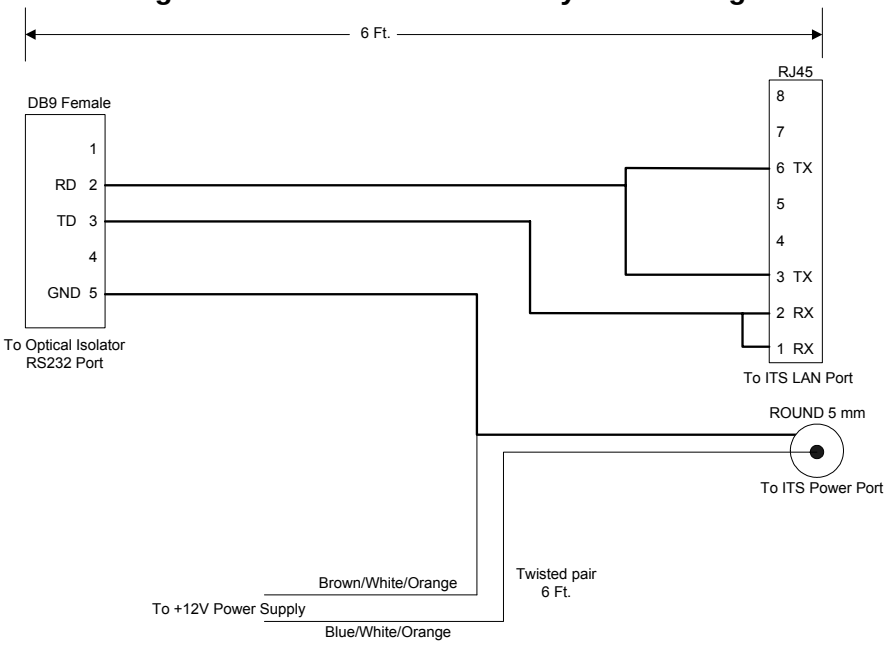
## 3. Product Configuration, (continued)

### 3.8. Block Diagram 2 – Spurious Emissions Configuration




### 3.9. Detail drawing for Cable E in Section 4.1 System Configuration Block Diagram



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# 4. Measurements Parameters

## 4.1. Measurement Equipment Used to Perform Test

| Device | Manufacturer | Model No. | Serial No. | Cal Due |
|---|---|---|---|---|
| EMI Receiver | Hewlett Packard | 8546A | 3650A00360 | 3/14/2008 |
| Spectrum Analyzer | Hewlett Packard | 8593E | 3829A03887 | 3/07/2008 |
| Microwave Preamp | Hewlett Packard | 8449B | 3008A01323 | 9/22/2008 |
| Bilog Antenna | Com-Power | AC220 | 25509 | 7/31/2007 |
| Horn Antenna | Electro-Metrics | EM-6961 | 6337 | 8/25/2008 |

## 4.2. Measurement & Equipment Setup

| | |
|---|---|
| Test Date: | March 20, 2007 |
| Test Engineer: | Brian Breault |
| Normal Site Temperature (15 – 35°C): | 21.0 |
| Relative Humidity (20 –75%RH): | 30% |
| Frequency Range of DUT: | >2.4 GHz & <2.4835 GHz |
| Measurement Distance: | 3 Meters |
| EMI Receiver IF Bandwidth:<br>EMI Receiver Avg Bandwidth:<br>Detector Function: | In accordance with FCC Part 15, Section 15.35 |

## 4.3. Test Procedure

Test measurements were made in accordance FCC Part 15.247, IC RSS-210 Annex VIII: Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5725 – 5875 MHz, and 24.0 – 24.25 GHz.

Radiated emissions testing is based on the requirements detailed in FCC 15.209: Radiated emission limits, general requirements.

The product under test complies with the definition for digital modulation outlined in FCC 15.403(f). The operating frequencies of the product under test were selected according to the requirements outlined in FCC 15.31(m).

The test methods used to generate the data in this test report are in accordance with ANSI C63.4: 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

The reference level offset in all of the plots included in this document has been adjusted to include correction factors.

In accordance with ANSI C63.4-2003, section 13.1.4.1, c), the device under test was rotated through three orthogonal axes to determine which attitude produced the highest emission relative to the limit. The attitude that produced the highest emission relative to the limit was used for all radiated emission measurements.



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## 5. Measurement Summary

| Test Requirement | FCC Part 15 Reference | Test Report Section | Result | Comment |
|---|---|---|---|---|
| Antenna Requirement | 15.203 | N/A | Compliant | See Note 1 below. |
| Minimum 6 dB Bandwidth | 15.247 (a) (2) | 6.1 | Compliant | |
| 99% Bandwidth | IC RSS-GEN | 6.1 | Compliant | For reference only |
| Maximum Peak Conducted Output Power | 15.247 (b) (3) & (b) (4) | 6.2 | Compliant | |
| Conducted Spurious Emissions | 15.247 (d) | 6.3 | Compliant | |
| Lower and Upper Band Edge Measurements | | 6.4 | Compliant | |
| Power Spectral Density | 15.247 (e) | 6.5 | Compliant | |
| Public Exposure to Radio Frequency Energy Levels | 1.1307 (b) (1) | 6.6 | Compliant | Calculated from field strength measurement and antenna gain. |
| Radiated Field Strength of Harmonics in Restricted Bands | 15.247 (d) 15.209 | 6.7 | Compliant | |
| Conducted Emissions | 15.207 | 6.8 | Compliant | -0.16 dB margin, neutral |
| Determination of Averaging Factor | 15.35 | 6.9 | Compliant | |

Note: Three antennas were supplied for test and individually tested:
1. Radiall/Larsen model SPDA17RP2400 right angle whip (external). This external antenna utilizes a reverse polarity TNC configuration for connection.
2. An alternative Tri-band antenna, Model #M8100-66490.
3. Dual Band Antenna, Part # M3002-66493.



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# 6. Measurement Data

## 6.1. Minimum 6 dB Bandwidth (15.247 (a) (2)) (RSS 210 A8.2(1))

Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

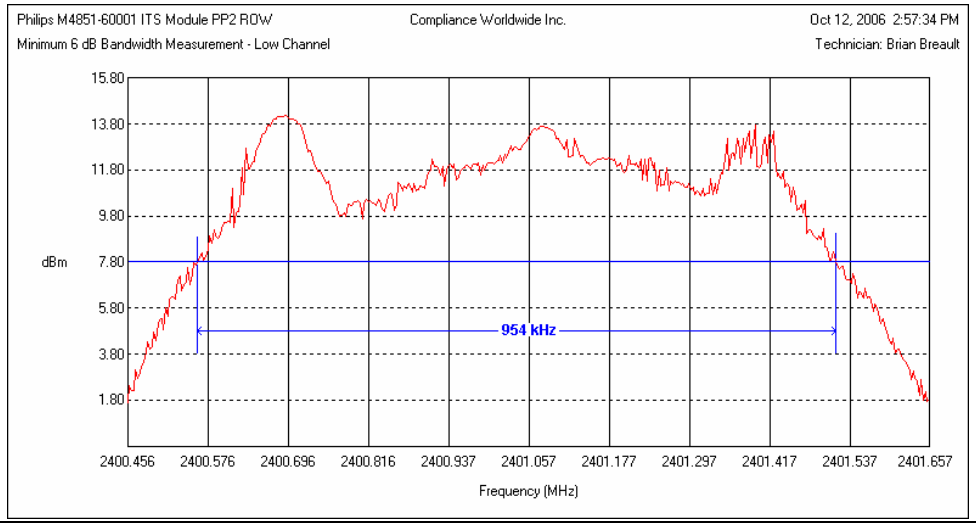
Resolution Bandwidth: 100 kHz
Video Bandwidth: 300 kHz
Sweep Time: 100 mS

### 6.1.1. Measurement Results

| Channel | Frequency | -6 dB Bandwidth (kHz) | Required -6 dB Bandwidth (kHz) | Result |
|---|---|---|---|---|
| Low | 2401.056 | 954 | ≥ 500 | Compliant |
| Middle | 2439.072 | 951 | ≥ 500 | Compliant |
| High | 2482.272 | 948 | ≥ 500 | Compliant |

### 6.1.2. 6 dB Bandwidth Measurement Plots

**Low Channel**



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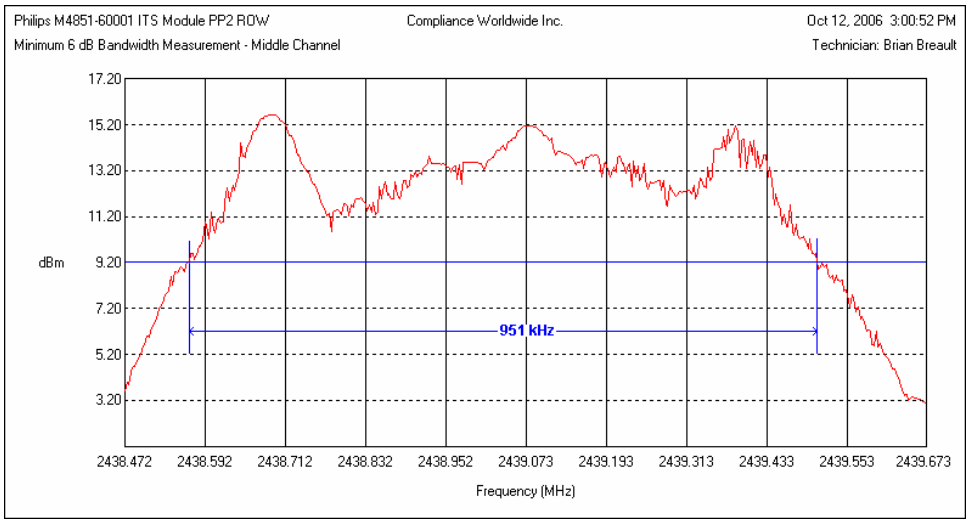
# 6. Measurement Data (continued)

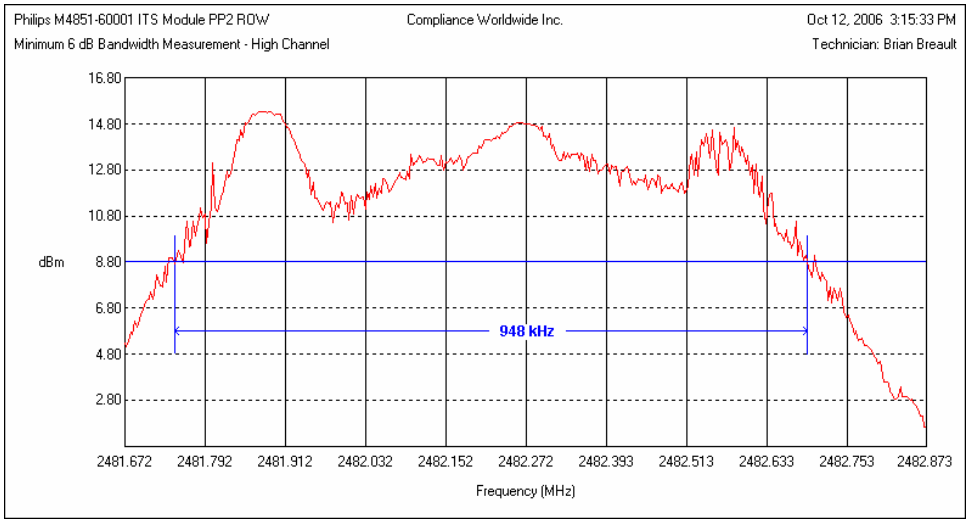
## 6.1. Minimum 6 dB Bandwidth (15.247 (a) (2)) (RSS 210 A8.2(1)) (continued)

### 6.1.2. 6 dB Bandwidth Measurement Plots (continued)

#### Middle Channel




#### High Channel



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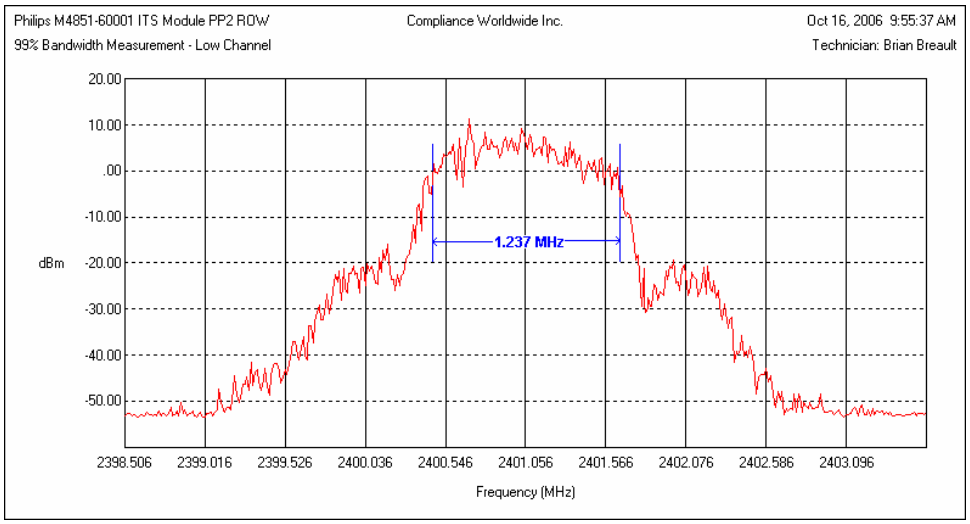
# 6. Measurement Data (continued)

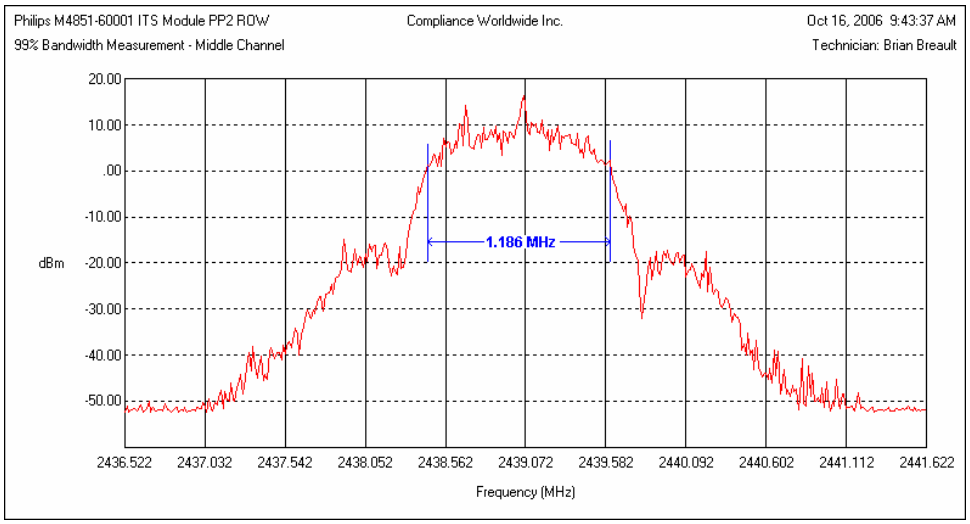
## 6.1. 99% Bandwidth

### 6.1.3. 99% dB Bandwidth Measurement Plots

#### Low Channel




#### Middle Channel



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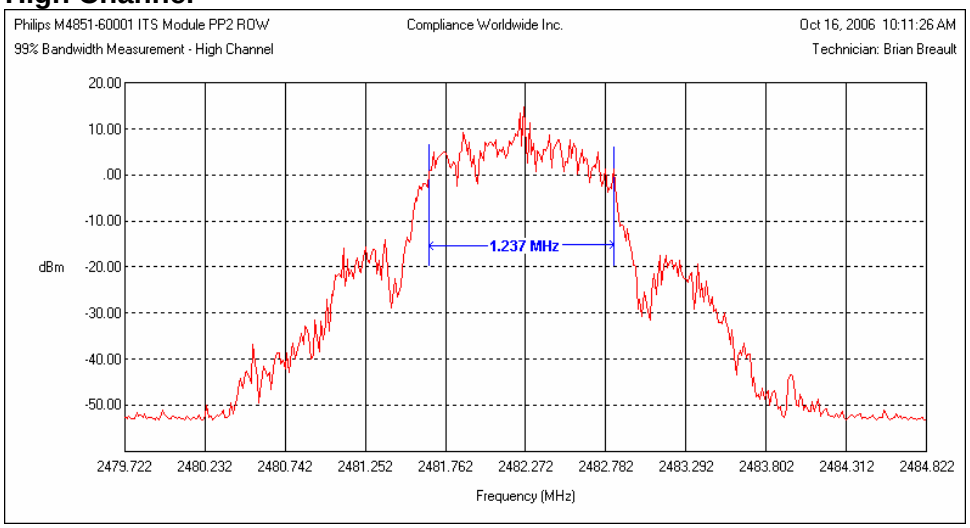
# 6. Measurement Data (continued)

## 6.1. 99% Bandwidth

### 6.1.3. 99% dB Bandwidth Measurement Plots (continued)

**High Channel**



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## 6. Measurement Data (continued)

### 6.2 Maximum Peak Conducted Output Power (15.247 (b) (1)) (RSS 210 A8.4.1)

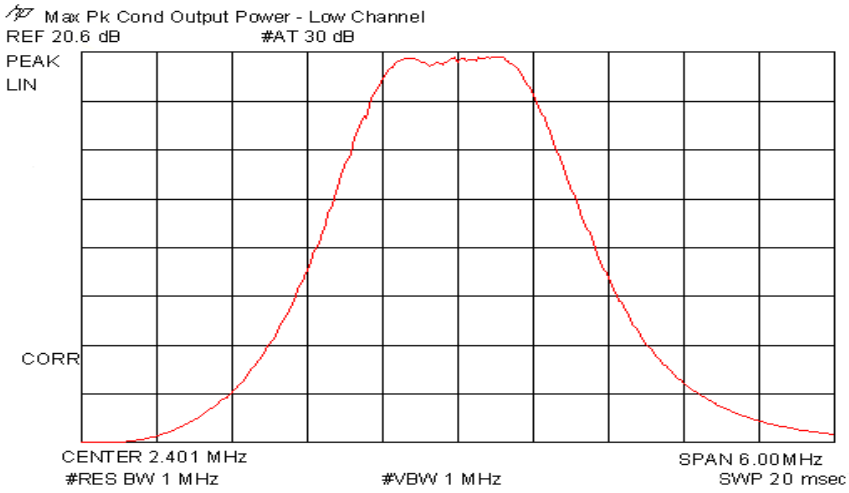
Requirement: For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt. Compliance with the one watt limit can be based on a measurement of the maximum conducted output power.

#### 6.2.1 Measurement Results

| Channel | Frequency | Conducted Output Power (dBm) | Conducted Output Power (W) | Conducted Output Power Limit (W) | Result |
|---|---|---|---|---|---|
| Low | 2401.056 | 20.60 | .1148 | 1 | Compliant |
| Middle | 2439.072 | 22.20 | .1659 | 1 | Compliant |
| High | 2482.272 | 21.80 | .1514 | 1 | Compliant |

#### 6.2.2 Measurement Plots

**Low Channel**



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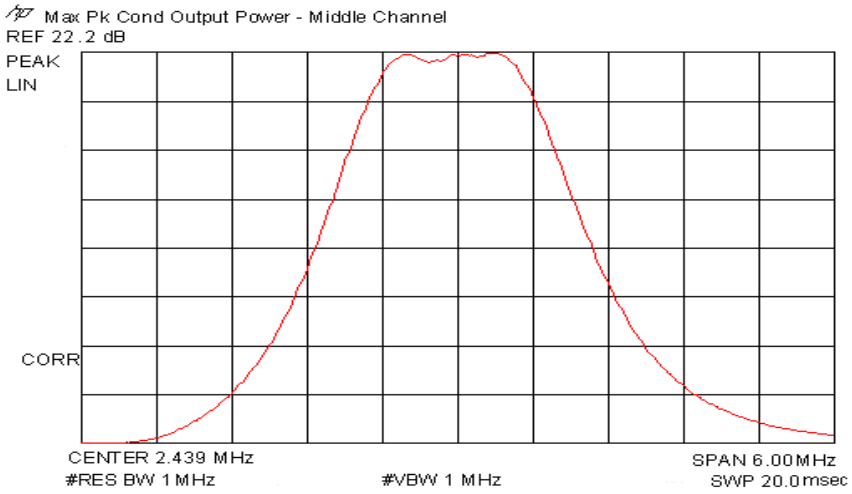
# 6. Measurement Data (continued)

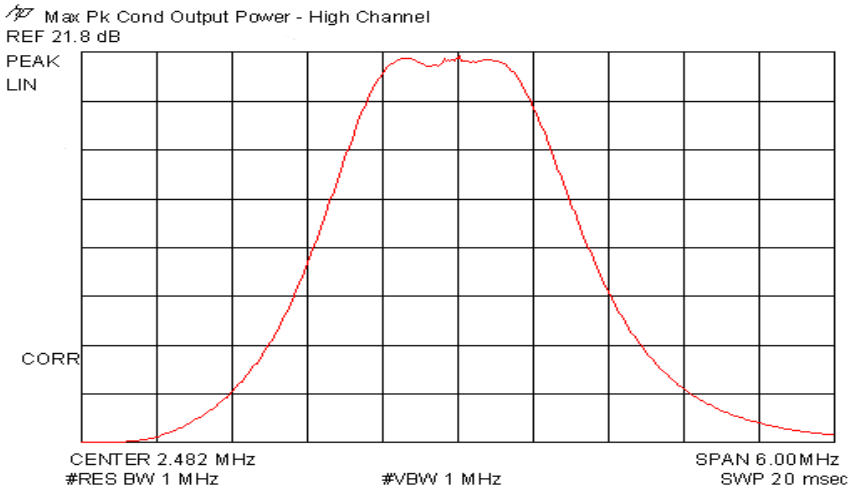
## 6.2. Maximum Peak Conducted Output Power (15.247 (b) (1)) (continued)

### 6.2.2 Measurement Plots (continued)

#### Middle Channel




#### High Channel



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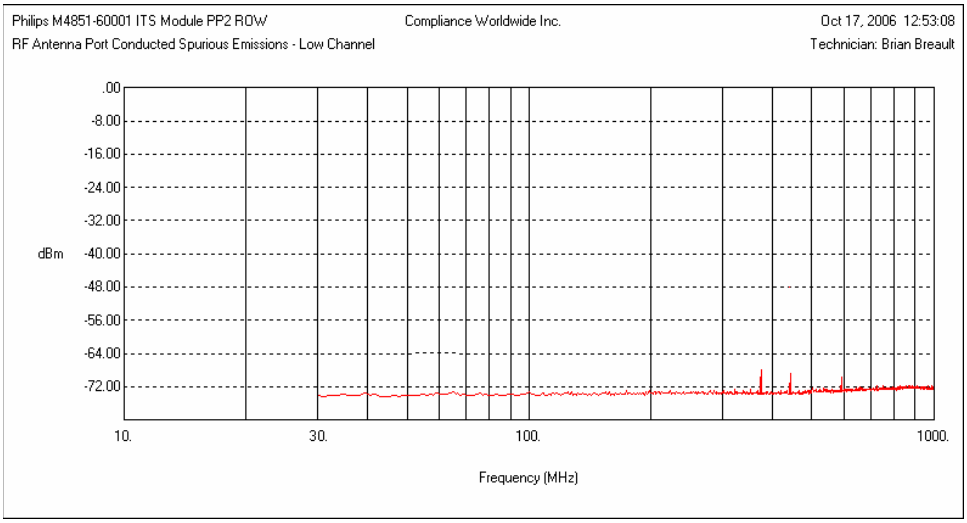
## 6. Measurement Data (continued)

### 6.3. Conducted Spurious Emissions (15.247 (d)) (RSS 210 A8.5)

Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

#### 6.3.1. RF Antenna Port Conducted Spurious Emissions
#### Low Channel Active – Plot 1 of 3



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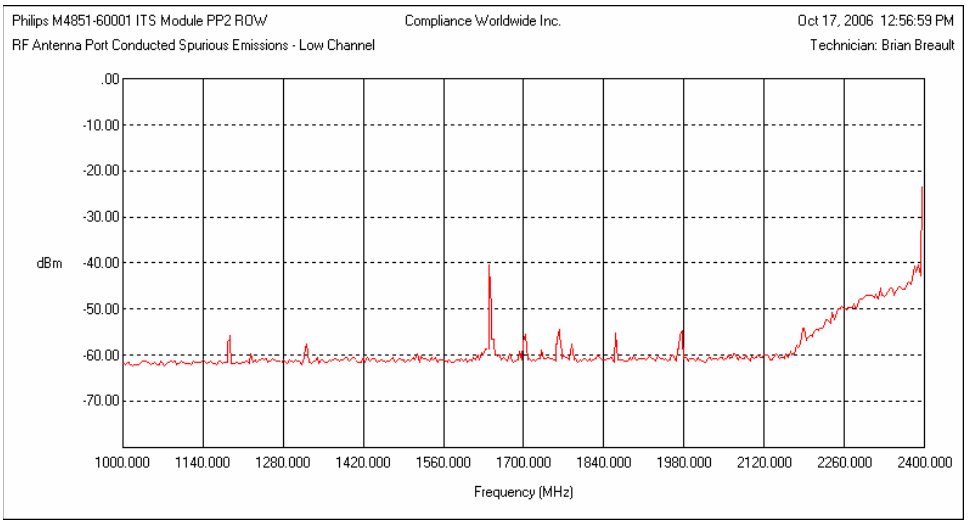
# 6. Measurement Data (continued)

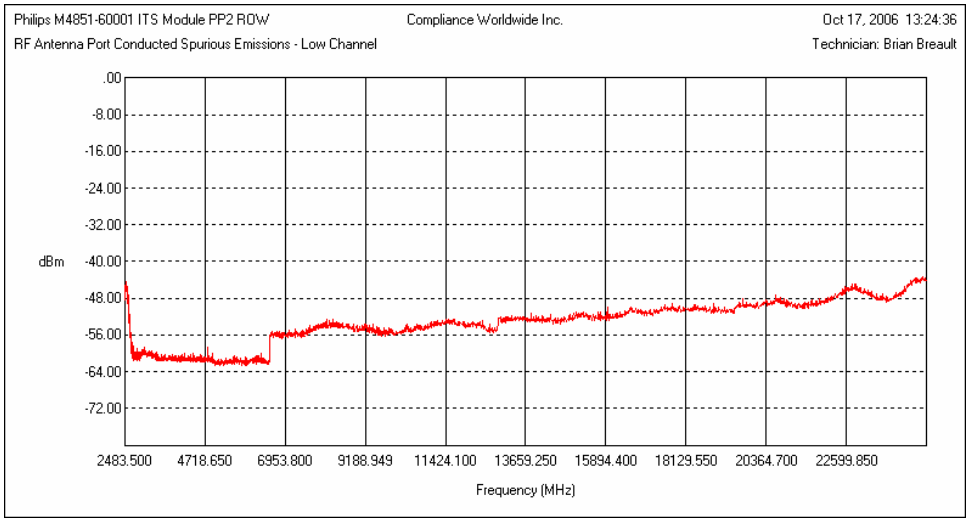
## 6.3. Conducted Spurious Emissions (15.247 (d)) (RSS 210 A8.5) (continued)

### 6.3.1. RF Antenna Port Conducted Spurious Emissions (continued)

**Low Channel Active – Plot 2 of 3**




**Low Channel Active – Plot 3 of 3**



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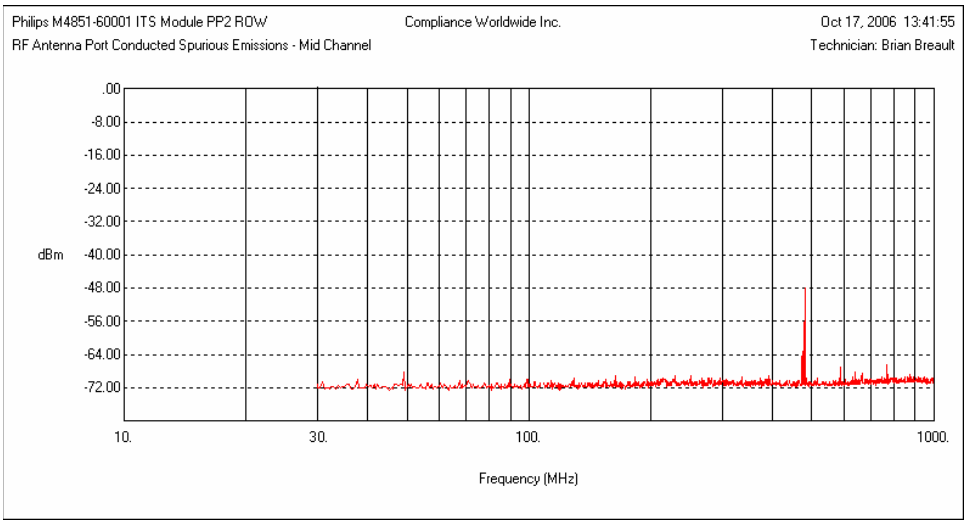
# 6. Measurement Data (continued)

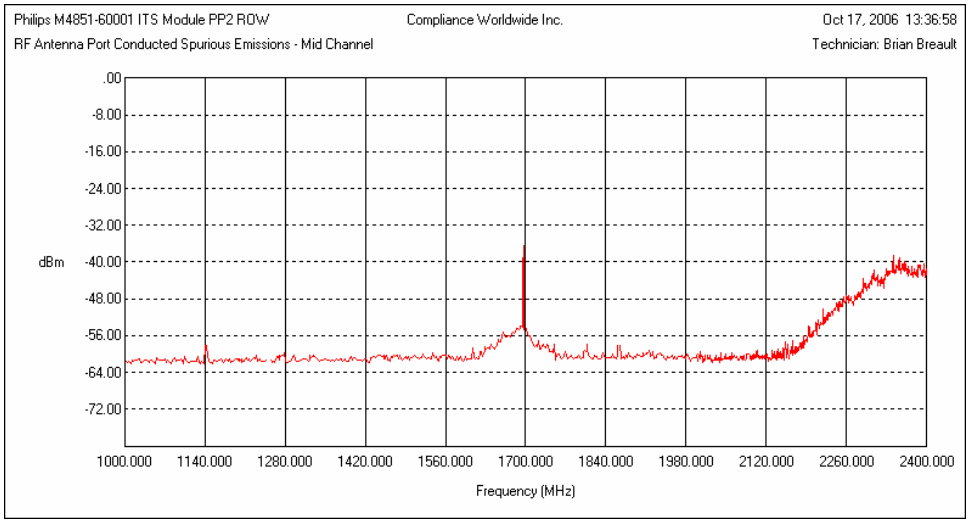
## 6.3. Conducted Spurious Emissions (15.247 (d)) (continued)

### 6.3.1. RF Antenna Port Conducted Spurious Emissions (continued)

**Middle Channel Active – Plot 1 of 3**




**Middle Channel Active – Plot 2 of 3**



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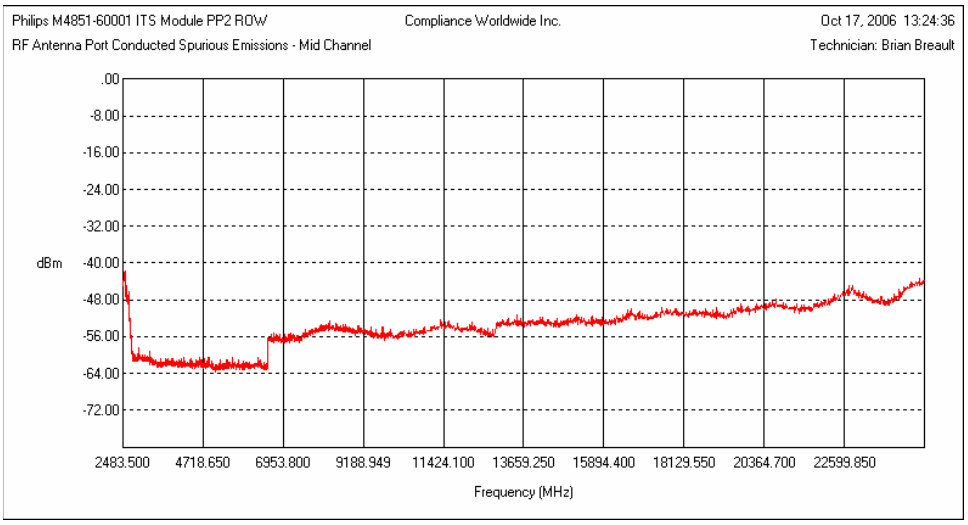
# 6. Measurement Data (continued)

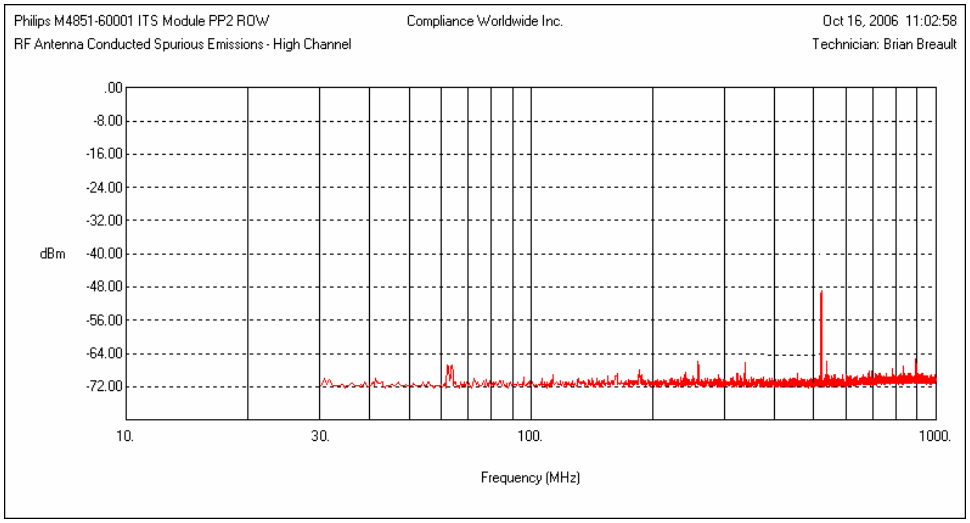
## 6.3. Conducted Spurious Emissions (15.247 (d)) (RSS 210 A8.5) (continued)

### 6.3.1. RF Antenna Port Conducted Spurious Emissions (continued)

**Middle Channel Active – Plot 3 of 3**




**High Channel Active – Plot 1 of 3**



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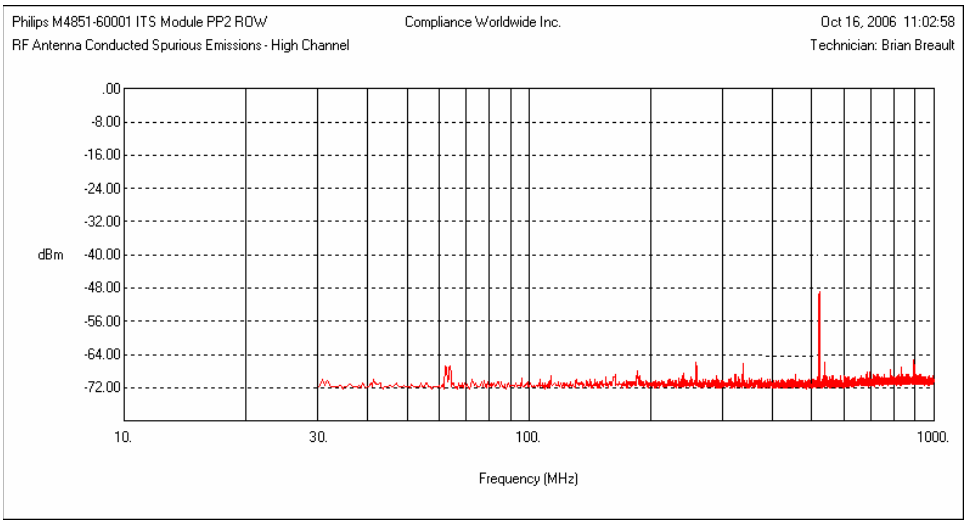
# 6. Measurement Data (continued)

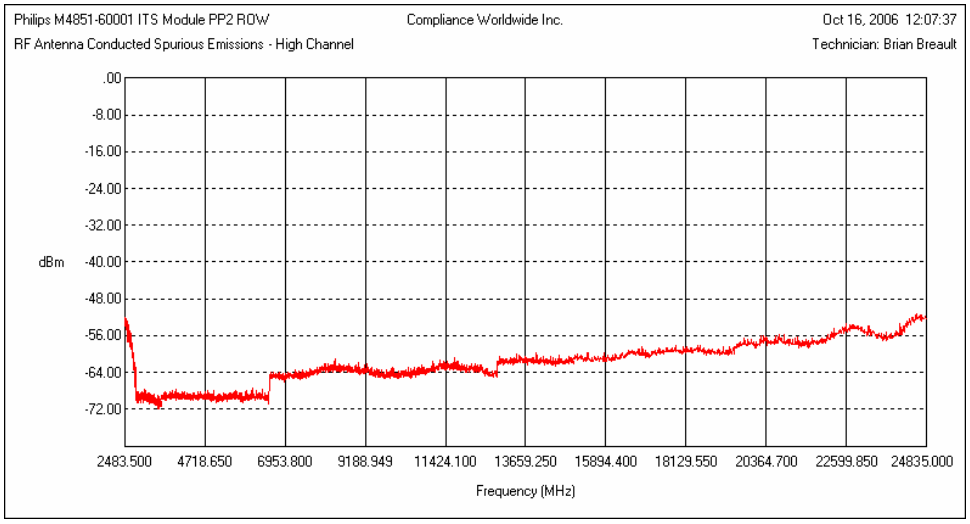
## 6.3. Conducted Spurious Emissions (15.247 (d)) (RSS 210 A8.5) (continued)

### 6.3.1. RF Antenna Port Conducted Spurious Emissions (continued)

**High Channel Active – Plot 2 of 3**




**High Channel Active – Plot 3 of 3**



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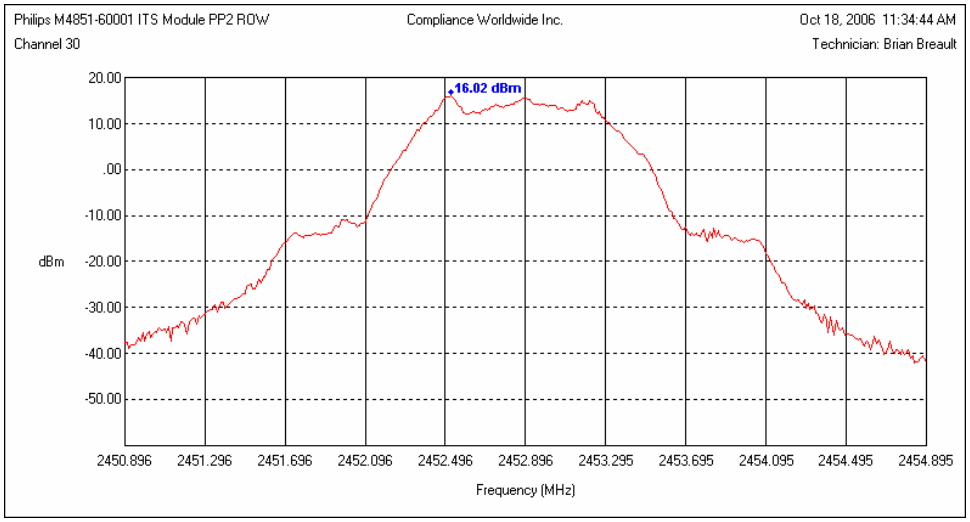
# 6. Measurement Data (continued)

## 6.4 Lower and Upper Band Edge Measurements (15.247 (d)) (RSS 210 A8.5)

Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

### 6.4.1 Highest Level of Desired Power Within the Band



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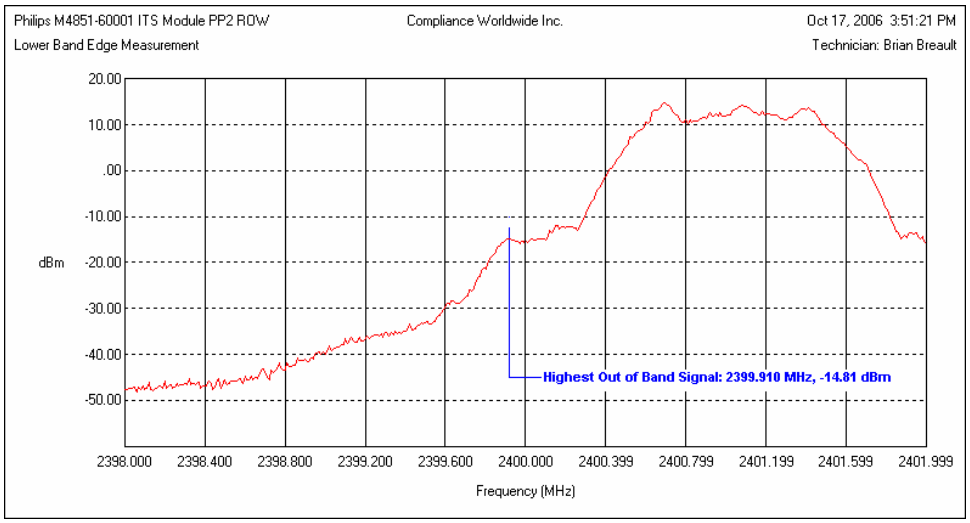
# 6. Measurement Data (continued)

## 6.4 Lower and Upper Band Edge Measurements (15.247 (d)) (RSS 210 A8.5) (cont'd)

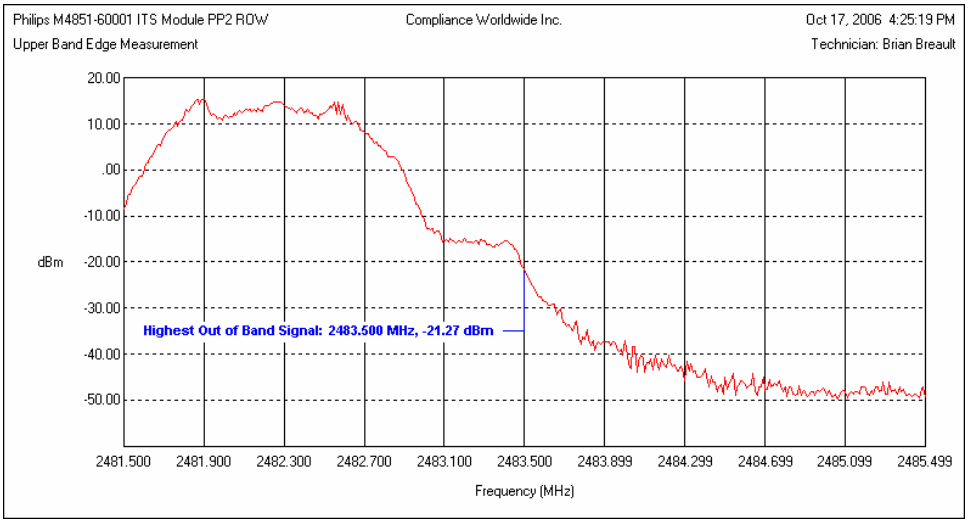
### 6.4.2. Measurement Results – Lower Band Edge

| Lowest Channel (MHz) | Highest Level Within the Band (dBm) | | Band Edge Frequency (MHz) | Highest Level Outside the Band (dBm) | | Margin (dB) | | Result |
|---|---|---|---|---|---|---|---|---|
| | Freq. | Peak | | Freq. | Peak | Required | Actual | |
| 2401.056 | 2452.896 | +16.02 | 2400.000 | 2399.910 | -14.81 | >30 dB | 30.83 dB | Compliant |




### 6.4.3. Measurement Results – Upper Band Edge

| Highest Channel (MHz) | Highest Level Within the Band (dBm) | | Band Edge Frequency (MHz) | Highest Level Outside the Band (dBm) | | Margin (dB) | | Result |
|---|---|---|---|---|---|---|---|---|
| | Freq. | Peak | | Freq. | Peak | Required | Actual | |
| 2482.272 | 2452.896 | +16.02 | 2483.500 | 2483.500 | -21.27 | >30 dB | 37.29 | Compliant |



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## 6. Measurement Data (continued)

### 6.5. Power Spectral Density (15.247 (e)) (RSS 210 A8.2(2))

Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

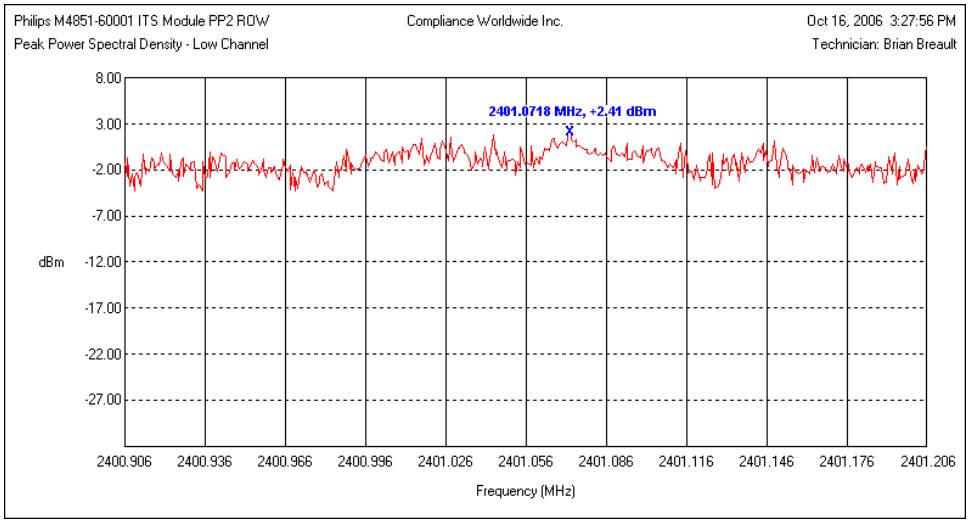
| | |
|---|---|
| Frequency Span: | 300 kHz |
| Resolution Bandwidth: | 3 kHz |
| Video Bandwidth: | 10 kHz |
| Sweep Time: | 100 Seconds |

### 6.5.1 Measurement Results

| Channel | Frequency | Power Spectral Density (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| Low | 2401.056 | 2.41 | 8 | Compliant |
| Middle | 2439.072 | 4.44 | 8 | Compliant |
| High | 2482.272 | 3.38 | 8 | Compliant |

### 6.5.2 Measurement Plots

#### Low Channel



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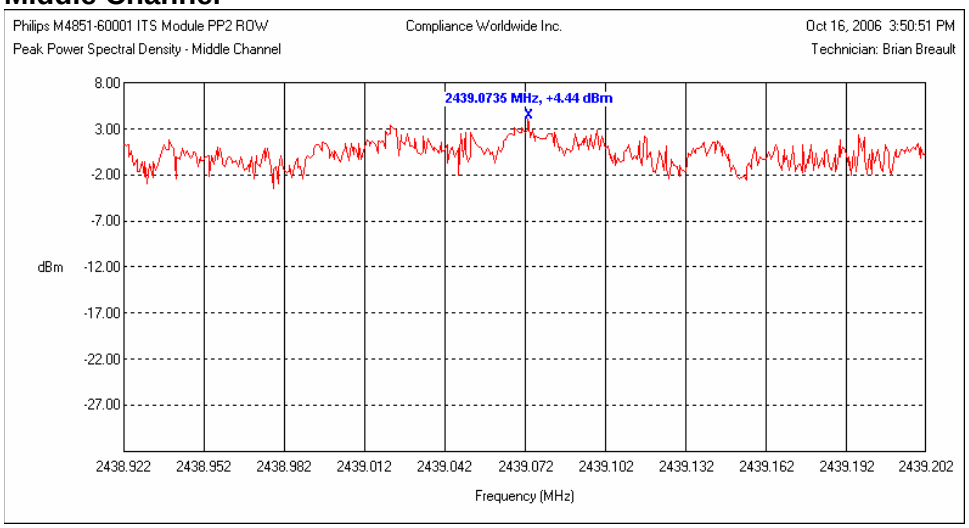
# 6. Measurement Data (continued)

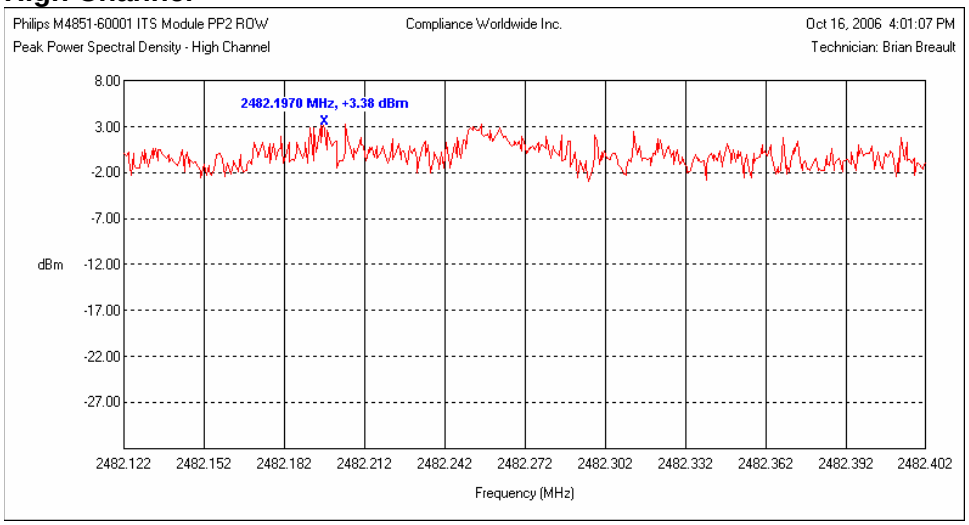
## 6.5. Power Spectral Density (15.247 (e)) (continued)

### 6.5.2 Measurement Plots (continued)

#### Middle Channel




#### High Channel



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## 6. Measurement Data (continued)

### 6.6. Public Exposure to Radio Frequency Energy Levels (15.247(i) (1.1307 (b)(1)) RSS-GEN 5.5, RSS 102

| MPE Distance (cm) | DUT Output Power (dBm) | DUT Antenna Gain (dBi) | Power Density ($mW/cm^2$) | Limit ($mW/cm^2$) | Result |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | |
| 20 cm[1] | 22.2 | +2.0 | .052 | 1.0 | Compliant |
| 20 cm[2] | 22.2 | +1.2 | .044 | 1.0 | Compliant |
| 20 cm[3] | 14.6 | +2.0 | .009 | 1.0 | Compliant |

[1] Calculation is based upon the Radiall/Larsen model SPDA17RP2400.
[2] Calculation is based upon the M8100-66490 Tri-band antenna.
[3] Calculation is based upon the M3002-66493 Dual Band Antenna.

1. Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.
2. Table 6.2.1 of this test report. The value used for this assessment is the highest of the 3 measured channels.
3. Data supplied by the client.
4. Calculated from field strength measurement and antenna gain.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.



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## 6. Measurement Data (continued)

### 6.7 Radiated Field Strength of Harmonics (15.247, Section (d))

#### 6.7. 1. Radiall/Larsen model SPDA17RP2400

Requirement: The 3 meter field strength of the harmonic emissions that fall within the restricted bands of operate per 15.205 from intentional radiators operated within the 2400-2483.5 MHz frequency bands shall comply with the following: 500 microvolts/meter (54 dBµV/m), average mode measurement

Note: The peak field strength of any emission shall not exceed the maximum permitted average limits specified by more than 20 dB under any condition of modulation.

#### 6.7.1.1 Lower Channel (2401.056 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4802.112[1] | 56.04 | 36.04 | 0.89 | 56.93 | 36.93 | 54 | -17.07 | H | 103 | 270 | Passed |
| 7203.168 | 48.01 | 28.01 | 4.77 | 52.78 | 32.78 | 54 | -21.22 | V | 159 | 225 | Passed |
| 9604.224 | 51.89 | 31.89 | 8.28 | 60.17 | 40.17 | 54 | -13.83 | V | 137 | 45 | Passed |
| 12005.280[1] | 44.91 | 24.91 | 11.75 | 56.66 | 36.66 | 54 | -17.34 | V | 185 | 137 | Passed |
| 14406.336 | 45.27 | 25.27 | 18.27 | 63.54 | 43.54 | 54 | -10.46 | H | 154 | 10 | Passed |
| 16807.392 | 45.65 | 25.65 | 20.52 | 66.17 | 46.17 | 54 | -7.83 | V | 107 | 245 | Passed |
| 19208.448[1] | 45.30 | 25.30 | 9.81 | 55.11 | 35.11 | 54 | -18.89 | Noise Floor | | | Passed |
| 21609.504 | 48.84 | 28.84 | 10.81 | 59.65 | 39.65 | 54 | -14.35 | Noise Floor | | | Passed |
| 24010.560 | 49.93 | 29.93 | 13.51 | 63.44 | 43.44 | 54 | -10.56 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.



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# 6. Measurement Data (continued)

## 6.7 Radiated Field Strength of Harmonics (15.247, Section (d)) (continued)

### 6.7. 1. Radiall/Larsen model SPDA17RP2400

#### 6.7.1.2 Middle Channel (2439.072 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4878.144[1] | 58.18 | 38.18 | 1.02 | 59.20 | 39.20 | 54 | -14.80 | V | 136 | 185 | Passed |
| 7317.216[1] | 52.31 | 32.31 | 5.05 | 57.36 | 37.36 | 54 | -16.64 | V | 109 | 170 | Passed |
| 9756.288 | 54.15 | 34.15 | 8.82 | 62.97 | 42.97 | 54 | -11.03 | V | 100 | 170 | Passed |
| 12195.360[1] | 44.60 | 24.60 | 11.99 | 56.59 | 36.59 | 54 | -17.41 | V | 145 | 80 | Passed |
| 14634.432 | 45.00 | 25.00 | 17.94 | 62.94 | 42.94 | 54 | -11.06 | V | 100 | 170 | Passed |
| 17073.504 | 45.29 | 25.29 | 23.92 | 69.21 | 49.21 | 54 | -4.79 | H | 150 | 180 | Passed |
| 19512.576[1] | 48.02 | 28.02 | 9.96 | 57.98 | 37.98 | 54 | -16.02 | Noise Floor | | | Passed |
| 21951.648 | 48.33 | 28.33 | 11.32 | 59.65 | 39.65 | 54 | -14.35 | Noise Floor | | | Passed |
| 24390.720 | 52.65 | 32.65 | 13.36 | 66.01 | 46.01 | 54 | -7.99 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.

#### 6.7.1.3 Upper Channel (2482.272 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4964.544[1] | 62.34 | 42.34 | 1.45 | 63.79 | 43.79 | 54 | -10.21 | V | 102 | 225 | Passed |
| 7446.816[1] | 54.20 | 34.20 | 5.66 | 59.86 | 39.86 | 54 | -14.14 | V | 111 | 100 | Passed |
| 9929.088 | 50.28 | 30.28 | 9.00 | 59.28 | 39.28 | 54 | -14.72 | V | 131 | 270 | Passed |
| 12411.360[1] | 46.59 | 26.59 | 12.17 | 58.76 | 38.76 | 54 | -15.24 | V | 121 | 160 | Passed |
| 14893.632 | 45.57 | 25.57 | 16.37 | 61.94 | 41.94 | 54 | -12.06 | V | 122 | 0 | Passed |
| 17375.904 | 45.48 | 25.48 | 26.73 | 72.21 | 52.21 | 54 | -1.79 | V | 130 | 270 | Passed |
| 19858.176[1] | 48.61 | 28.61 | 9.06 | 57.67 | 37.67 | 54 | -16.33 | Noise Floor | | | Passed |
| 22340.448 | 49.21 | 29.21 | 13.14 | 62.35 | 42.35 | 54 | -11.65 | Noise Floor | | | Passed |
| 24822.720 | 52.56 | 32.56 | 13.84 | 66.40 | 46.40 | 54 | -7.60 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.



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# 6. Measurement Data (continued)

## 6.7 Radiated Field Strength of Harmonics (15.247, Section (d))

### 6.7.2. Alternative Tri-band antenna, Model #M8100-66490

#### 6.7.2.1 Lower Channel (2401.056 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4802.112[1] | 57.37 | 37.37 | -0.56 | 56.81 | 36.81 | 54 | -17.19 | V | 107 | 80 | Passed |
| 7203.168 | 57.76 | 37.76 | 3.82 | 61.58 | 41.58 | 54 | -12.42 | V | 174 | 355 | Passed |
| 9604.224 | 60.64 | 40.64 | 5.07 | 65.71 | 45.71 | 54 | -8.29 | V | 160 | 355 | Passed |
| 12005.280[1] | 54.86 | 34.86 | 7.40 | 62.26 | 42.26 | 54 | -11.74 | V | 137 | 0 | Passed |
| 14406.336 | 51.76 | 31.76 | 11.80 | 63.56 | 43.56 | 54 | -10.44 | V | 160 | 280 | Passed |
| 16807.392 | 49.58 | 29.58 | 17.59 | 67.17 | 47.17 | 54 | -6.83 | V | 160 | 355 | Passed |
| 19208.448[1] | 51.40 | 31.40 | 9.81 | 61.21 | 41.21 | 54 | -12.79 | Noise Floor | | | Passed |
| 21609.504 | 51.16 | 31.16 | 10.81 | 61.97 | 41.97 | 54 | -12.03 | Noise Floor | | | Passed |
| 24010.560 | 51.94 | 31.94 | 13.51 | 65.45 | 45.45 | 54 | -8.55 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.

#### 6.7.2.2. Middle Channel (2439.072 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4878.144[1] | 60.72 | 40.72 | -0.41 | 60.31 | 40.31 | 54 | -13.69 | V | 165 | 0 | Passed |
| 7317.216[1] | 58.04 | 38.04 | 3.61 | 61.65 | 41.65 | 54 | -12.35 | V | 169 | 0 | Passed |
| 9756.288 | 57.01 | 37.01 | 5.35 | 62.36 | 42.36 | 54 | -11.64 | V | 145 | 260 | Passed |
| 12195.360[1] | 49.98 | 29.98 | 7.67 | 57.65 | 37.65 | 54 | -16.35 | V | 132 | 355 | Passed |
| 14634.432 | 48.22 | 28.22 | 12.23 | 60.45 | 40.45 | 54 | -13.55 | V | 136 | 0 | Passed |
| 17073.504 | 49.40 | 29.40 | 18.71 | 68.11 | 48.11 | 54 | -5.89 | V | 131 | 0 | Passed |
| 19512.576[1] | 50.97 | 30.97 | 9.96 | 60.93 | 40.93 | 54 | -13.07 | Noise Floor | | | Passed |
| 21951.648 | 51.59 | 31.59 | 11.32 | 62.91 | 42.91 | 54 | -11.09 | Noise Floor | | | Passed |
| 24390.720 | 52.18 | 32.18 | 13.36 | 65.54 | 45.54 | 54 | -8.46 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.



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# 6. Measurement Data (continued)

## 6.7 Radiated Field Strength of Harmonics (15.247, Section (d)) (continued)

### 6.7.2. Alternative Tri-band antenna, Model #M8100-66490

#### 6.7.2.3. Upper Channel (2482.272 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4964.544[1] | 63.10 | 43.10 | -0.24 | 62.86 | 42.86 | 54 | -11.14 | V | 231 | 358 | Passed |
| 7446.816[1] | 57.68 | 37.68 | 3.85 | 61.53 | 41.53 | 54 | -12.47 | V | 191 | 355 | Passed |
| 9929.088 | 55.63 | 35.63 | 6.17 | 61.80 | 41.80 | 54 | -12.20 | V | 148 | 95 | Passed |
| 12411.360[1] | 54.10 | 34.10 | 7.92 | 62.02 | 42.02 | 54 | -11.98 | V | 137 | 260 | Passed |
| 14893.632 | 49.93 | 29.93 | 12.53 | 62.46 | 42.46 | 54 | -11.54 | V | 199 | 90 | Passed |
| 17375.904 | 49.41 | 29.41 | 28.65 | 78.06 | 58.06 | 54 | 4.06 | V | 163 | 350 | Passed |
| 19858.176[1] | 51.21 | 31.21 | 9.06 | 60.27 | 40.27 | 54 | -13.73 | Noise Floor | | | Passed |
| 22340.448 | 51.45 | 31.45 | 13.14 | 64.59 | 44.59 | 54 | -9.41 | Noise Floor | | | Passed |
| 24822.720 | 51.71 | 31.71 | 13.84 | 65.55 | 45.55 | 54 | -8.45 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.

### 6.7.3. Alternative Dual Band Antenna, Part # M3002-66493

#### 6.7.3.1 Lower Channel (2401.056 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4802.112[1] | 64.59 | 44.59 | -5.36 | 39.23 | 54.00 | -14.77 | V | 162 | 268 | 268 | Passed |
| 7203.168 | 59.36 | 39.36 | -0.94 | 38.42 | 54.00 | -15.58 | V | 200 | 220 | 220 | Passed |
| 9604.224 | 62.05 | 42.05 | -0.21 | 41.84 | 54.00 | -12.16 | H | 148 | 268 | 268 | Passed |
| 12005.280[1] | 56.27 | 36.27 | 3.59 | 39.86 | 54.00 | -14.14 | V | 149 | 270 | 270 | Passed |
| 14406.336 | 54.25 | 34.25 | 4.47 | 38.72 | 54.00 | -15.28 | 54.25 | V | 160 | 280 | Passed |
| 16807.392 | 54.78 | 34.78 | 5.05 | 39.83 | 54.00 | -14.17 | 54.78 | Noise Floor | | | Passed |
| 19208.448[1] | 54.69 | 34.69 | 6.09 | 40.78 | 54.00 | -13.22 | 54.69 | Noise Floor | | | Passed |
| 21609.504 | 58.72 | 38.72 | 9.19 | 47.91 | 54.00 | -6.09 | 58.72 | Noise Floor | | | Passed |
| 24010.560 | 50.68 | 30.68 | 13.64 | 44.32 | 54.00 | -9.68 | 50.68 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.



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# 6. Measurement Data (continued)

## 6.7 Radiated Field Strength of Harmonics (15.247, Section (d)) (continued)

### 6.7.3. Alternative Dual Band Antenna, Part # M3002-66493

#### 6.7.3.2. Middle Channel (2439.072 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4878.144[1] | 63.68 | 43.68 | -5.35 | 38.33 | 54.00 | -15.67 | 63.68 | V | 163 | 355 | Passed |
| 7317.216[1] | 57.69 | 37.69 | -1.65 | 36.04 | 54.00 | -17.96 | 57.69 | H | 182 | 275 | Passed |
| 9756.288 | 52.65 | 32.65 | -0.18 | 32.47 | 54.00 | -21.53 | 52.65 | V | 193 | 350 | Passed |
| 12195.360[1] | 53.12 | 33.12 | 4.50 | 37.62 | 54.00 | -16.38 | 53.12 | H | 147 | 300 | Passed |
| 14634.432 | 54.36 | 34.36 | 4.89 | 39.25 | 54.00 | -14.75 | 54.36 | V | 136 | 0 | Passed |
| 17073.504 | 54.32 | 34.32 | 6.33 | 40.65 | 54.00 | -13.35 | 54.32 | Noise Floor | | | Passed |
| 19512.576[1] | 56.01 | 36.01 | 8.82 | 44.83 | 54.00 | -9.17 | 56.01 | Noise Floor | | | Passed |
| 21951.648 | 58.51 | 38.51 | 9.09 | 47.60 | 54.00 | -6.40 | 58.51 | Noise Floor | | | Passed |
| 24390.720 | 50.12 | 30.12 | 13.09 | 43.21 | 54.00 | -10.79 | 50.12 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.

#### 6.7.3.3. Upper Channel (2482.272 MHz)

| Frequency (MHz) | Amplitude (dBµV) | | Corr. Fact. (dB) | Amplitude (dBµV/m) | | Average Limit | Margin (dB) | Ant Pol | Ant Ht | TT Pos | Result |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peak | Avg | | Peak | Avg | | | H/V | cm | Deg | |
| 4964.544[1] | 66.03 | 46.03 | -5.18 | 40.85 | 54.00 | -13.15 | 66.03 | V | 100 | 260 | Passed |
| 7446.816[1] | 60.05 | 40.05 | -1.43 | 38.62 | 54.00 | -15.38 | 60.05 | V | 155 | 90 | Passed |
| 9929.088 | 55.03 | 35.03 | -0.55 | 34.48 | 54.00 | -19.52 | 55.03 | V | 131 | 260 | Passed |
| 12411.360[1] | 52.02 | 32.02 | 3.46 | 35.48 | 54.00 | -18.52 | 52.02 | V | 100 | 260 | Passed |
| 14893.632 | 54.63 | 34.63 | 4.90 | 39.53 | 54.00 | -14.47 | 54.63 | V | 199 | 90 | Passed |
| 17375.904 | 54.49 | 34.49 | 7.26 | 41.75 | 54.00 | -12.25 | 54.49 | Noise Floor | | | Passed |
| 19858.176[1] | 54.22 | 34.22 | 9.03 | 43.25 | 54.00 | -10.75 | 54.22 | Noise Floor | | | Passed |
| 22340.448 | 57.96 | 37.96 | 10.28 | 48.24 | 54.00 | -5.76 | 57.96 | Noise Floor | | | Passed |
| 24822.720 | 51.23 | 31.23 | 14.19 | 45.42 | 54.00 | -8.58 | 51.23 | Noise Floor | | | Passed |

[1] Frequency falls within the Restricted Bands of Operation. See FCC Part 15, Section 15.205 for additional information.



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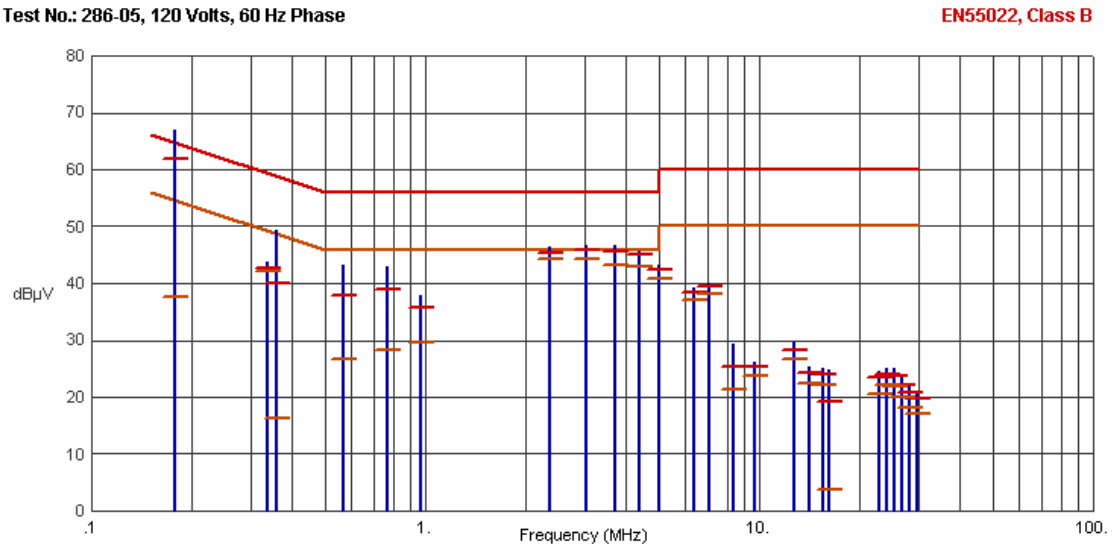
# 6. Measurement Data (continued)

## 6.8 Line Conducted Emissions (15.207)

### 6.8. 1. Radiall/Larsen model SPDA17RP2400

#### 6.8.1.1. 120 Volts, 60 Hz Phase




| Frequency (MHz) | Pk Amp (dBµV) | QP Amp (dBµV) | QP Limit (dBµV) | QP Margin (dB) | Avg Amp (dBµV) | Avg Limit (dBµV) | Avg Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|
| .1774 | 66.83 | 61.77 | 64.61 | -2.84 | 37.52 | 54.61 | -17.09 | |
| .3355 | 43.64 | 42.64 | 59.31 | -16.67 | 42.08 | 49.31 | -7.23 | |
| .3604 | 49.28 | 40.13 | 58.72 | -18.59 | 16.33 | 48.72 | -32.39 | |
| .5711 | 43.09 | 37.84 | 56.00 | -18.16 | 26.54 | 46.00 | -19.46 | |
| .7698 | 42.90 | 39.05 | 56.00 | -16.95 | 28.40 | 46.00 | -17.60 | |
| .9645 | 38.00 | 35.74 | 56.00 | -20.26 | 29.72 | 46.00 | -16.28 | |
| 2.3508 | 46.27 | 45.39 | 56.00 | -10.61 | 44.33 | 46.00 | -1.67 | |
| 3.0217 | 46.76 | 45.78 | 56.00 | -10.22 | 44.21 | 46.00 | -1.79 | |
| 3.6945 | 46.72 | 45.64 | 56.00 | -10.36 | 43.15 | 46.00 | -2.85 | |
| 4.3645 | 45.58 | 44.96 | 56.00 | -11.04 | 42.82 | 46.00 | -3.18 | |
| 5.0379 | 43.24 | 42.51 | 60.00 | -17.49 | 40.78 | 50.00 | -9.22 | |
| 6.3795 | 39.07 | 38.44 | 60.00 | -21.56 | 37.09 | 50.00 | -12.91 | |
| 7.0507 | 40.03 | 39.43 | 60.00 | -20.57 | 38.18 | 50.00 | -11.82 | |
| 8.3991 | 29.34 | 25.25 | 60.00 | -34.75 | 21.31 | 50.00 | -28.69 | |
| 9.7378 | 26.20 | 25.45 | 60.00 | -34.55 | 23.84 | 50.00 | -26.16 | |
| 12.7572 | 29.52 | 28.37 | 60.00 | -31.63 | 26.66 | 50.00 | -23.34 | |
| 14.1005 | 25.30 | 24.19 | 60.00 | -35.81 | 22.41 | 50.00 | -27.59 | |
| 15.4427 | 25.16 | 23.98 | 60.00 | -36.02 | 22.22 | 50.00 | -27.78 | |
| 16.1261 | 24.79 | 19.21 | 60.00 | -40.79 | 3.72 | 50.00 | -46.28 | |
| 22.8290 | 24.55 | 23.50 | 60.00 | -36.50 | 20.65 | 50.00 | -29.35 | |
| 24.1689 | 25.07 | 24.04 | 60.00 | -35.96 | 22.06 | 50.00 | -27.94 | |
| 25.5122 | 24.94 | 23.78 | 60.00 | -36.22 | 21.81 | 50.00 | -28.19 | |
| 26.8551 | 23.37 | 22.03 | 60.00 | -37.97 | 19.87 | 50.00 | -30.13 | |
| 28.1997 | 22.07 | 20.70 | 60.00 | -39.30 | 18.21 | 50.00 | -31.79 | |
| 29.5463 | 20.91 | 19.65 | 60.00 | -40.35 | 17.09 | 50.00 | -32.91 | |



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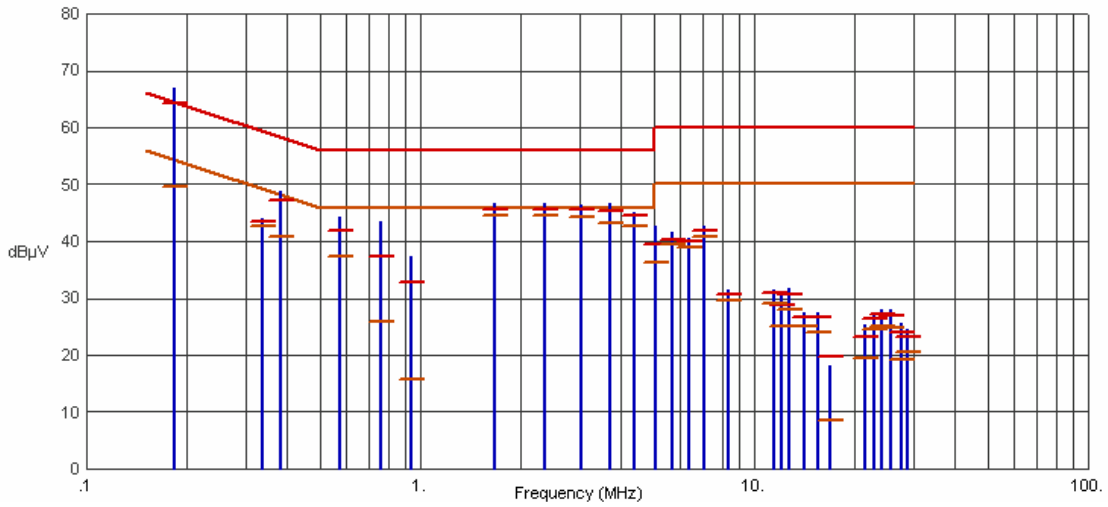
# 6. Measurement Data (continued)

## 6.8 Line Conducted Emissions (15.207) (continued)

### 6.8. 1. Radiall/Larsen model SPDA17RP2400 (continued)

### 6.8.1.2. 120 Volts, 60 Hz Neutral

Test No.: 286-05, 120 Volts, 60 Hz Neutral EN55022, Class B




| Frequency (MHz) | Pk Amp (dBµV) | QP Amp (dBµV) | QP Limit (dBµV) | QP Margin (dB) | Avg Amp (dBµV) | Avg Limit (dBµV) | Avg Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|
| .1826 | 66.84 | 64.21 | 64.37 | -.16 | 49.58 | 54.37 | -4.79 | |
| .3364 | 44.11 | 43.37 | 59.29 | -15.92 | 42.65 | 49.29 | -6.64 | |
| .3829 | 48.91 | 47.18 | 58.22 | -11.04 | 40.70 | 48.22 | -7.52 | |
| .5753 | 44.15 | 41.85 | 56.00 | -14.15 | 37.23 | 46.00 | -8.77 | |
| .7617 | 43.34 | 37.34 | 56.00 | -18.66 | 25.89 | 46.00 | -20.11 | |
| .9410 | 37.25 | 32.88 | 56.00 | -23.12 | 15.71 | 46.00 | -30.29 | |
| 1.6780 | 46.76 | 45.67 | 56.00 | -10.33 | 44.65 | 46.00 | -1.35 | |
| 2.3501 | 46.60 | 45.70 | 56.00 | -10.30 | 44.65 | 46.00 | -1.35 | |
| 3.0219 | 46.34 | 45.71 | 56.00 | -10.29 | 44.31 | 46.00 | -1.69 | |
| 3.6944 | 46.58 | 45.45 | 56.00 | -10.55 | 43.24 | 46.00 | -2.76 | |
| 4.3670 | 44.98 | 44.43 | 56.00 | -11.57 | 42.63 | 46.00 | -3.37 | |
| 5.0426 | 42.78 | 39.45 | 60.00 | -20.55 | 36.33 | 50.00 | -13.67 | |
| 5.7098 | 41.60 | 40.38 | 60.00 | -19.62 | 39.39 | 50.00 | -10.61 | |
| 6.3826 | 40.61 | 40.08 | 60.00 | -19.92 | 38.93 | 50.00 | -11.07 | |
| 7.0545 | 42.58 | 41.78 | 60.00 | -18.22 | 40.84 | 50.00 | -9.16 | |
| 8.4004 | 31.51 | 30.64 | 60.00 | -29.36 | 29.57 | 50.00 | -20.43 | |
| 11.4264 | 31.53 | 30.85 | 60.00 | -29.15 | 29.17 | 50.00 | -20.83 | |
| 12.0948 | 30.92 | 28.90 | 60.00 | -31.10 | 25.13 | 50.00 | -24.87 | |
| 12.7655 | 31.73 | 30.76 | 60.00 | -29.24 | 28.01 | 50.00 | -21.99 | |
| 14.1154 | 27.37 | 26.65 | 60.00 | -33.35 | 25.19 | 50.00 | -24.81 | |
| 15.4628 | 27.38 | 26.55 | 60.00 | -33.45 | 24.04 | 50.00 | -25.96 | |
| 16.8155 | 18.26 | 19.64 | 60.00 | -40.36 | 8.64 | 50.00 | -41.36 | |
| 21.5159 | 25.26 | 23.19 | 60.00 | -36.81 | 19.44 | 50.00 | -30.56 | |
| 22.8567 | 27.44 | 26.35 | 60.00 | -33.65 | 24.48 | 50.00 | -25.52 | |
| 24.2041 | 27.92 | 27.10 | 60.00 | -32.90 | 25.09 | 50.00 | -24.91 | |
| 25.5519 | 27.90 | 26.91 | 60.00 | -33.09 | 24.68 | 50.00 | -25.32 | |
| 27.5665 | 25.61 | 24.02 | 60.00 | -35.98 | 19.23 | 50.00 | -30.77 | |
| 28.9190 | 24.43 | 23.26 | 60.00 | -36.74 | 20.50 | 50.00 | -29.50 | |



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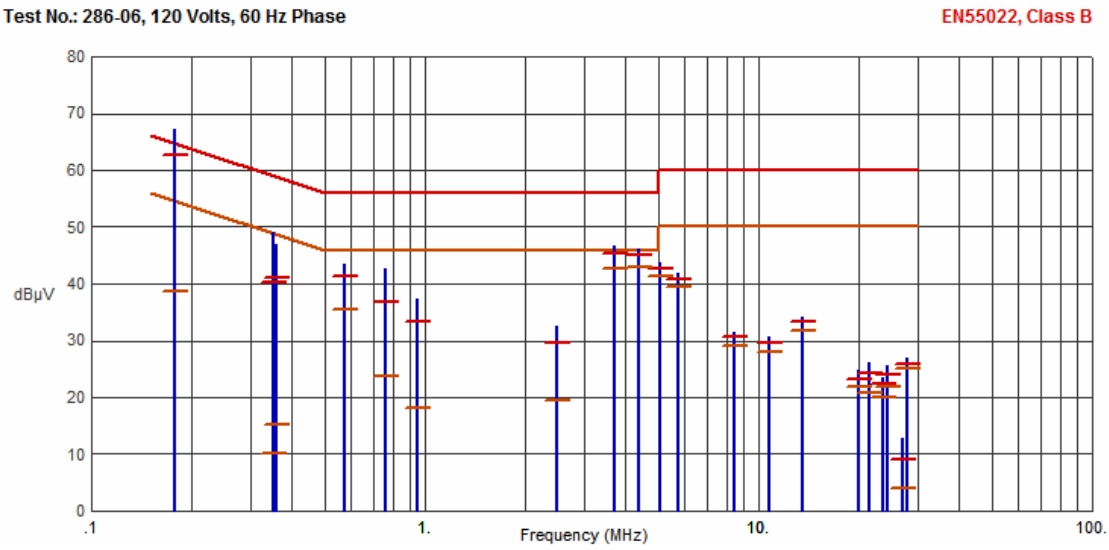
# 6. Measurement Data (continued)

## 6.8 Line Conducted Emissions (15.207) (continued)

### 6.8.2. Alternative Tri-band antenna, Model #M8100-66490

#### 6.8.2.1. 120 Volts, 60 Hz Phase




| Frequency (MHz) | Pk Amp (dBµV) | QP Amp (dBµV) | QP Limit (dBµV) | QP Margin (dB) | Avg Amp (dBµV) | Avg Limit (dBµV) | Avg Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|
| .1772 | 67.20 | 62.65 | 64.62 | -1.97 | 38.54 | 54.62 | -16.08 | |
| .3512 | 49.06 | 40.26 | 58.93 | -18.67 | 10.21 | 48.93 | -38.72 | |
| .3577 | 46.98 | 40.98 | 58.78 | -17.80 | 15.29 | 48.78 | -33.49 | |
| .5741 | 43.44 | 41.41 | 56.00 | -14.59 | 35.43 | 46.00 | -10.57 | |
| .7610 | 42.58 | 36.69 | 56.00 | -19.31 | 23.71 | 46.00 | -22.29 | |
| .9472 | 37.20 | 33.36 | 56.00 | -22.64 | 18.25 | 46.00 | -27.75 | |
| 2.4926 | 32.61 | 29.51 | 56.00 | -26.49 | 19.56 | 46.00 | -26.44 | |
| 3.7047 | 46.56 | 45.42 | 56.00 | -10.58 | 42.79 | 46.00 | -3.21 | |
| 4.3786 | 46.18 | 45.18 | 56.00 | -10.82 | 42.87 | 46.00 | -3.13 | |
| 5.0525 | 43.63 | 42.77 | 60.00 | -17.23 | 41.31 | 50.00 | -8.69 | |
| 5.7269 | 41.90 | 40.84 | 60.00 | -19.16 | 39.43 | 50.00 | -10.57 | |
| 8.4221 | 31.55 | 30.55 | 60.00 | -29.45 | 29.09 | 50.00 | -20.91 | |
| 10.7797 | 30.57 | 29.64 | 60.00 | -30.36 | 27.97 | 50.00 | -22.03 | |
| 13.4756 | 34.12 | 33.27 | 60.00 | -26.73 | 31.73 | 50.00 | -18.27 | |
| 20.0002 | 24.91 | 23.22 | 60.00 | -36.78 | 21.89 | 50.00 | -28.11 | |
| 21.5576 | 26.13 | 24.19 | 60.00 | -35.81 | 20.67 | 50.00 | -29.33 | |
| 23.5847 | 23.48 | 22.42 | 60.00 | -37.58 | 20.04 | 50.00 | -29.96 | |
| 24.2577 | 25.51 | 23.99 | 60.00 | -36.01 | 21.88 | 50.00 | -28.12 | |
| 26.9134 | 12.71 | 9.01 | 60.00 | -50.99 | 3.88 | 50.00 | -46.12 | |
| 28.0003 | 26.90 | 25.80 | 60.00 | -34.20 | 24.95 | 50.00 | -25.05 | |



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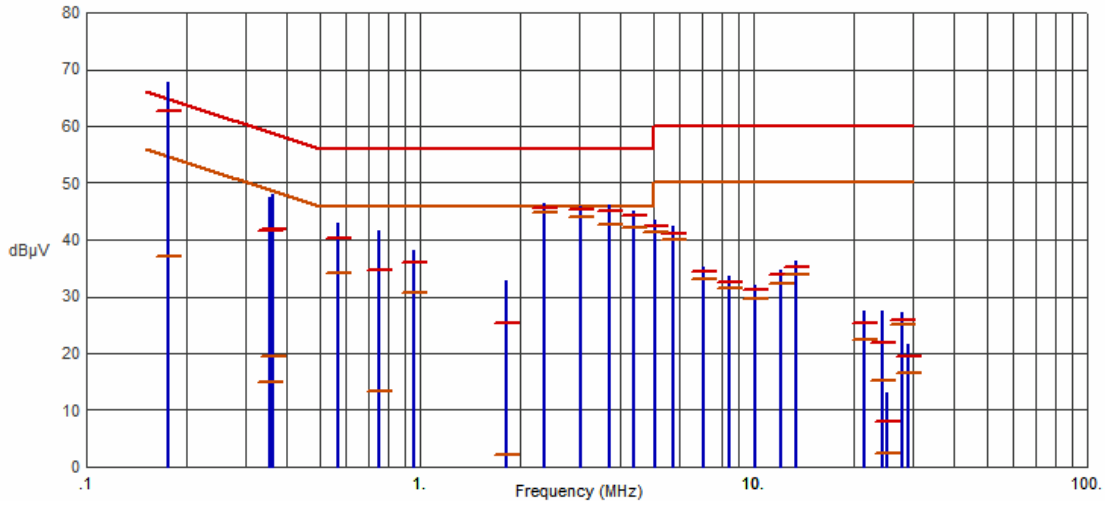
## 6. Measurement Data (continued)

### 6.8 Line Conducted Emissions (15.207) (continued)

#### 6.8.2. Alternative Tri-band antenna, Model #M8100-66490

#### 6.8.2.2. 120 Volts, 60 Hz Neutral

Test No.: 286-06, 120 Volts, 60 Hz Neutral EN55022, Class B




| Frequency (MHz) | Pk Amp (dBµV) | QP Amp (dBµV) | QP Limit (dBµV) | QP Margin (dB) | Avg Amp (dBµV) | Avg Limit (dBµV) | Avg Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|
| .1755 | 67.79 | 62.67 | 64.70 | -2.03 | 37.06 | 54.70 | -17.64 | |
| .3564 | 47.46 | 41.69 | 58.81 | -17.12 | 14.94 | 48.81 | -33.87 | |
| .3611 | 48.00 | 41.83 | 58.70 | -16.87 | 19.34 | 48.70 | -29.36 | |
| .5706 | 43.06 | 40.21 | 56.00 | -15.79 | 34.04 | 46.00 | -11.96 | |
| .7503 | 41.47 | 34.57 | 56.00 | -21.43 | 13.43 | 46.00 | -32.57 | |
| .9580 | 38.26 | 35.95 | 56.00 | -20.05 | 30.57 | 46.00 | -15.43 | |
| 1.8207 | 32.71 | 25.30 | 56.00 | -30.70 | 2.16 | 46.00 | -43.84 | |
| 2.3580 | 46.35 | 45.69 | 56.00 | -10.31 | 44.74 | 46.00 | -1.26 | |
| 3.0309 | 45.91 | 45.32 | 56.00 | -10.68 | 43.96 | 46.00 | -2.04 | |
| 3.7056 | 46.09 | 45.05 | 56.00 | -10.95 | 42.80 | 46.00 | -3.20 | |
| 4.3799 | 45.05 | 44.38 | 56.00 | -11.62 | 42.07 | 46.00 | -3.93 | |
| 5.0526 | 43.35 | 42.48 | 60.00 | -17.52 | 41.21 | 50.00 | -8.79 | |
| 5.7278 | 42.31 | 41.13 | 60.00 | -18.87 | 40.08 | 50.00 | -9.92 | |
| 7.0749 | 35.27 | 34.33 | 60.00 | -25.67 | 33.12 | 50.00 | -16.88 | |
| 8.4209 | 33.57 | 32.52 | 60.00 | -27.48 | 31.42 | 50.00 | -18.58 | |
| 10.1057 | 32.02 | 31.21 | 60.00 | -28.79 | 29.69 | 50.00 | -20.31 | |
| 12.1256 | 34.70 | 33.96 | 60.00 | -26.04 | 32.35 | 50.00 | -17.65 | |
| 13.4730 | 36.23 | 35.31 | 60.00 | -24.69 | 33.85 | 50.00 | -16.15 | |
| 21.5550 | 27.36 | 25.30 | 60.00 | -34.70 | 22.41 | 50.00 | -27.59 | |
| 24.2444 | 27.53 | 21.79 | 60.00 | -38.21 | 15.18 | 50.00 | -34.82 | |
| 25.0704 | 13.16 | 8.03 | 60.00 | -51.97 | 2.52 | 50.00 | -47.48 | |
| 28.0005 | 27.07 | 25.92 | 60.00 | -34.08 | 24.97 | 50.00 | -25.03 | |
| 28.9706 | 21.57 | 19.40 | 60.00 | -40.60 | 16.48 | 50.00 | -33.52 | |



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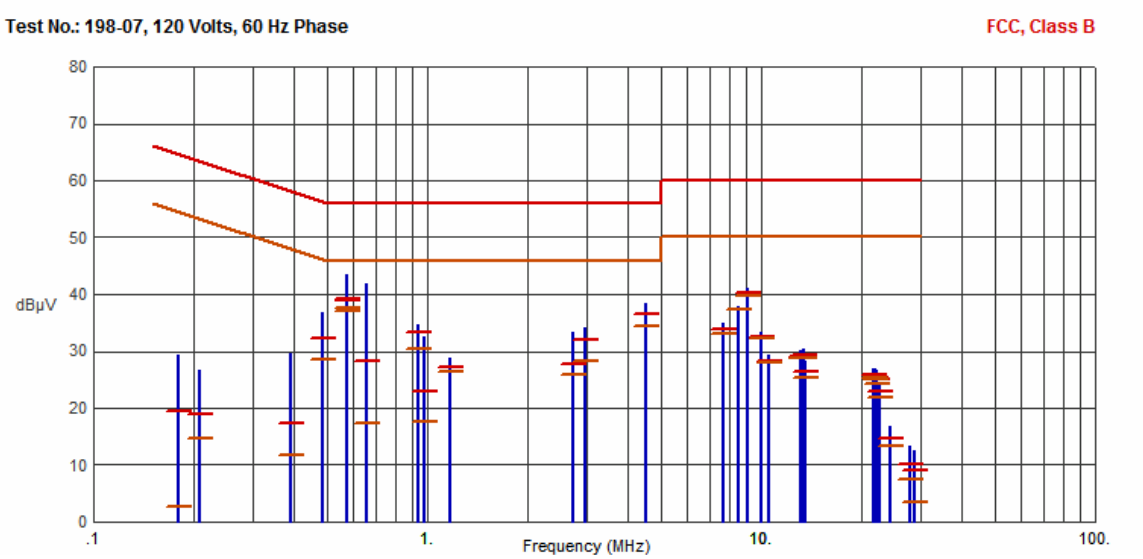
## 6. Measurement Data (continued)

### 6.8 Line Conducted Emissions (15.207) (continued)

#### 6.8.3. Alternative with Dual Band Antenna, Part # M3002-66493

#### 6.8.3.1. 120 Volts, 60 Hz Phase




| Frequency (MHz) | Pk Amp (dBµV) | QP Amp (dBµV) | QP Limit (dBµV) | QP Margin (dB) | Avg Amp (dBµV) | Avg Limit (dBµV) | Avg Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|
| .1794 | 29.40 | 19.54 | 64.51 | -44.97 | 2.66 | 54.51 | -51.85 | |
| .2077 | 26.72 | 18.99 | 63.30 | -44.31 | 14.56 | 53.30 | -38.74 | |
| .3904 | 29.52 | 17.35 | 58.06 | -40.71 | 11.78 | 48.06 | -36.28 | |
| .4838 | 36.74 | 32.35 | 56.27 | -23.92 | 28.44 | 46.27 | -17.83 | |
| .5718 | 42.18 | 38.98 | 56.00 | -17.02 | 37.07 | 46.00 | -8.93 | |
| .5746 | 43.41 | 39.30 | 56.00 | -16.70 | 37.55 | 46.00 | -8.45 | |
| .6568 | 41.96 | 28.19 | 56.00 | -27.81 | 17.41 | 46.00 | -28.59 | |
| .9398 | 34.61 | 33.28 | 56.00 | -22.72 | 30.48 | 46.00 | -15.52 | |
| .9788 | 32.46 | 23.02 | 56.00 | -32.98 | 17.60 | 46.00 | -28.40 | |
| 1.1687 | 28.67 | 27.29 | 56.00 | -28.71 | 26.53 | 46.00 | -19.47 | |
| 2.7182 | 33.43 | 27.72 | 56.00 | -28.28 | 25.84 | 46.00 | -20.16 | |
| 2.9853 | 34.20 | 31.87 | 56.00 | -24.13 | 28.37 | 46.00 | -17.63 | |
| 4.5215 | 38.33 | 36.55 | 56.00 | -19.45 | 34.46 | 46.00 | -11.54 | |
| 7.6943 | 34.88 | 33.79 | 60.00 | -26.21 | 33.05 | 50.00 | -16.95 | |
| 8.5600 | 37.95 | 37.38 | 60.00 | -22.62 | 37.33 | 50.00 | -12.67 | |
| 9.1386 | 41.05 | 40.17 | 60.00 | -19.83 | 39.70 | 50.00 | -10.30 | |
| 10.0033 | 33.40 | 32.45 | 60.00 | -27.55 | 32.25 | 50.00 | -17.75 | |
| 10.4843 | 29.44 | 28.24 | 60.00 | -31.76 | 27.91 | 50.00 | -22.09 | |
| 13.1771 | 30.08 | 29.10 | 60.00 | -30.90 | 28.90 | 50.00 | -21.10 | |
| 13.4676 | 30.38 | 29.40 | 60.00 | -30.60 | 28.72 | 50.00 | -21.28 | |
| 13.5619 | 28.28 | 26.51 | 60.00 | -33.49 | 25.39 | 50.00 | -24.61 | |
| 21.6428 | 27.00 | 25.74 | 60.00 | -34.26 | 25.33 | 50.00 | -24.67 | |
| 22.0275 | 26.85 | 25.36 | 60.00 | -34.64 | 25.08 | 50.00 | -24.92 | |
| 22.2191 | 26.66 | 25.14 | 60.00 | -34.86 | 24.19 | 50.00 | -25.81 | |
| 22.6030 | 24.64 | 22.88 | 60.00 | -37.12 | 21.96 | 50.00 | -28.04 | |
| 24.3356 | 16.78 | 14.61 | 60.00 | -45.39 | 13.26 | 50.00 | -36.74 | |
| 28.0014 | 13.23 | 10.20 | 60.00 | -49.80 | 7.60 | 50.00 | -42.40 | |
| 28.6865 | 12.64 | 9.06 | 60.00 | -50.94 | 3.56 | 50.00 | -46.44 | |



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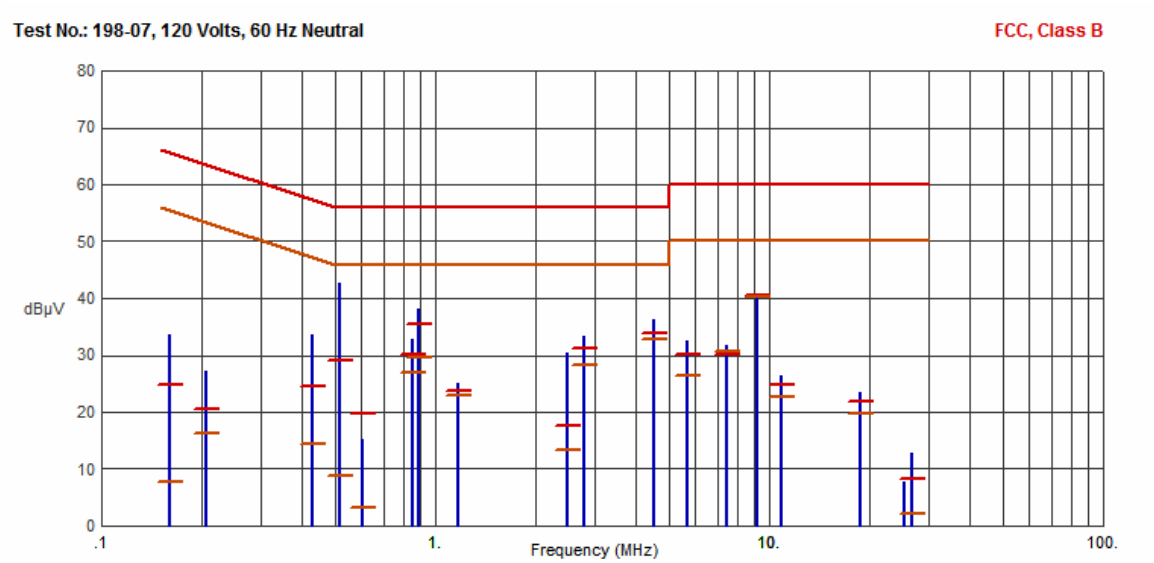
## 6. Measurement Data (continued)

### 6.8 Line Conducted Emissions (15.207) (continued)

#### 6.8.3. Alternative with Dual Band Antenna, Part # M3002-66493

#### 6.8.3.2. 120 Volts, 60 Hz Neutral




| Frequency (MHz) | Pk Amp (dBµV) | QP Amp (dBµV) | QP Limit (dBµV) | QP Margin (dB) | Avg Amp (dBµV) | Avg Limit (dBµV) | Avg Margin (dB) | Comments |
|---|---|---|---|---|---|---|---|---|
| .1608 | 33.69 | 24.76 | 65.42 | -40.66 | 7.62 | 55.42 | -47.80 | |
| .2054 | 27.33 | 20.62 | 63.39 | -42.77 | 16.16 | 53.39 | -37.23 | |
| .4305 | 33.67 | 24.66 | 57.24 | -32.58 | 14.48 | 47.24 | -32.76 | |
| .5182 | 42.72 | 28.94 | 56.00 | -27.06 | 8.75 | 46.00 | -37.25 | |
| .6051 | 15.21 | 19.83 | 56.00 | -36.17 | 3.15 | 46.00 | -42.85 | |
| .8516 | 32.82 | 30.08 | 56.00 | -25.92 | 26.99 | 46.00 | -19.01 | |
| .8946 | 37.46 | 35.44 | 56.00 | -20.56 | 29.67 | 46.00 | -16.33 | |
| .8954 | 38.13 | 35.52 | 56.00 | -20.48 | 29.61 | 46.00 | -16.39 | |
| 1.1697 | 25.09 | 23.69 | 56.00 | -32.31 | 22.91 | 46.00 | -23.09 | |
| 2.4902 | 30.46 | 17.53 | 56.00 | -38.47 | 13.27 | 46.00 | -32.73 | |
| 2.7856 | 33.32 | 31.10 | 56.00 | -24.90 | 28.16 | 46.00 | -17.84 | |
| 4.5160 | 36.39 | 33.76 | 56.00 | -22.24 | 32.88 | 46.00 | -13.12 | |
| 5.6662 | 32.56 | 30.13 | 60.00 | -29.87 | 26.48 | 50.00 | -23.52 | |
| 7.4918 | 31.79 | 30.02 | 60.00 | -29.98 | 30.65 | 50.00 | -19.35 | |
| 9.2206 | 40.87 | 40.42 | 60.00 | -19.58 | 40.25 | 50.00 | -9.75 | |
| 10.8561 | 26.35 | 24.88 | 60.00 | -35.12 | 22.61 | 50.00 | -27.39 | |
| 18.8276 | 23.35 | 21.84 | 60.00 | -38.16 | 19.80 | 50.00 | -30.20 | |
| 25.3842 | 7.70 | -.09 | 60.00 | -60.09 | -6.49 | 50.00 | -56.49 | |
| 26.6083 | 12.76 | 8.28 | 60.00 | -51.72 | 2.05 | 50.00 | -47.95 | |



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## 6. Measurement Data (continued)

### 6.9 Determination of Average Factor

| | |
|---|---|
| Total Duration of 1 cycle: | 26.6 mS |
| Total On-Time in 1 cycle: | 412 µS |
| On-Time divided by cycle: | 0.0154 |
| Average Factor: | 20 X $\log_{10}(0.0154)$ = -36.2dB |

FCC and IC maximum allowed average factor is –20dB.

## 7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with Federal Communications Commission (FCC) and Industry Canada standards. A description of the test sites is on file with the FCC (registration number **96392**) and Industry Canada (file number **IC 3023A-1)**.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022.

Both sites are designed to test products or systems 1.5 meter W x 1.5 meter L x 2.0 meter H, floor standing or table top.



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http://www.cw-inc.com

# 8. Test Setup Photographs

## 8.1. Radiall/Larsen model SPDA17RP2400

### 8.1.1. Radiated Emissions, Front



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## 8. Test Setup Photographs (Continued)

### 8.1. Radiall/Larsen model SPDA17RP2400 (continued)

#### 8.1.2. Radiated Emissions, Back



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# 8. Test Setup Photographs (Continued)

## 8.1. Radiall/Larsen model SPDA17RP2400 (continued)

### 8.1.3. Conducted Emissions, Front



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## 8. Test Setup Photographs (Continued)

### 8.1. Radiall/Larsen model SPDA17RP2400 (continued)

#### 8.1.4. Conducted Emissions, Back




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## 8. Test Setup Photographs (Continued)

### 8.2. Alternative Tri-band Antenna, Model #M8100-66490

#### 8.2.1-A Radiated Emissions, Front



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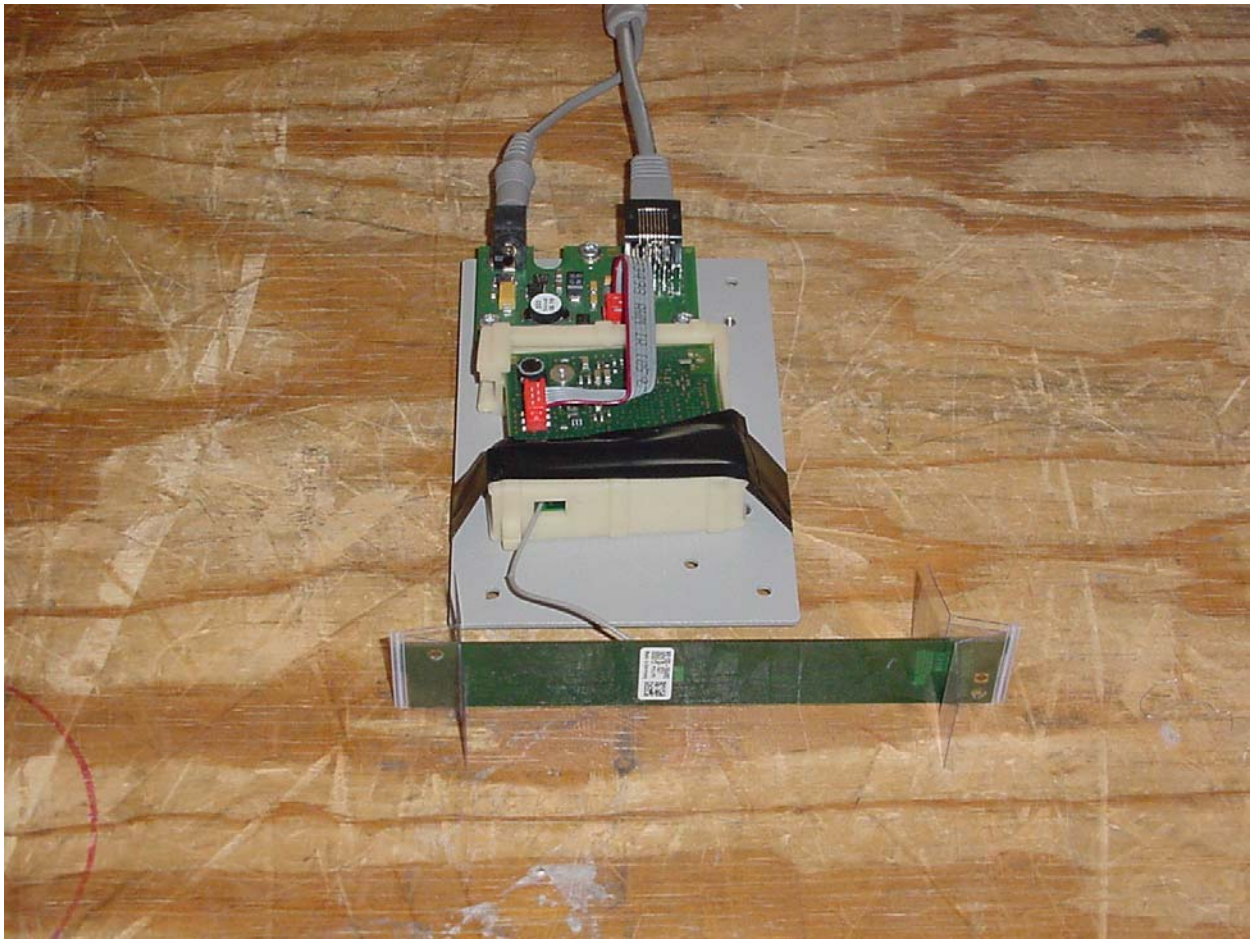
## 8. Test Setup Photographs (Continued)

### 8.2. Alternative Tri-band Antenna, Model #M8100-66490 (continued)

#### 8.2.1-B Radiated Emissions, Front, Close-up



Note: Non-metallic holders were used to maintain an orientation of the antenna circuit board that was perpendicular to the table. This attitude produced the highest emission relative to the limit. See Section 4.3, paragraph 6 for additional information.



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## 8. Test Setup Photographs (Continued)

### 8.2. Alternative Tri-band Antenna, Model #M8100-66490 (continued)

#### 8.2.2. Radiated Emissions, Back



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## 8. Test Setup Photographs (Continued)

### 8.2. Alternative Tri-band Antenna, Model #M8100-66490 (continued)

#### 8.2.3. Conducted Emissions, Front



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## 8. Test Setup Photographs (Continued)

### 8.2. Alternative Tri-band Antenna, Model #M8100-66490 (continued)

#### 8.2.4. Conducted Emissions, Back



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## 8. Test Setup Photographs (Continued)

### 8.3. Alternative Dual Band Antenna, Part # M3002-66493

#### 8.3.1. Radiated Emissions, Front



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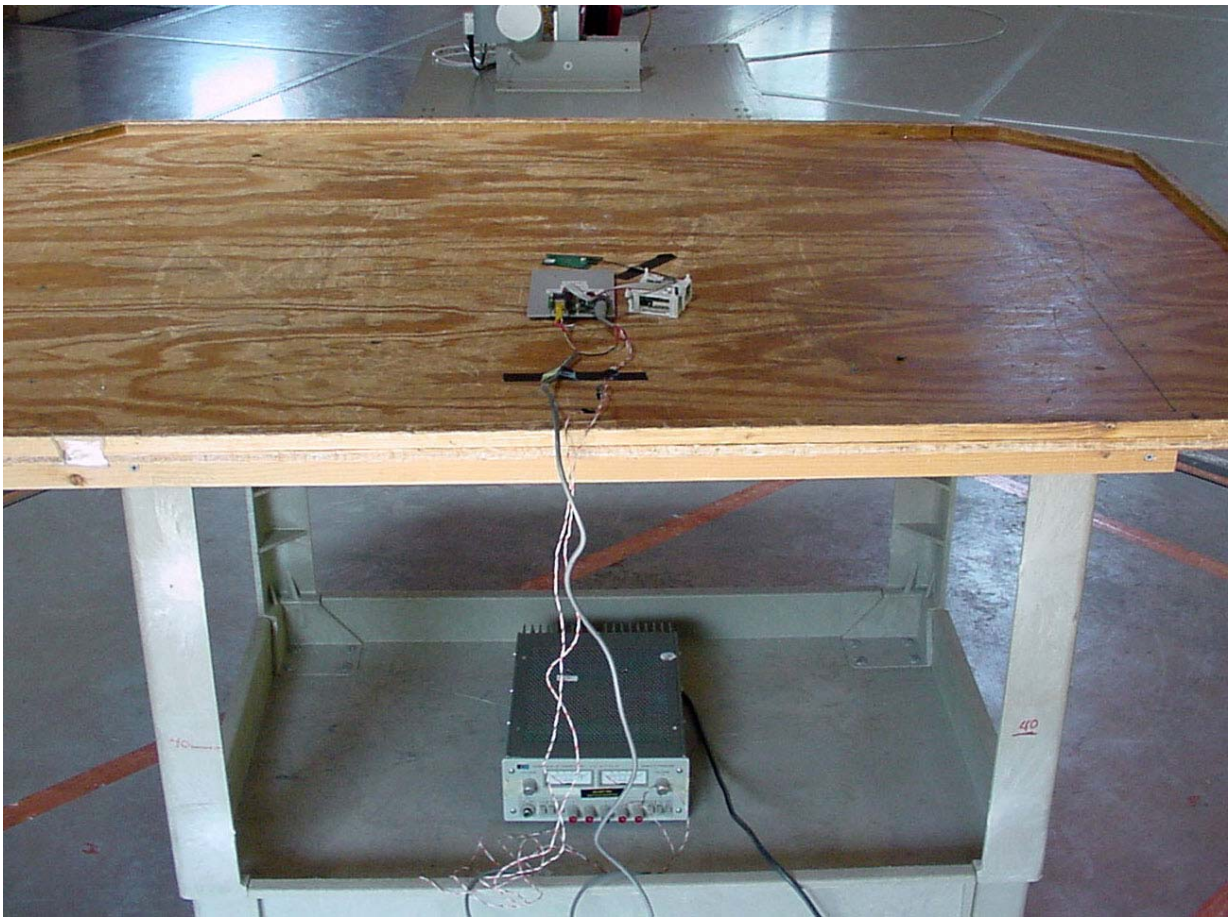
## 8. Test Setup Photographs (Continued)

### 8.3. Alternative Dual Band Antenna, Part # M3002-66493

#### 8.3.2. Radiated Emissions, Rear





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