

# Amended FCC Test Report

(Includes R091008-02-02)

Parts 15.203, 15.205, 15.207, 15.209, 15.247

Company: 3e Technologies

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Product: CM9 PCI Transmitter Module  
FCC ID: QVT-525A-3

Test Report No: R091008-02-02A

APPROVED BY: Nic Johnson  
Test Engineer

A handwritten signature in black ink, appearing to read "Nic Johnson", written over a horizontal line.

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**1.0 Summary of test results****1.1 Test Results**

The EUT has been tested according to the following specifications:

| <b>APPLIED STANDARDS: FCC Part 15, Subpart C</b> |                                                                                            |               |                                         |
|--------------------------------------------------|--------------------------------------------------------------------------------------------|---------------|-----------------------------------------|
| <b>Standard Section</b>                          | <b>Test Type and Limit</b>                                                                 | <b>Result</b> | <b>Remark</b>                           |
| 15.203                                           | Unique Antenna Requirement                                                                 | Pass          | EUT requires professional installation. |
| 15.207                                           | Conducted Emissions                                                                        | Pass          | Meets the requirement of the limit.     |
| 15.209                                           | Radiated Emissions                                                                         | Pass          | Meets the requirement of the limit.     |
| 15.247(a)(2)                                     | Minimum Bandwidth,<br>Limit: min. 500kHz                                                   | Pass          | Meets the requirement of the limit.     |
| 15.247(b)                                        | Maximum Peak Output Power, Limit:<br>Max. 23.9dBm                                          | Pass          | Meets the requirement of the limit.     |
| 15.247(e)                                        | Power Spectral Density,<br>Limit: Max. 8dBm                                                | Pass          | Meets the requirement of the limit.     |
| 15.247(d)                                        | Band Edge Measurement, Limit: 20dB<br>less than the peak value of<br>fundamental frequency | Pass          | Meets the requirement of the limit.     |

## **1.2 Test Methods**

### **1.2.1 Conducted AC Emissions**

The EUT was powered by 120VAC/60Hz with a 50 $\Omega$  load on the antenna port. Compliance to 47 CFR Part 15.207 was tested in accordance with the methods of ANSI/IEEE C63.4: 2003. Measurements were made on both conductors.

### **1.2.2 Radiated Emissions**

Compliance to 47 CFR Parts 15.209 and 15.247 was tested in accordance with the methods of ANSI/IEEE C63.4: 2003. Several configurations were examined and the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to find the angles of maximum emissions and the receiving antenna was moved from 1m to 4m in both vertical and horizontal positions. The EUT was tested while sitting both vertically and horizontally. The horizontal configuration produced the highest emissions, and that position was used for all radiated testing. All measurements were taken at a distance of 3m from the EUT for Part 15.209 intentional radiator measurements.

## **1.3 Reason for Amendment**

- Section 1.1 and Section 4.1.2 have been modified to list the correct antennas configuration
- Section 4.4 has been modified to show maximum power output limits with corrections for antenna gain. A note has also been added about point-to-point operation.
- Section 2.2 has been modified to include a statement about simultaneous operation of the 2.4GHz and 5.8GHz radio no being possible
- Section 2.4 and section 4.5.1 have been modified to show the correct frequency range of operation
- Section 4.3.2 has been modified to show the correct resolution bandwidth used for bandwidth measurements as well as the correct unit (MHz) for bandwidth measurements.
- Section 2.4 has added KDB Publication 558074 to the list of measurement procedures.

**2.0 Description****2.1 Equipment under test**

EUT Received Date: 29 September 2008

EUT Tested Dates: 9 – 11 February 2009

|                    |                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PRODUCT            | CM9 PCI Transmitter Module                                                                                                                                                        |
| MODULATION TYPE    | OFDM, DBPSK, DQPSK, CCK<br>Maximum data rate 11mbs                                                                                                                                |
| RADIO TECHNOLOGY   | 802.11a, a turbo, b, g, g super                                                                                                                                                   |
| FREQUENCY RANGE    | 2.412-2.462GHz: 802.11b, g, g super<br>5.745-5.825GHz: 802.11a, a turbo<br>4.986GHz -4.988GHz: Public safety Band<br>(public safety band testing is covered in a separate report) |
| NUMBER OF CHANNELS | 802.11b, g, 11<br>802.11g super: 1<br>802.11a: 5<br>802.11a turbo: 2<br>Public Safety Band: 2                                                                                     |
| MAX OUTPUT POWER   | 21.68dBm                                                                                                                                                                          |
| TEST SOFTWARE      | 3eTi AirGuard Wireless Access Point<br>Version 4.3.3.00, Build 14                                                                                                                 |

**NOTE:**

1. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.

**2.2 Laboratory description**

All testing was performed at the NCEE Lincoln facility, which is a FCC and IC registered lab. This site has been fully described in previously submitted reports. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of  $45 \pm 4\%$ Temperature of  $20 \pm 3^\circ$  Celsius

**2.3 Description of test modes**

The EUT was tested at the frequencies below:

| Channel | Frequency GHz | Test Mode                    |
|---------|---------------|------------------------------|
| 1       | 2.412         | 802.11b/g mixed (low)        |
| 6       | 2.437         | 802.11b/g mixed (middle)     |
| 11      | 2.462         | 802.11b/g mixed (high)       |
| 6**     | 2.437         | 802.11g super (only channel) |
| 149     | 5.745         | 802.11a (low)                |
| 157     | 5.785         | 802.11a (middle)             |
| 165     | 5.825         | 802.11a (high)               |
| 152*    | 5.760         | 802.11a turbo (low)          |
| 160*    | 5.800         | 802.11a turbo (high)         |

\*Note: for 802.11a turbo mode, only channels 152 and 160 are available, therefore there was no middle channel tested.

\*\*Note: for 802.11g super mode, only channel 6 is available, therefore it was the only channel tested.

**2.4 Applied standards**

The EUT uses digital modulation and operates between 902 MHz and 928 MHz. It has no AC mains connection. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.247) using ANSI/IEEE C63.4: 2003**  
**FCC Part 15, Subpart C (15.209) using ANSI/IEEE C63.4: 2003**  
**KDB Publication No. 558074: 2005**

All test items have been performed and recorded as per the above standards.

**2.5 Description of support units**

None

**2.6 Configuration of system under test**

This EUT was set to transmit in a worse-case scenario with modulation on. The software allowed the selection of the channel and modulation type.

**List of antenna options for use with CM9**

| <b>Model</b> | <b>Manufacturer</b> | <b>Type</b> | <b>2.4GHz Gain (dBi)</b> | <b>5GHz Gain (dBi)</b> | <b>Source</b> |
|--------------|---------------------|-------------|--------------------------|------------------------|---------------|
| RD2458-5-NM  | Pacific Wireless    | omni        | 2.2                      | 5                      | NA            |
| ECO9-5500    | Mobile Mark         | omni        | ---                      | 9                      | NA            |
| ES58-17*     | Laird               | panel       | ---                      | 17                     | NA            |
| OD9-2400     | Mobile Mark         | omni        | 9                        | ---                    | NA            |
| HG2414D      | HyperLink           | dish        | 14                       | ---                    | NA            |
| HG5822G*     | HyperLink           | dish        | ---                      | 22                     | NA            |

\*These antennas are intended for point-to-point, bridge mode operation only.

**3.0 Test equipment used**

| <b>DESCRIPTION AND MANUFACTURER</b> | <b>MODEL NO.</b> | <b>SERIAL NO.</b> | <b>LAST CALIBRATION DATE</b> |
|-------------------------------------|------------------|-------------------|------------------------------|
| Rohde & Schwarz Test Receiver       | ESIB26           | 100037            | 9 June 2008                  |
| Rohde & Schwarz Spec. Analyzer***   | FSP40            | 100307            | 19 Jan 2009                  |
| EMCO Biconilog Antenna              | 3142B            | 1647              | 8 Feb 2008                   |
| EMCO Horn Antenna                   | 3115             | 6416              | 5 Feb 2008                   |
| EMCO Horn Antenna***                | 3116             | 2576              | 6 Jun 2008                   |
| Rohde & Schwarz LISN                | ESH3-Z5          | 100023            | 6 Feb 2008                   |
| Hewlett Packard Power Meter         | 4378             | 100307            | 20 Jan 2009                  |
| Hewlett Packard Power Sensor        | 8481A            | 2702A63981        | 20 Jan 2009                  |
| Rohde & Schwarz Preamp*             | TS-PR18          | 082001/003        | 6 Dec 2008                   |
| Trilithic High Pass Filter*         | 6HC330           | 23042             | 6 Dec 2008                   |
| Mini-circuits High Pass Filter**    | VHF-8400+        | 15542             | 6 Dec 2008                   |

\*Used for radiated measurements above 3GHz

\*\*Used for measurements above 6GHz

\*\*\*Used for measurements above 18GHz

#### **4.0 Detailed results**

#### **4.1 Unique antenna requirement**

##### **4.1.1 Standard applicable**

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

##### **4.1.2 Antenna description**

The equipment requires professional installation, and the antenna port will not be readily accessible in its final configuration, which meets this requirement.

## 4.2 Radiated emissions

### 4.2.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

| FREQUENCIES (MHz) | FIELD STRENGTH ( $\mu\text{V/m}$ ) | MEASUREMENT DISTANCE (m) |
|-------------------|------------------------------------|--------------------------|
| 0.009-0.490       | 2400/F(kHz)                        | 300                      |
| 0.490-1.705       | 24000/F(kHz)                       | 30                       |
| 1.705-30.0        | 30                                 | 3                        |
| 30-88             | 100                                | 3                        |
| 88-216            | 150                                | 3                        |
| 216-960           | 200                                | 3                        |
| Above 960         | 500                                | 3                        |

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) =  $20 * \log * \text{Emission level } (\mu\text{V/m})$ .
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

#### 4.2.2 Test procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.
- d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.
- e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for peak and average detectors at frequencies above 1GHz.

#### 4.2.3 Deviations from test standard

No deviation.

#### 4.2.4 Test setup

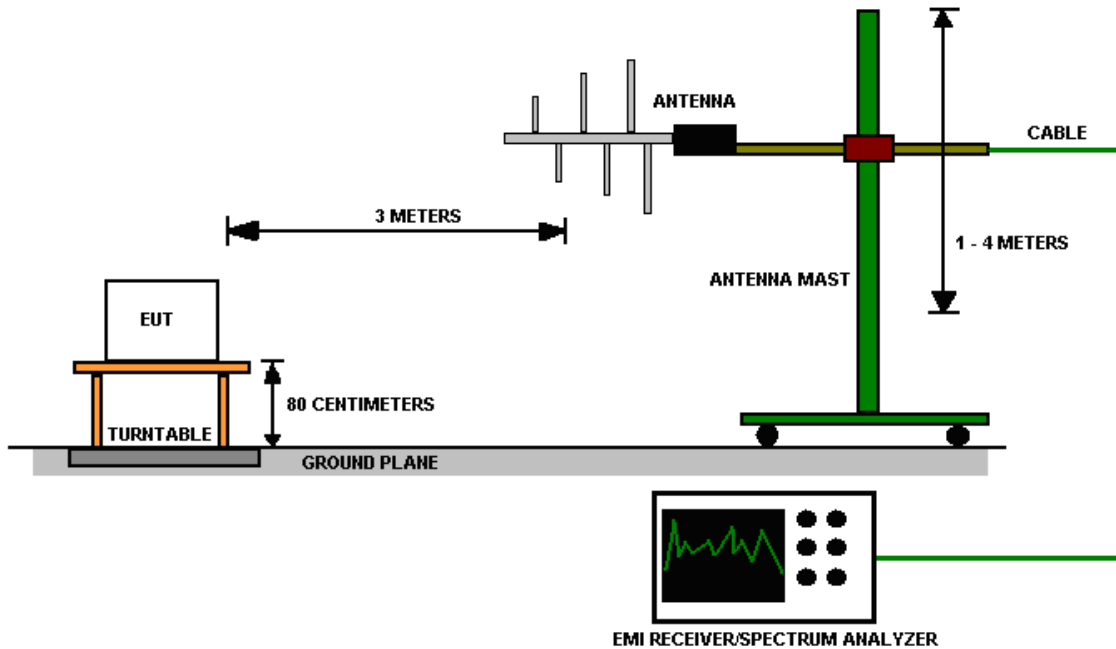


Figure 1 - Radiated Emissions Test Setup

For the actual test configuration, please refer to Appendix A for photographs of the test configuration.

#### 4.2.5 EUT operating conditions

A special test program was used to make the EUT transmit continuously. The software allowed the selection of the channel, modulation and power setting. Power setting was at maximum for all tests.

**4.2.6 Test results**

|                          |                            |                 |                     |
|--------------------------|----------------------------|-----------------|---------------------|
| EUT                      | CM9 PCI Transmitter Module | MODE            | Continuous transmit |
| INPUT POWER              | 5VDC                       | FREQUENCY RANGE | 30MHz – 40GHz       |
| ENVIRONMENTAL CONDITIONS | 45% ± 5% RH<br>20 ± 3°C    | TECHNICIAN      | NJohnson            |

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Pretesting was done for all high, middle and low channel settings for 802.11a, b and g. Worse-case quasi-peak results are presented below. Antenna model is listed atop of table.

**RD2458-5-NM**

| Frequency | Level  | Limit  | Margin | Height | Angle | Pol.       |
|-----------|--------|--------|--------|--------|-------|------------|
| MHz       | dBμV/m | dBμV/m | dB     | cm     | deg   |            |
|           |        |        |        |        |       |            |
| 40.32     | 33.98  | 40     | 6.0    | 101    | 77    | VERTICAL   |
| 42.90     | 28.77  | 40     | 11.2   | 101    | 102   | VERTICAL   |
| 42.96     | 32.01  | 40     | 8.0    | 101    | 85    | VERTICAL   |
| 307.98    | 33.84  | 46     | 12.2   | 98     | 269   | HORIZONTAL |
| 330.00    | 37.98  | 46     | 8.0    | 101    | 30    | HORIZONTAL |
| 626.94    | 36.30  | 46     | 9.7    | 98     | 352   | HORIZONTAL |
| 659.94    | 38.39  | 46     | 7.6    | 101    | 359   | HORIZONTAL |
| 923.94    | 37.53  | 46     | 8.5    | 119    | 359   | VERTICAL   |

**ECO9-5500**

| Frequency | Level  | Limit  | Margin | Height | Angle | Pol.       |
|-----------|--------|--------|--------|--------|-------|------------|
| MHz       | dBμV/m | dBμV/m | dB     | cm     | deg   |            |
|           |        |        |        |        |       |            |
| 40.32     | 38.34  | 40     | 1.7    | 99     | 94    | VERTICAL   |
| 41.58     | 33.99  | 40     | 6.0    | 106    | 57    | VERTICAL   |
| 85.50     | 38.57  | 40     | 1.4    | 126    | 22    | VERTICAL   |
| 86.04     | 38.44  | 40     | 1.6    | 100    | 25    | VERTICAL   |
| 329.94    | 38.07  | 46     | 7.9    | 103    | 18    | HORIZONTAL |
| 659.94    | 38.60  | 46     | 7.4    | 100    | 354   | HORIZONTAL |

## ES58-17

| Frequency | Level        | Limit        | Margin | Height | Angle | Pol.       |
|-----------|--------------|--------------|--------|--------|-------|------------|
| MHz       | dB $\mu$ V/m | dB $\mu$ V/m | dB     | cm     | deg   |            |
|           |              |              |        |        |       |            |
| 34.62     | 31.54        | 40           | 8.5    | 100    | 0     | VERTICAL   |
| 40.32     | 34.95        | 40           | 5.0    | 103    | 63    | VERTICAL   |
| 40.62     | 32.18        | 40           | 7.8    | 98     | 72    | VERTICAL   |
| 329.94    | 37.27        | 46           | 8.7    | 115    | 187   | HORIZONTAL |
| 626.94    | 36.65        | 46           | 9.3    | 109    | 355   | HORIZONTAL |
| 659.94    | 38.47        | 46           | 7.5    | 99     | 355   | HORIZONTAL |
| 923.94    | 37.56        | 46           | 8.4    | 109    | 359   | VERTICAL   |

## OD9-24CO

| Frequency | Level        | Limit        | Margin | Height | Angle | Pol.       |
|-----------|--------------|--------------|--------|--------|-------|------------|
| MHz       | dB $\mu$ V/m | dB $\mu$ V/m | dB     | cm     | deg   |            |
|           |              |              |        |        |       |            |
| 34.62     | 32.20        | 40           | 7.8    | 99     | 204   | VERTICAL   |
| 40.32     | 34.88        | 40           | 5.1    | 98     | 61    | VERTICAL   |
| 42.90     | 32.81        | 40           | 7.2    | 102    | 84    | VERTICAL   |
| 307.92    | 36.49        | 46           | 9.5    | 101    | 267   | HORIZONTAL |
| 329.94    | 37.87        | 46           | 8.1    | 100    | 30    | HORIZONTAL |
| 659.94    | 38.36        | 46           | 7.6    | 100    | 355   | HORIZONTAL |

## HG2414D

| Frequency | Level        | Limit        | Margin | Height | Angle | Pol.       |
|-----------|--------------|--------------|--------|--------|-------|------------|
| MHz       | dB $\mu$ V/m | dB $\mu$ V/m | dB     | cm     | deg   |            |
|           |              |              |        |        |       |            |
| 34.62     | 32.03        | 40           | 8.0    | 101    | 154   | VERTICAL   |
| 40.32     | 35.53        | 40           | 4.5    | 100    | 69    | VERTICAL   |
| 42.96     | 32.75        | 40           | 7.3    | 99     | 131   | VERTICAL   |
| 307.92    | 36.42        | 46           | 9.6    | 99     | 262   | HORIZONTAL |
| 330.00    | 35.32        | 46           | 10.7   | 124    | 8     | HORIZONTAL |
| 659.94    | 38.52        | 46           | 7.5    | 99     | 355   | HORIZONTAL |
| 923.94    | 37.07        | 46           | 8.9    | 110    | 13    | VERTICAL   |

## HG5822G

| Frequency | Level        | Measured   | Limit        | Margin | Height | Angle | Pol.       |
|-----------|--------------|------------|--------------|--------|--------|-------|------------|
| MHz       | dB $\mu$ V/m | dB $\mu$ V | dB $\mu$ V/m | dB     | cm     | deg   |            |
|           |              |            |              |        |        |       |            |
| 41.58     | 33.91        | 20.27      | 40           | 6.1    | 101    | 72    | VERTICAL   |
| 42.90     | 35.76        | 22.66      | 40           | 4.2    | 98     | 116   | VERTICAL   |
| 43.50     | 34.48        | 21.56      | 40           | 5.5    | 103    | 95    | VERTICAL   |
| 307.92    | 37.93        | 21.26      | 46           | 8.1    | 99     | 316   | HORIZONTAL |
| 329.94    | 40.50        | 23.31      | 46           | 5.5    | 177    | 224   | VERTICAL   |
| 659.94    | 38.33        | 14.13      | 46           | 7.7    | 100    | 0     | HORIZONTAL |
| 923.94    | 38.13        | 10.27      | 46           | 7.9    | 115    | 9     | VERTICAL   |

## RD2458-5-NM

| Channel: 1, 802.11b, g    |          |          |          |          |           |           |        |       |      |
|---------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1249.75                   | 49.26    | 58.15    | 54.00    | 74.00    | 4.74      | 15.85     | 101    | 21    | V    |
| 4824.00                   | 50.25    | 59.98    | 54.00    | 74.00    | 3.75      | 14.02     | 105    | 56    | V    |
| 7236.00                   | 46.23    | 58.21    | 54.00    | 74.00    | 11.98     | 15.79     | 112    | 108   | V    |
| 9648.00                   | 43.95    | 51.11    | 54.00    | 74.00    | 10.05     | 22.89     | 104    | 190   | V    |
| Channel: 6, 802.11b, g    |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | Deg   |      |
| 1800.21                   | 48.96    | 57.26    | 54.00    | 74.00    | 5.04      | 16.74     | 136    | 350   | V    |
| 4874.00                   | 51.21    | 58.71    | 54.00    | 74.00    | 2.79      | 15.29     | 101    | 321   | V    |
| 7311.00                   | 44.49    | 59.65    | 54.00    | 74.00    | 9.51      | 14.35     | 112    | 104   | V    |
| 9728.00                   | 48.65    | 52.23    | 54.00    | 74.00    | 5.35      | 21.77     | 108    | 4     | V    |
| Channel: 11, 802.11b, g   |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1701.95                   | 49.01    | 58.88    | 54.00    | 74.00    | 4.99      | 15.12     | 102    | 305   | V    |
| 4924.00                   | 49.99    | 59.87    | 54.00    | 74.00    | 4.01      | 14.13     | 105    | 210   | V    |
| 7386.00                   | 47.70    | 56.23    | 54.00    | 74.00    | 6.30      | 17.77     | 99     | 201   | V    |
| 9848.00                   | 49.52    | 52.30    | 54.00    | 74.00    | 4.48      | 21.70     | 104    | 230   | V    |
| Channel: 6, 802.11g super |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1256.01                   | 47.89    | 57.24    | 54.00    | 74.00    | 6.11      | 16.76     | 102    | 301   | V    |
| 4874.00                   | 48.52    | 58.71    | 54.00    | 74.00    | 5.48      | 15.29     | 100    | 306   | V    |
| 7311.00                   | 48.90    | 59.23    | 54.00    | 74.00    | 5.10      | 14.77     | 105    | 302   | V    |
| 9748.00                   | 48.75    | 53.50    | 54.00    | 74.00    | 5.25      | 20.20     | 110    | 211   | V    |

## RD2458-5-NM

| Channel: 149, 802.11a       |          |          |          |          |           |           |        |       |      |
|-----------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1112.31                     | 49.10    | 58.47    | 54.00    | 74.00    | 4.90      | 15.53     | 99     | 282   | V    |
| 11490.00                    | 52.30    | 60.87    | 54.00    | 74.00    | 1.70      | 13.13     | 105    | 300   | V    |
| 17235.00                    | 52.90    | 60.24    | 54.00    | 74.00    | 1.10      | 13.76     | 112    | 356   | V    |
| Channel: 157, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1243.45                     | 50.20    | 57.78    | 54.00    | 74.00    | 3.80      | 16.22     | 118    | 13    | V    |
| 11570.00                    | 53.12    | 61.02    | 54.00    | 74.00    | 0.88      | 12.98     | 107    | 17    | V    |
| 17355.00                    | 52.13    | 59.89    | 54.00    | 74.00    | 1.87      | 14.11     | 100    | 245   | V    |
| Channel: 165, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1008.89                     | 51.23    | 56.89    | 54.00    | 74.00    | 2.77      | 17.11     | 106    | 185   | V    |
| 11650.00                    | 53.01    | 59.98    | 54.00    | 74.00    | 0.99      | 14.02     | 130    | 34    | V    |
| 17475.00                    | 52.98    | 60.03    | 54.00    | 74.00    | 1.02      | 13.97     | 99     | 28    | V    |
| Channel: 152, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1020.56                     | 49.89    | 56.89    | 54.00    | 74.00    | 4.11      | 17.11     | 108    | 329   | V    |
| 11520.00                    | 50.00    | 59.98    | 54.00    | 74.00    | 4.00      | 14.02     | 107    | 263   | V    |
| 17280.00                    | 53.02    | 60.01    | 54.00    | 74.00    | 0.98      | 13.99     | 100    | 264   | V    |
| Channel: 160, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1115.62                     | 50.02    | 56.87    | 54.00    | 74.00    | 3.98      | 17.13     | 100    | 172   | V    |
| 11600.00                    | 53.61    | 59.87    | 54.00    | 74.00    | 0.39      | 14.13     | 102    | 119   | V    |
| 17400.00                    | 52.12    | 62.01    | 54.00    | 74.00    | 1.88      | 11.99     | 103    | 98    | V    |

## ECO9-5500

| Channel: 149, 802.11a       |          |          |          |          |           |           |        |       |      |
|-----------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1112.31                     | 49.99    | 56.52    | 54.00    | 74.00    | 4.01      | 17.48     | 101    | 212   | V    |
| 11490.00                    | 52.36    | 60.01    | 54.00    | 74.00    | 1.64      | 13.99     | 102    | 311   | V    |
| 17235.00                    | 51.89    | 59.98    | 54.00    | 74.00    | 2.11      | 14.02     | 119    | 350   | V    |
| Channel: 157, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1243.45                     | 50.11    | 56.40    | 54.00    | 74.00    | 3.89      | 17.6      | 110    | 92    | V    |
| 11570.00                    | 52.98    | 59.66    | 54.00    | 74.00    | 1.02      | 14.34     | 104    | 23    | V    |
| 17355.00                    | 51.87    | 60.36    | 54.00    | 74.00    | 2.13      | 13.64     | 102    | 246   | V    |
| Channel: 165, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1008.89                     | 49.80    | 55.89    | 54.00    | 74.00    | 4.20      | 18.11     | 104    | 145   | V    |
| 11650.00                    | 51.22    | 57.69    | 54.00    | 74.00    | 2.78      | 16.31     | 99     | 97    | V    |
| 17475.00                    | 52.01    | 60.99    | 54.00    | 74.00    | 1.99      | 13.01     | 115    | 24    | V    |
| Channel: 152, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1020.56                     | 50.02    | 56.02    | 54.00    | 74.00    | 3.98      | 17.98     | 101    | 169   | V    |
| 11520.00                    | 52.31    | 56.87    | 54.00    | 74.00    | 1.69      | 17.13     | 106    | 212   | V    |
| 17280.00                    | 53.00    | 62.03    | 54.00    | 74.00    | 1.00      | 11.97     | 109    | 254   | V    |
| Channel: 160, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1115.62                     | 49.91    | 55.50    | 54.00    | 74.00    | 4.09      | 18.5      | 101    | 192   | V    |
| 11600.00                    | 51.23    | 56.87    | 54.00    | 74.00    | 2.77      | 17.13     | 103    | 104   | V    |
| 17400.00                    | 52.03    | 60.45    | 54.00    | 74.00    | 1.97      | 13.55     | 105    | 198   | V    |

## ES24-14

| Channel: 149, 802.11a       |          |          |          |          |           |           |        |       |      |
|-----------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1112.31                     | 48.89    | 55.21    | 54.00    | 74.00    | 5.11      | 18.79     | 102    | 123   | V    |
| 11490.00                    | 52.30    | 60.03    | 54.00    | 74.00    | 1.70      | 13.97     | 109    | 87    | V    |
| 17235.00                    | 51.98    | 60.01    | 54.00    | 74.00    | 2.02      | 13.99     | 118    | 306   | V    |
| Channel: 157, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1243.45                     | 50.21    | 54.33    | 54.00    | 74.00    | 3.79      | 19.67     | 108    | 16    | V    |
| 11570.00                    | 51.11    | 59.87    | 54.00    | 74.00    | 2.89      | 14.13     | 106    | 97    | V    |
| 17355.00                    | 52.98    | 61.20    | 54.00    | 74.00    | 1.02      | 12.8      | 102    | 205   | V    |
| Channel: 165, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1008.89                     | 48.89    | 56.32    | 54.00    | 74.00    | 5.11      | 17.68     | 105    | 158   | V    |
| 11650.00                    | 50.23    | 59.45    | 54.00    | 74.00    | 3.77      | 14.55     | 123    | 36    | V    |
| 17475.00                    | 52.25    | 60.01    | 54.00    | 74.00    | 1.75      | 13.99     | 108    | 27    | V    |
| Channel: 152, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1020.56                     | 49.65    | 55.23    | 54.00    | 74.00    | 4.35      | 18.77     | 99     | 342   | V    |
| 11520.00                    | 50.11    | 60.54    | 54.00    | 74.00    | 3.89      | 13.46     | 104    | 296   | V    |
| 17280.00                    | 49.89    | 62.30    | 54.00    | 74.00    | 4.11      | 11.70     | 101    | 212   | V    |
| Channel: 160, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1115.62                     | 49.65    | 54.45    | 54.00    | 74.00    | 4.35      | 19.55     | 109    | 196   | V    |
| 11600.00                    | 51.23    | 60.02    | 54.00    | 74.00    | 2.77      | 13.98     | 110    | 123   | V    |
| 17400.00                    | 52.00    | 59.97    | 54.00    | 74.00    | 2.00      | 14.03     | 108    | 102   | V    |

## OD9-2400

| Channel: 1, 802.11b, g    |          |          |          |          |           |           |        |       |      |
|---------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1249.75                   | 50.21    | 59.23    | 54.00    | 74.00    | 3.79      | 14.77     | 100    | 101   | V    |
| 4824.00                   | 51.23    | 60.89    | 54.00    | 74.00    | 2.77      | 13.11     | 110    | 99    | V    |
| 7236.00                   | 47.51    | 55.24    | 54.00    | 74.00    | 6.49      | 18.76     | 104    | 100   | V    |
| 9648.00                   | 45.98    | 51.47    | 54.00    | 74.00    | 8.02      | 22.53     | 110    | 107   | V    |
| Channel: 6, 802.11b, g    |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | Deg   |      |
| 1800.21                   | 51.21    | 60.12    | 54.00    | 74.00    | 2.79      | 13.88     | 100    | 109   | V    |
| 4874.00                   | 50.23    | 61.96    | 54.00    | 74.00    | 3.77      | 12.04     | 115    | 110   | V    |
| 7311.00                   | 48.12    | 57.01    | 54.00    | 74.00    | 5.88      | 16.99     | 106    | 111   | V    |
| 9728.00                   | 46.45    | 54.23    | 54.00    | 74.00    | 7.55      | 19.77     | 102    | 103   | V    |
| Channel: 11, 802.11b, g   |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1701.95                   | 51.89    | 60.23    | 54.00    | 74.00    | 2.11      | 13.77     | 117    | 102   | V    |
| 4924.00                   | 50.69    | 59.62    | 54.00    | 74.00    | 3.31      | 14.38     | 114    | 107   | V    |
| 7386.00                   | 48.02    | 57.23    | 54.00    | 74.00    | 5.98      | 16.77     | 104    | 109   | V    |
| 9848.00                   | 47.56    | 55.96    | 54.00    | 74.00    | 6.44      | 18.04     | 125    | 98    | V    |
| Channel: 6, 802.11g super |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1256.01                   | 50.78    | 58.49    | 54.00    | 74.00    | 3.22      | 15.51     | 99     | 99    | V    |
| 4874.00                   | 50.65    | 58.10    | 54.00    | 74.00    | 3.35      | 15.90     | 104    | 103   | V    |
| 7311.00                   | 48.21    | 57.42    | 54.00    | 74.00    | 5.79      | 16.58     | 102    | 102   | V    |
| 9748.00                   | 47.60    | 52.33    | 54.00    | 74.00    | 6.40      | 21.67     | 100    | 115   | V    |

## HG2414D

| Channel: 1, 802.11b, g    |          |          |          |          |           |           |        |       |      |
|---------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1249.75                   | 52.47    | 60.71    | 54.00    | 74.00    | 1.53      | 13.29     | 100    | 293   | V    |
| 4824.00                   | 50.12    | 58.01    | 54.00    | 74.00    | 3.88      | 15.99     | 101    | 322   | V    |
| 7236.00                   | 48.56    | 55.23    | 54.00    | 74.00    | 5.44      | 18.77     | 109    | 303   | V    |
| 9648.00                   | 42.80    | 50.11    | 54.00    | 74.00    | 11.20     | 23.89     | 112    | 24    | V    |
| Channel: 6, 802.11b, g    |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1800.21                   | 52.56    | 61.23    | 54.00    | 74.00    | 1.44      | 12.77     | 99     | 211   | V    |
| 4874.00                   | 49.52    | 59.47    | 54.00    | 74.00    | 4.48      | 14.53     | 115    | 18    | V    |
| 7311.00                   | 45.56    | 52.21    | 54.00    | 74.00    | 8.44      | 21.79     | 120    | 246   | V    |
| 9728.00                   | 45.98    | 52.00    | 54.00    | 74.00    | 8.02      | 22.00     | 101    | 140   | V    |
| Channel: 11, 802.11b, g   |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1701.95                   | 51.71    | 62.03    | 54.00    | 74.00    | 2.29      | 11.97     | 102    | 93    | V    |
| 4924.00                   | 50.23    | 57.46    | 54.00    | 74.00    | 3.77      | 16.54     | 114    | 130   | V    |
| 7386.00                   | 49.87    | 56.65    | 54.00    | 74.00    | 4.13      | 17.35     | 109    | 86    | V    |
| 9848.00                   | 46.60    | 54.13    | 54.00    | 74.00    | 7.40      | 19.87     | 125    | 244   | V    |
| Channel: 6, 802.11g super |          |          |          |          |           |           |        |       |      |
| Frequency                 | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                       | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1256.01                   | 50.23    | 59.83    | 54.00    | 74.00    | 3.77      | 14.17     | 113    | 279   | V    |
| 4874.00                   | 52.42    | 59.54    | 54.00    | 74.00    | 1.58      | 14.46     | 112    | 64    | V    |
| 7311.00                   | 48.51    | 56.41    | 54.00    | 74.00    | 5.49      | 17.59     | 100    | 237   | V    |
| 9748.00                   | 47.32    | 53.99    | 54.00    | 74.00    | 6.68      | 20.01     | 99     | 297   | V    |

## HG5822G

| Channel: 149, 802.11a       |          |          |          |          |           |           |        |       |      |
|-----------------------------|----------|----------|----------|----------|-----------|-----------|--------|-------|------|
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | cm     | deg   |      |
| 1112.31                     | 49.51    | 58.10    | 54.00    | 74.00    | 4.49      | 15.9      | 102    | 202   | V    |
| 11490.00                    | 51.20    | 60.12    | 54.00    | 74.00    | 2.80      | 13.88     | 109    | 310   | V    |
| 17235.00                    | 50.97    | 58.71    | 54.00    | 74.00    | 3.03      | 15.29     | 113    | 396   | V    |
| Channel: 157, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1243.45                     | 48.56    | 56.23    | 54.00    | 74.00    | 5.44      | 17.77     | 111    | 10    | V    |
| 11570.00                    | 50.78    | 59.61    | 54.00    | 74.00    | 3.22      | 14.39     | 102    | 19    | V    |
| 17355.00                    | 52.06    | 60.82    | 54.00    | 74.00    | 1.94      | 13.18     | 109    | 205   | V    |
| Channel: 165, 802.11a       |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1008.89                     | 47.50    | 57.32    | 54.00    | 74.00    | 6.5       | 16.68     | 105    | 177   | V    |
| 11650.00                    | 50.41    | 57.12    | 54.00    | 74.00    | 3.59      | 16.88     | 112    | 36    | V    |
| 17475.00                    | 51.23    | 58.91    | 54.00    | 74.00    | 2.77      | 15.09     | 109    | 29    | V    |
| Channel: 152, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | deg   |      |
| 1020.56                     | 46.98    | 54.23    | 54.00    | 74.00    | 7.02      | 19.77     | 113    | 300   | V    |
| 11520.00                    | 49.96    | 61.95    | 54.00    | 74.00    | 4.04      | 12.05     | 106    | 126   | V    |
| 17280.00                    | 50.78    | 57.81    | 54.00    | 74.00    | 3.22      | 16.19     | 109    | 298   | V    |
| Channel: 160, 802.11a turbo |          |          |          |          |           |           |        |       |      |
| Frequency                   | Av Level | Pk Level | Av Limit | Pk Limit | Av Margin | Pk Margin | Height | Angle | Pol. |
| MHz                         | dBμV/m   | dBμV/m   | dBμV/m   | dBμV/m   | dB        | dB        | Cm     | Deg   |      |
| 1115.62                     | 47.89    | 56.33    | 54.00    | 74.00    | 6.11      | 17.67     | 112    | 114   | V    |
| 11600.00                    | 50.12    | 58.74    | 54.00    | 74.00    | 3.88      | 15.26     | 104    | 196   | V    |
| 17400.00                    | 51.63    | 59.13    | 54.00    | 74.00    | 2.37      | 14.87     | 95     | 111   | V    |

### 4.3 Bandwidth

#### 4.3.1 Limits of bandwidth measurements

The 6dB bandwidth of the signal must be greater than 0.50MHz.

#### 4.3.2 Test procedures

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 10 MHz VBW. The 6 dB bandwidth is defined as the bandwidth of which is higher than peak power minus 6dB.

#### 4.3.3 Deviations from test standard

No deviation.

#### 4.3.4 Test setup



#### 4.3.5 EUT operating conditions

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

**4.3.6 Test results**

|                          |                             |                 |                                          |
|--------------------------|-----------------------------|-----------------|------------------------------------------|
| EUT                      | CM9 PCI Transmitter Module  | MODE            | Continuous transmit                      |
| INPUT POWER              | 5VDC, AC-DC power converter | FREQUENCY RANGE | 2.412GHz – 2.462GHz, 5.745GHz – 5.800GHz |
| ENVIRONMENTAL CONDITIONS | 45% ± 5% RH<br>20 ± 3°C     | TECHNICIAN      | NJohnson                                 |

| CHANNEL            | CHANNEL FREQUENCY (MHz) | 6dB BW (MHz) | 20dB Limit Min (kHz) | RESULT |
|--------------------|-------------------------|--------------|----------------------|--------|
| 1, 802.11b         | 2.412                   | 13.38        | 500.00               | PASS   |
| 6, 802.11b         | 2.437                   | 13.08        | 500.00               | PASS   |
| 11, 802.11b        | 2.462                   | 12.72        | 500.00               | PASS   |
| 1, 802.11g         | 2.412                   | 12.63        | 500.00               | PASS   |
| 6, 802.11g         | 2.437                   | 12.78        | 500.00               | PASS   |
| 11, 802.11g        | 2.462                   | 12.93        | 500.00               | PASS   |
| 6, 802.11g super   | 2.437                   | 33.62        | 500.00               | PASS   |
| 149, 802.11a       | 5.745                   | 16.68        | 500.00               | PASS   |
| 157, 802.11a       | 5.785                   | 16.83        | 500.00               | PASS   |
| 165, 802.11a       | 5.825                   | 16.63        | 500.00               | PASS   |
| 152, 802.11a turbo | 5.760                   | 33.33        | 500.00               | PASS   |
| 160, 802.11a turbo | 5.800                   | 33.07        | 500.00               | PASS   |

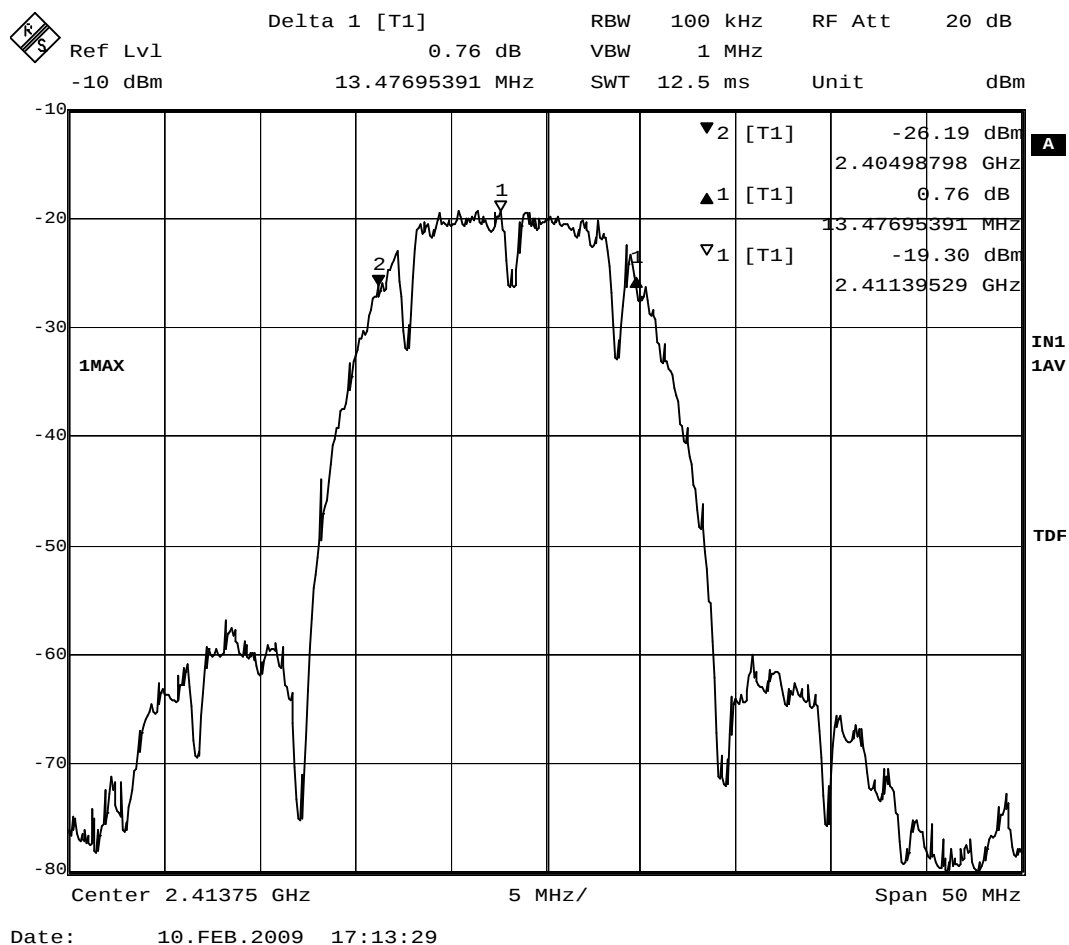


Figure 2 - Channel 1, 802.11b, 6dB Bandwidth

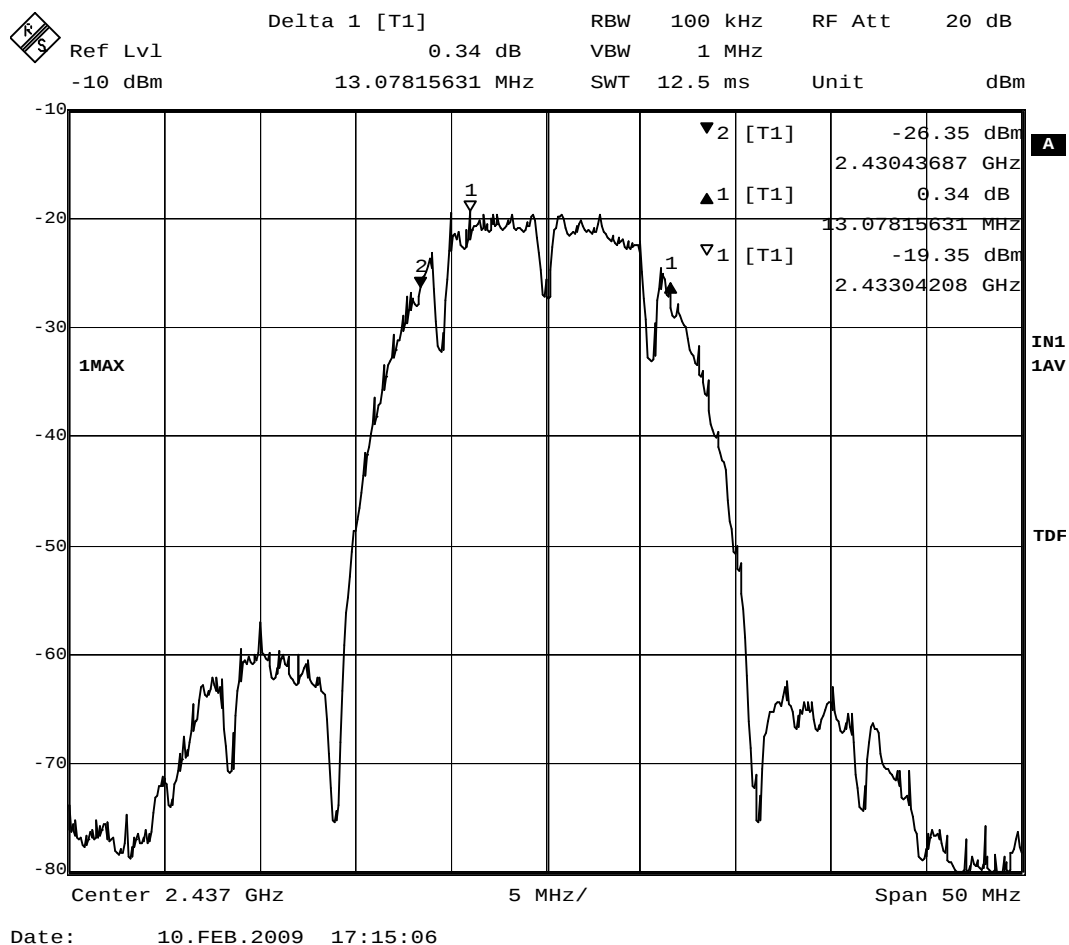


Figure 3 - Channel 6, 802.11b, 6dB Bandwidth

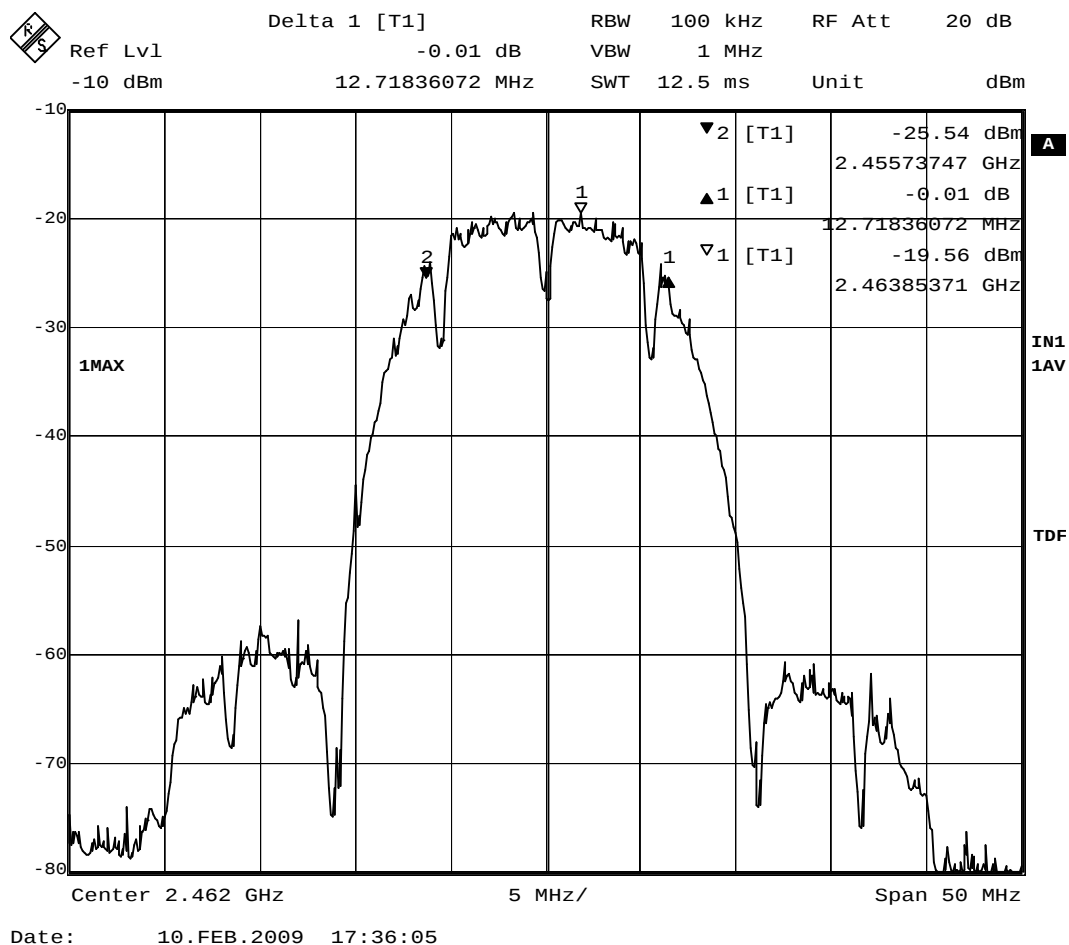


Figure 4 - Channel 11, 802.11b, 6dB Bandwidth

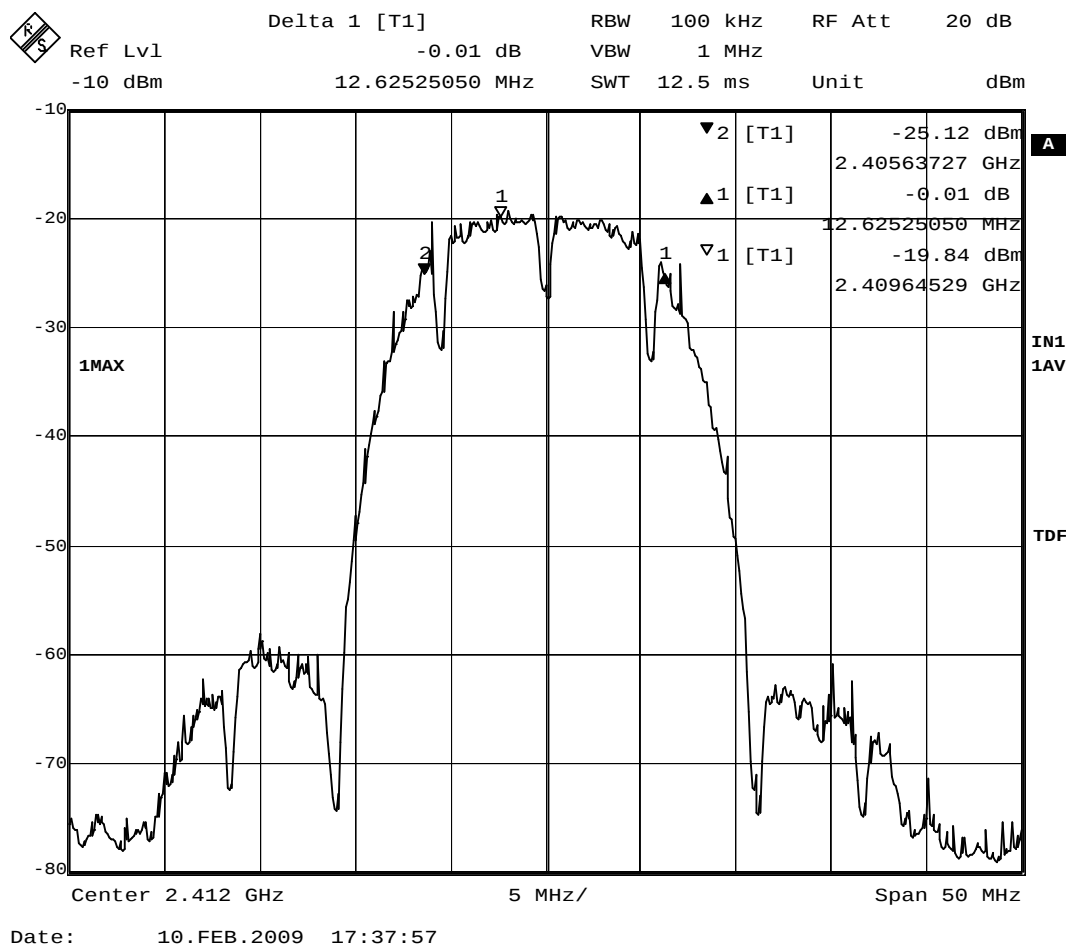


Figure 5 - Channel 1, 802.11g, 6dB Bandwidth

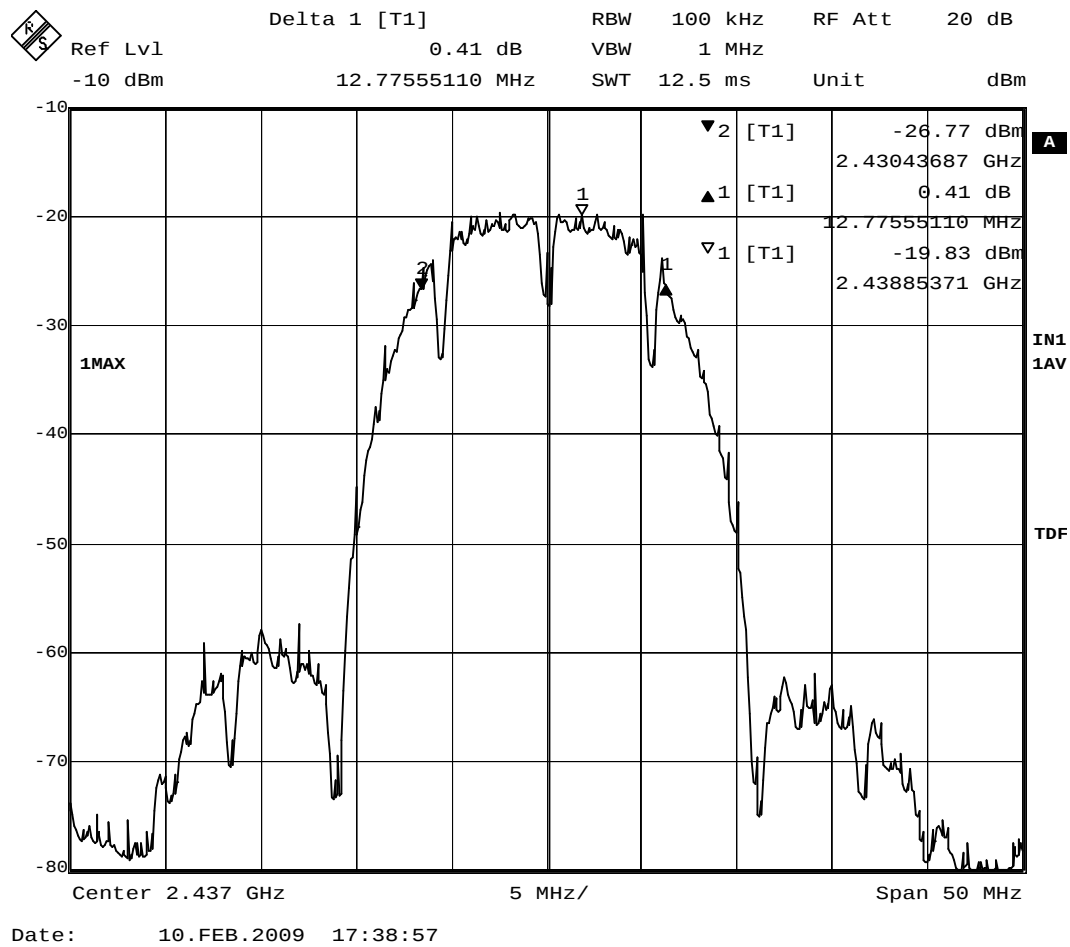
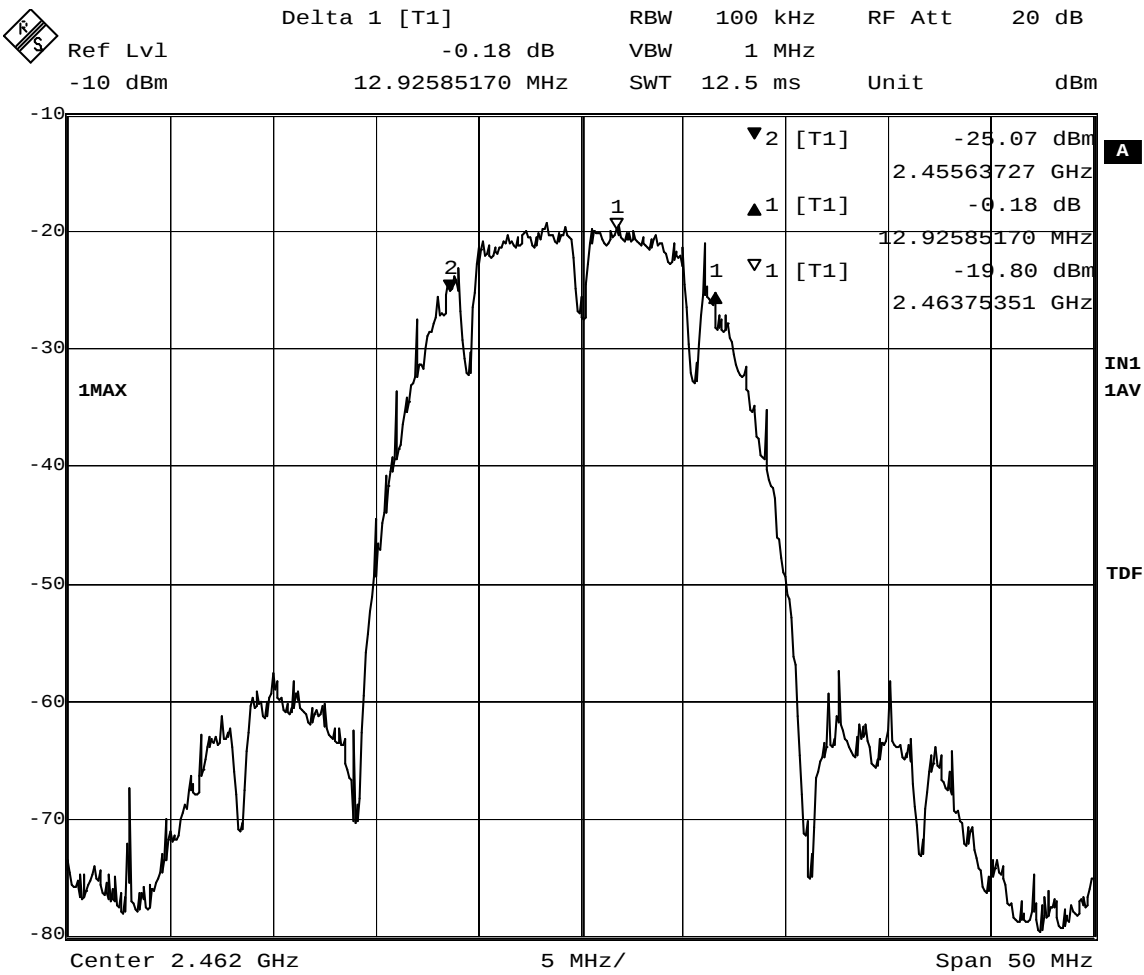
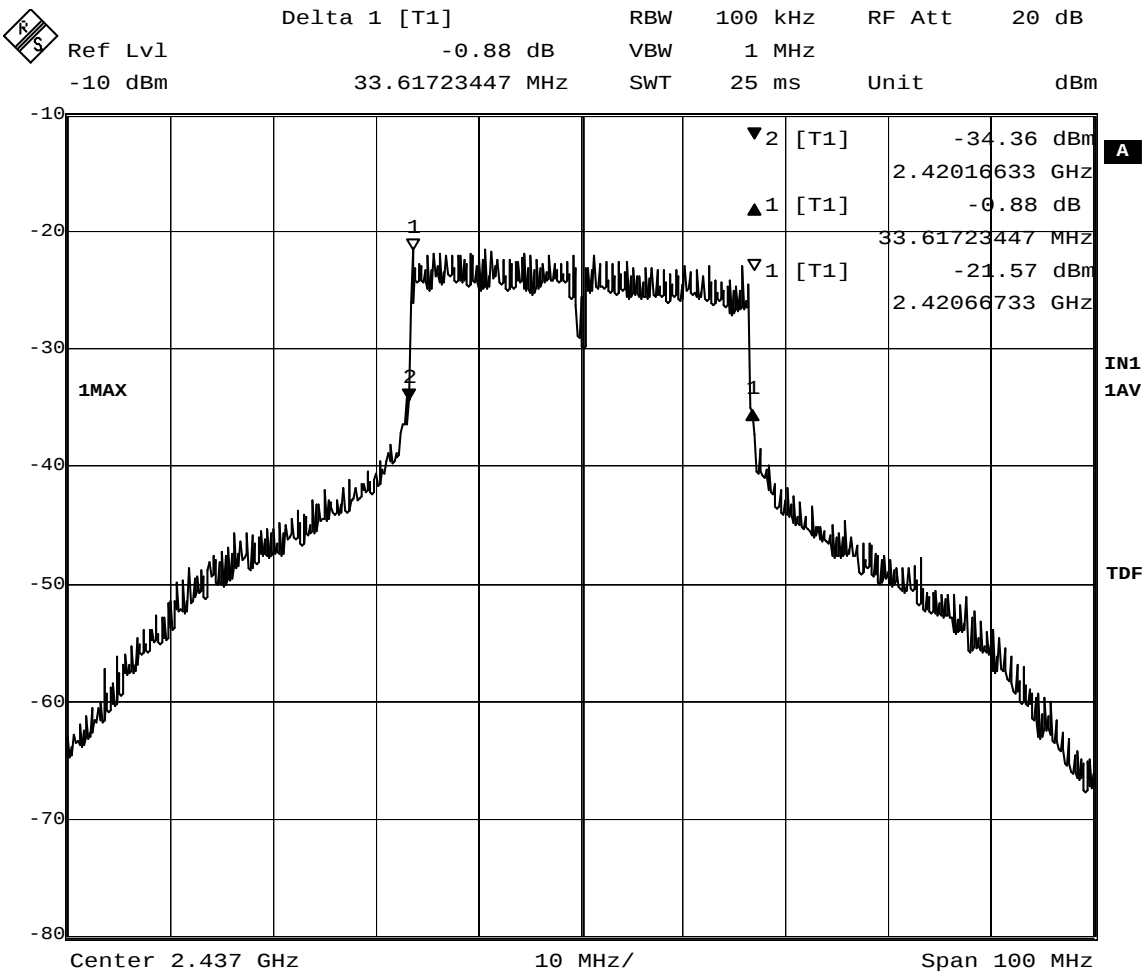


Figure 6 - Channel 6, 802.11g, 6dB Bandwidth



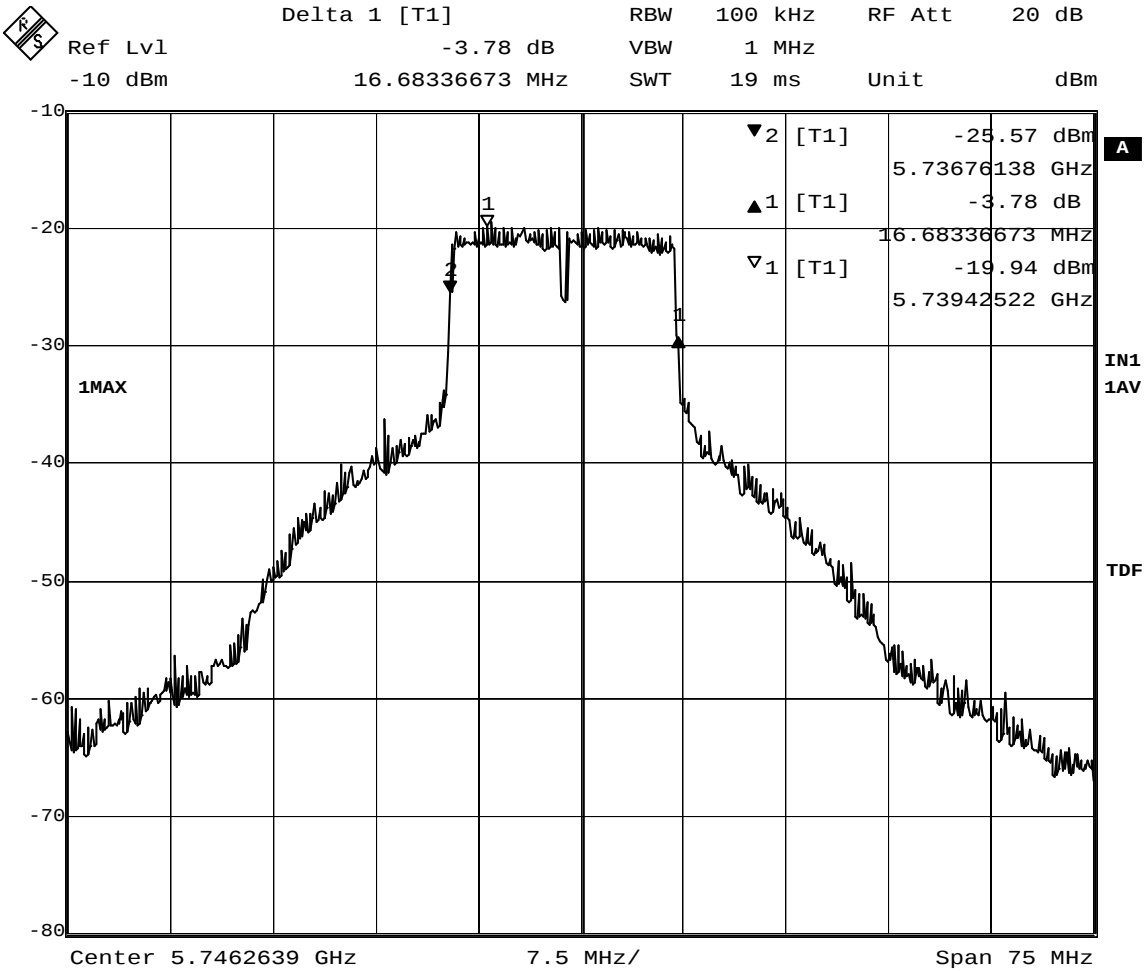
Date: 10.FEB.2009 17:40:05

Figure 7 - Channel 11, 802.11g, 6dB Bandwidth



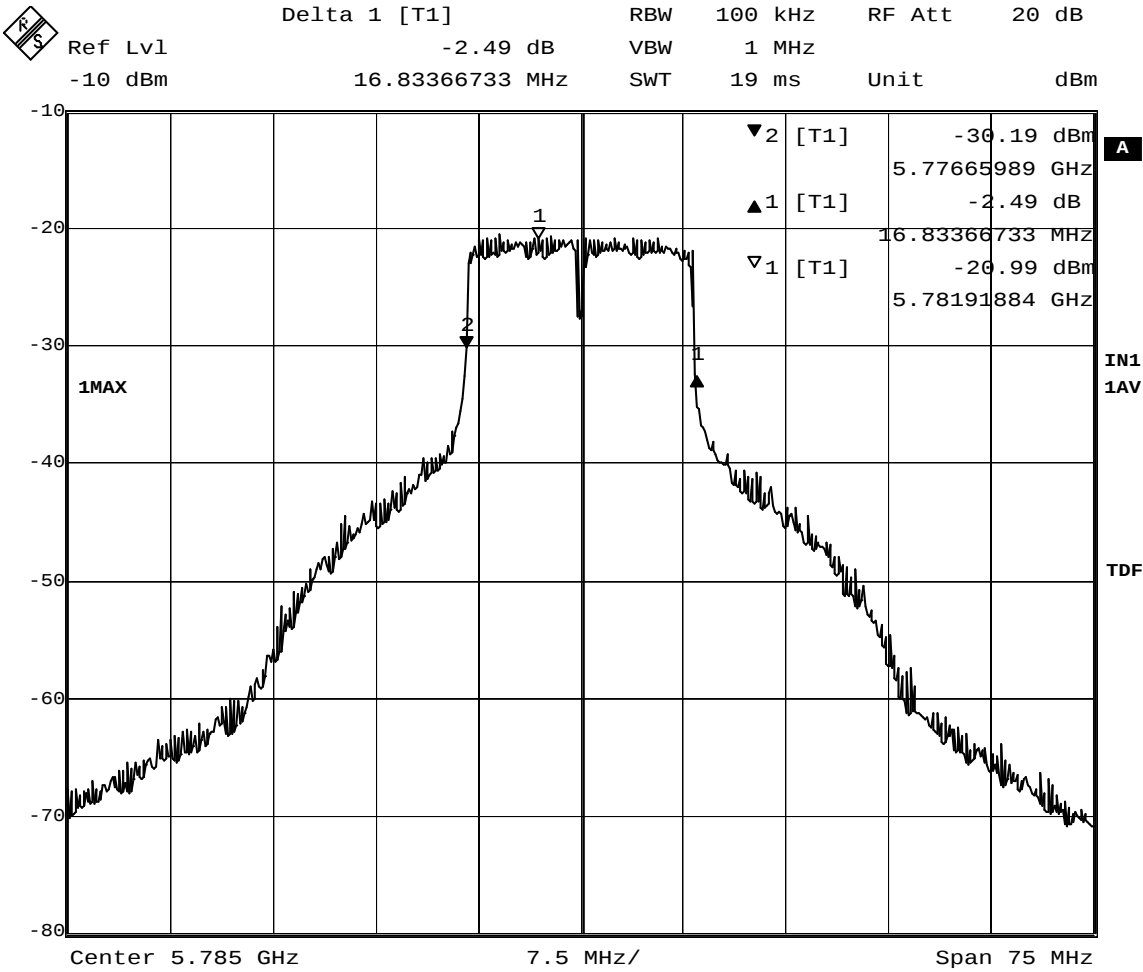
Date: 10.FEB.2009 17:41:08

Figure 8 - Channel 6, 802.11g super, 6dB Bandwidth



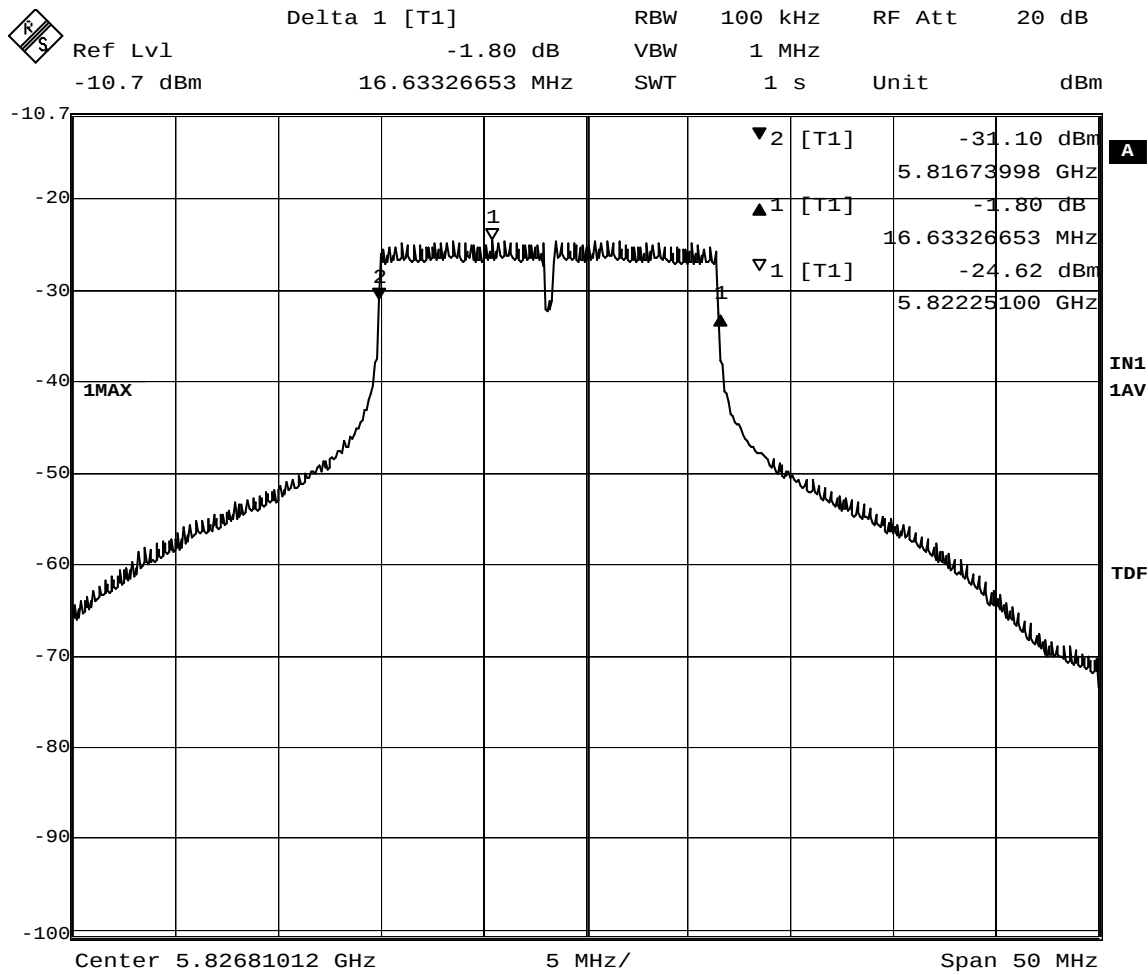
Date: 10.FEB.2009 16:47:10

Figure 9 - Channel 149, 802.11a, 6dB Bandwidth



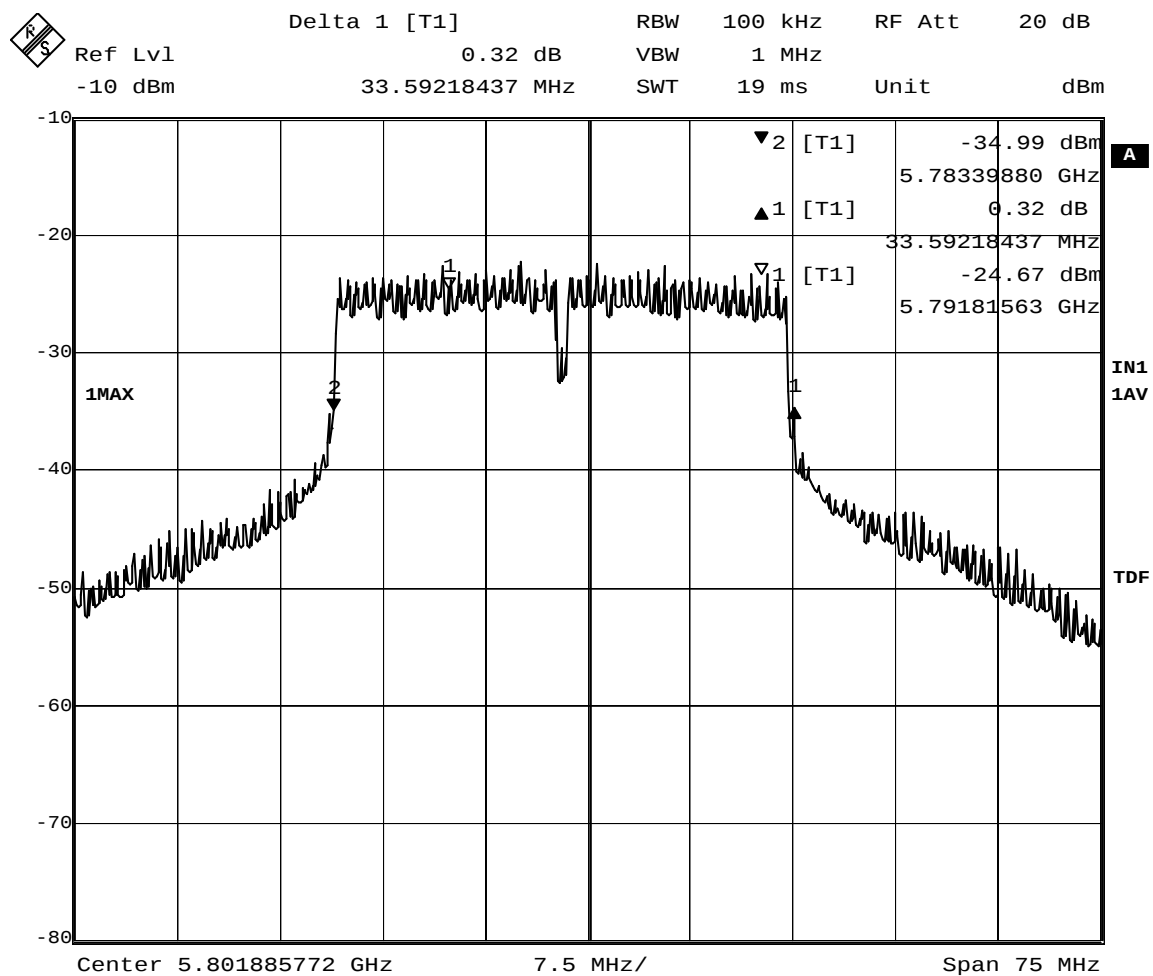
Date: 10.FEB.2009 17:06:47

Figure 10 - Channel 157, 802.11a, 6dB Bandwidth



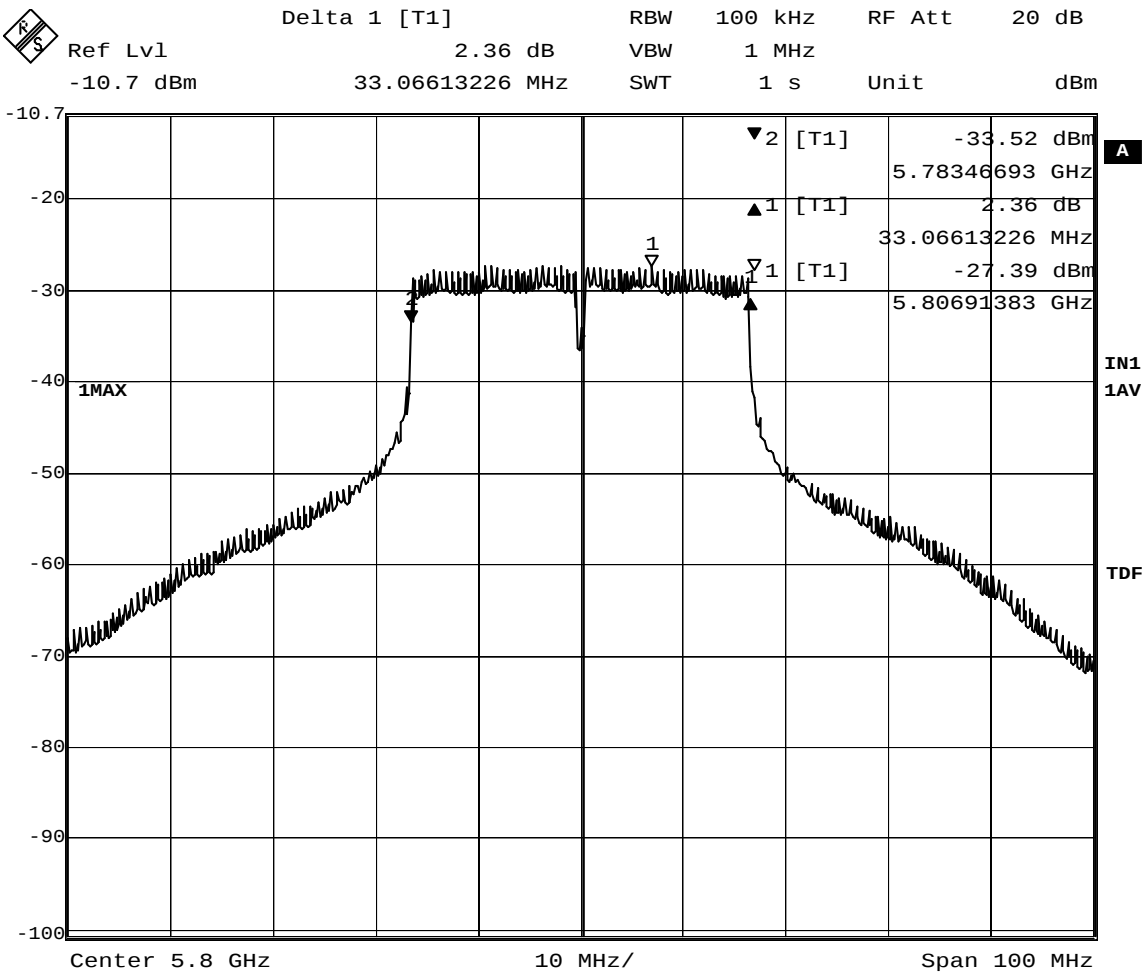
Date: 12.FEB.2009 09:46:56

Figure 11 - Channel 165, 802.11a, 6dB Bandwidth



Date: 10.FEB.2009 16:40:24

Figure 12 - Channel 152, 802.11a turbo, 6dB Bandwidth



Date: 12.FEB.2009 09:54:44

Figure 13 - Channel 160, 802.11a turbo, 6dB Bandwidth

#### **4.4 Maximum peak output power**

##### **4.4.1 Limits of power measurements**

The maximum peak output power allowed is 30dBm (1000mW).

##### **4.4.2 Test procedures**

1. The EUT was connected to the power sensor directly with a low-loss shielded coaxial cable.

##### **4.4.3 Deviations from test standard**

No deviation.

##### **4.4.4 Test setup**

The RF output of the EUT was connected to a diode power sensor and power meter through a 30dB attenuator. All measurements shown are corrected for this attenuation.

##### **4.4.5 EUT operating conditions**

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

**4.4.6 Test results**

|                          |                             |                 |                                    |
|--------------------------|-----------------------------|-----------------|------------------------------------|
| EUT                      | CM9 PCI Transmitter Module  | MODE            | Continuous transmit                |
| INPUT POWER              | 5VDC, AC-DC power converter | FREQUENCY RANGE | 2.412 - 2.437GHz, 5.745 – 5.800GHz |
| ENVIRONMENTAL CONDITIONS | 45% ± 5% RH<br>20 ± 3°C     | TECHNICIAN      | NJohnson                           |

**Maximum peak output power**

| CHANNEL | Operating Mode | CHANNEL FREQUENCY (GHz) | PEAK POWER OUTPUT (dBm) | PEAK POWER LIMIT (dBm) | RESULT |
|---------|----------------|-------------------------|-------------------------|------------------------|--------|
| 1       | 802.11b        | 2.412                   | 15.91                   | 22*                    | PASS   |
| 6       | 802.11b        | 2.437                   | 15.13                   | 22*                    | PASS   |
| 11      | 802.11b        | 2.462                   | 15.60                   | 22*                    | PASS   |
| 1       | 802.11g        | 2.412                   | 15.35                   | 22*                    | PASS   |
| 6       | 802.11g        | 2.437                   | 15.06                   | 22*                    | PASS   |
| 11      | 802.11g        | 2.462                   | 15.50                   | 22*                    | PASS   |
| 6       | 802.11g super  | 2.437                   | 18.20                   | 22*                    | PASS   |
| 149     | 802.11a        | 5.745                   | 20.62                   | 27** (30***)           | PASS   |
| 157     | 802.11a        | 5.785                   | 18.56                   | 27** (30***)           | PASS   |
| 165     | 802.11a        | 5.825                   | 18.77                   | 27** (30***)           | PASS   |
| 152     | 802.11a turbo  | 5.760                   | 21.68                   | 27** (30***)           | PASS   |
| 160     | 802.11a turbo  | 5.800                   | 19.15                   | 27** (30***)           | PASS   |

\*Note: Maximum power using approved antenna with highest gain in the 2.4GHz band. HG2414D (Gain = 14dBi, Maximum power output = 30dBm – [14 – 6] = 22dBm)

\*\*Note: Maximum power using approved antenna with highest gain in the 5.8GHz band. (Gain = 14dBi, Maximum power output = 30dBm – [9 – 6] = 27dBm)

\*\*\*Note: According to CFR 47, Part 15.247(b)(3)(ii), for antennas used for point-to-point operation in the 5.8GHz no reduction in peak power is required. See section 2.6 for a list of antennas to be used only for point-to-point operation.

**REMARKS:**

802.11g turbo only operates on one frequency  
802.11a turbo only operates on two frequencies



## **4.5 Bandedges**

### **4.5.1 Limits of bandedge measurements**

For emissions outside of the allowed band of operation the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

### **4.5.2 Test procedures**

The antenna output of the EUT was connected directly to the spectrum analyzer using a low-loss shielded coaxial cable. The span was adjusted as to show the edge of the allowed band and the highest emissions. The delta between the two was recorded.

### **4.5.3 Deviations from test standard**

No deviation.

### **4.5.4 Test setup**

See Section 4.4

### **4.5.5 EUT operating conditions**

The EUT was powered by 5VDC from an AC-DC power converter, which was powered by 120VAC/60Hz from the AC mains. The EUT was tested while connected to a Dell D60 Latitude laptop PC via USB.

**4.5.6 Test results**

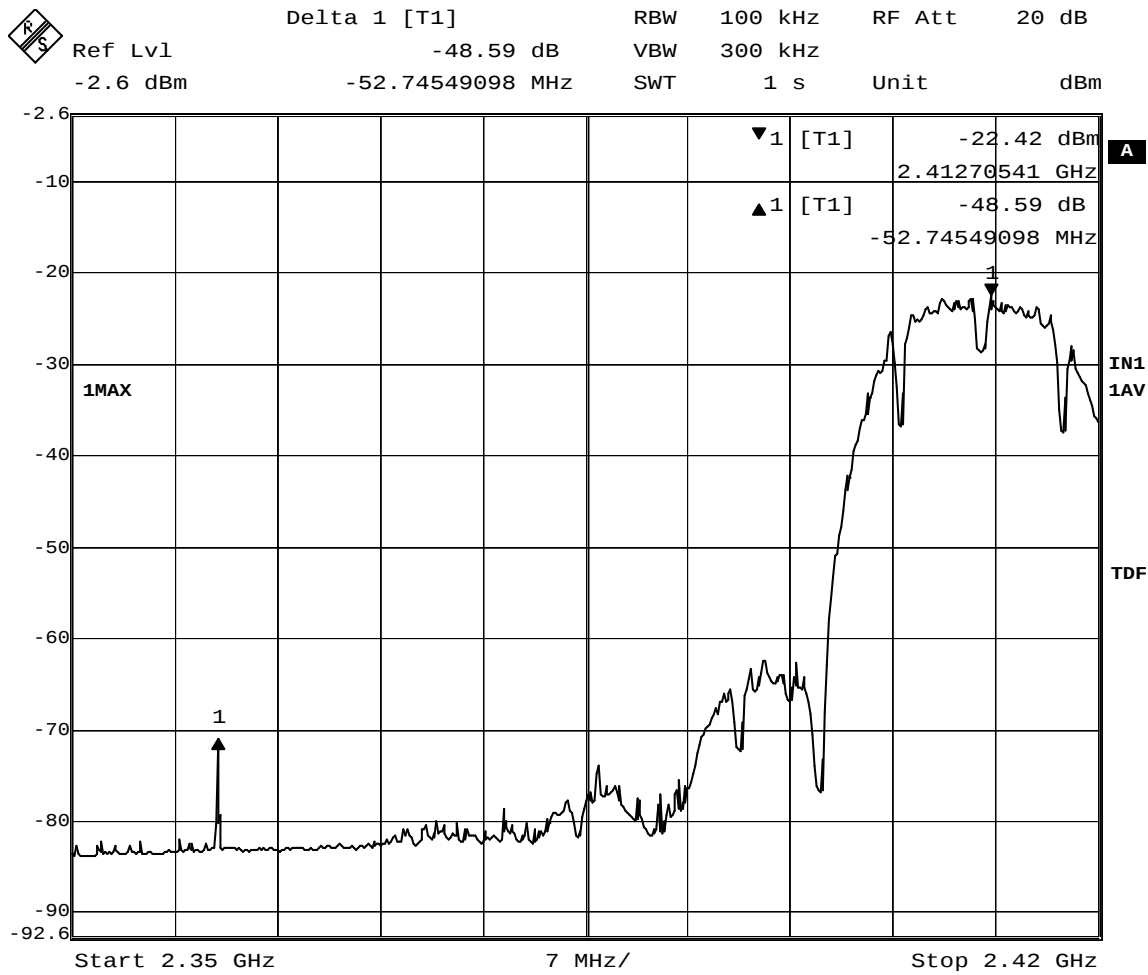
|                          |                             |                 |                                            |
|--------------------------|-----------------------------|-----------------|--------------------------------------------|
| EUT                      | CM9 PCI Transmitter Module  | MODE            | Continuous transmit                        |
| INPUT POWER              | 5VDC, AC-DC power converter | FREQUENCY RANGE | 2.412GHz – 2.462GHz<br>5.745GHz – 5.800GHz |
| ENVIRONMENTAL CONDITIONS | 45% ± 5% RH<br>20 ± 3°C     | TECHNICIAN      | NJohnson                                   |

**Highest Out of Band Emissions**

| CHANNEL                       | Highest in band level dBm | Delta dB | Delta Limit dB | Result |
|-------------------------------|---------------------------|----------|----------------|--------|
| 1, 802.11b (2.412GHz)         | -22.42                    | 48.39    | 20.00          | PASS   |
| 11, 802.11b (2.462GHz)        | -23.76                    | 36.80    | 20.00          | PASS   |
| 1, 802.11g (2.412GHz)         | -23.17                    | 48.74    | 20.00          | PASS   |
| 11, 802.11g(2.462GHz)         | -23.32                    | 56.22    | 20.00          | PASS   |
| 6, 802.11g super (2.437GHz)   | -24.69                    | 28.55    | 20.00          | PASS   |
| 149, 802.11a (5.745GHz)       | -23.42                    | 31.90    | 20.00          | PASS   |
| 160, 802.11a (5.800GHz)       | -24.06                    | 58.84    | 20.00          | PASS   |
| 152, 802.11a turbo (5.760GHz) | -25.89                    | 27.15    | 20.00          | PASS   |
| 160, 802.11a turbo (5.800GHz) | -26.78                    | 50.10    | 20.00          | PASS   |

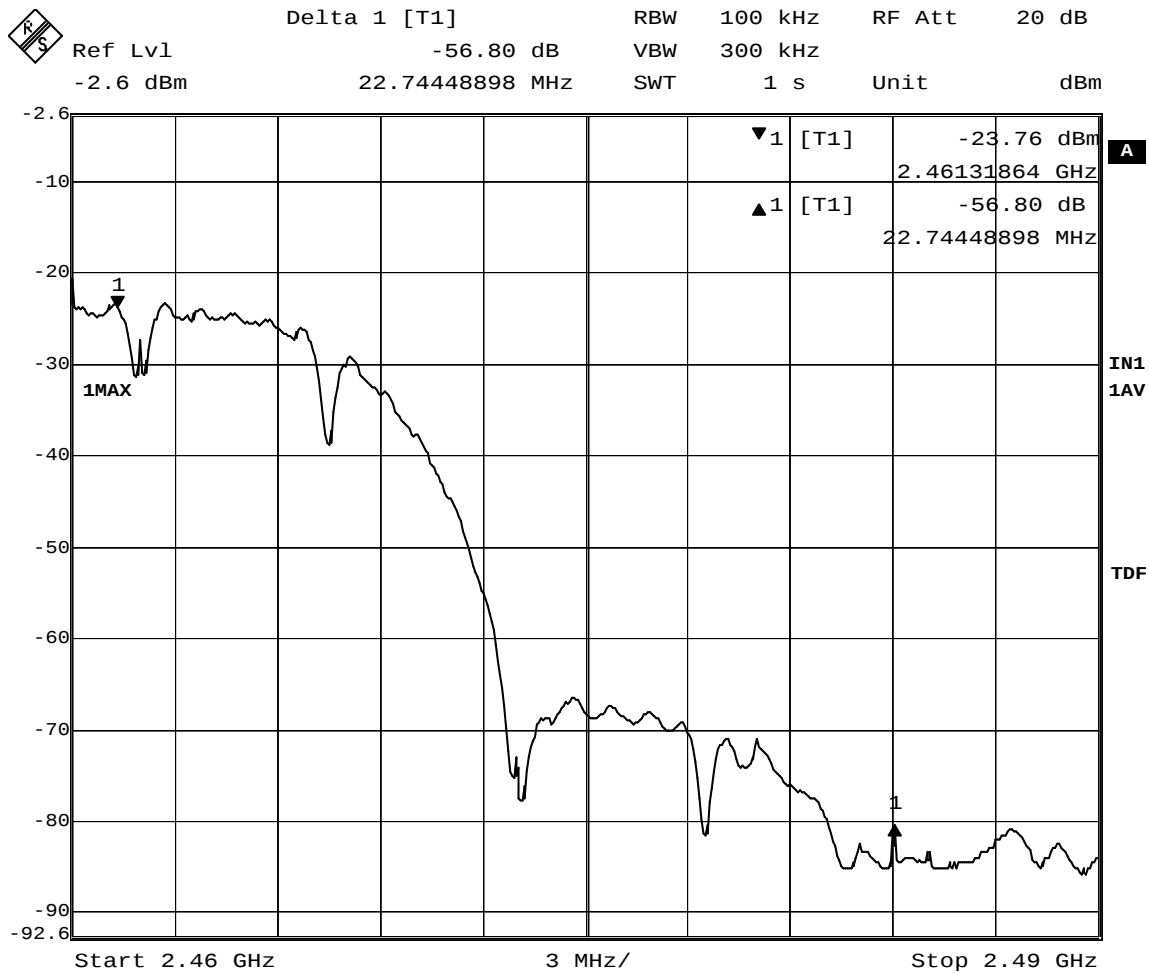
**NOTE:**

EUT was tested as described in section 4.2. All measurements above were taken from section 4.2. The highest out of band measurement was maximized in a 5MHz frequency band, so the frequency may be slightly within the frequency band, but represents a worse-case scenario for all out of band measurements. The plots on the following page shows the peak measurements in green and quasi-peak in red.



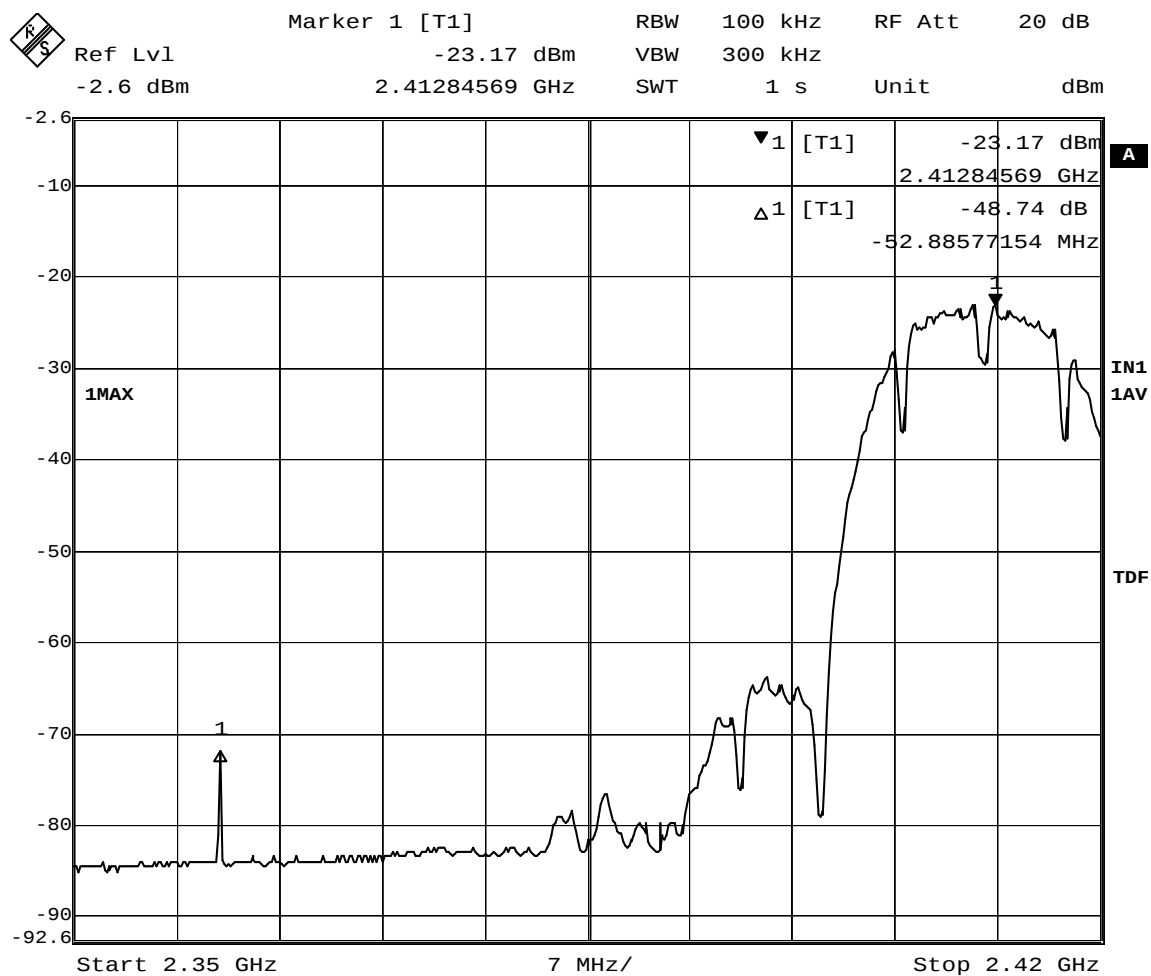
Date: 11.FEB.2009 15:31:39

Figure 14 - Channel 1, 802.11b, 2.4GHz Bandedge



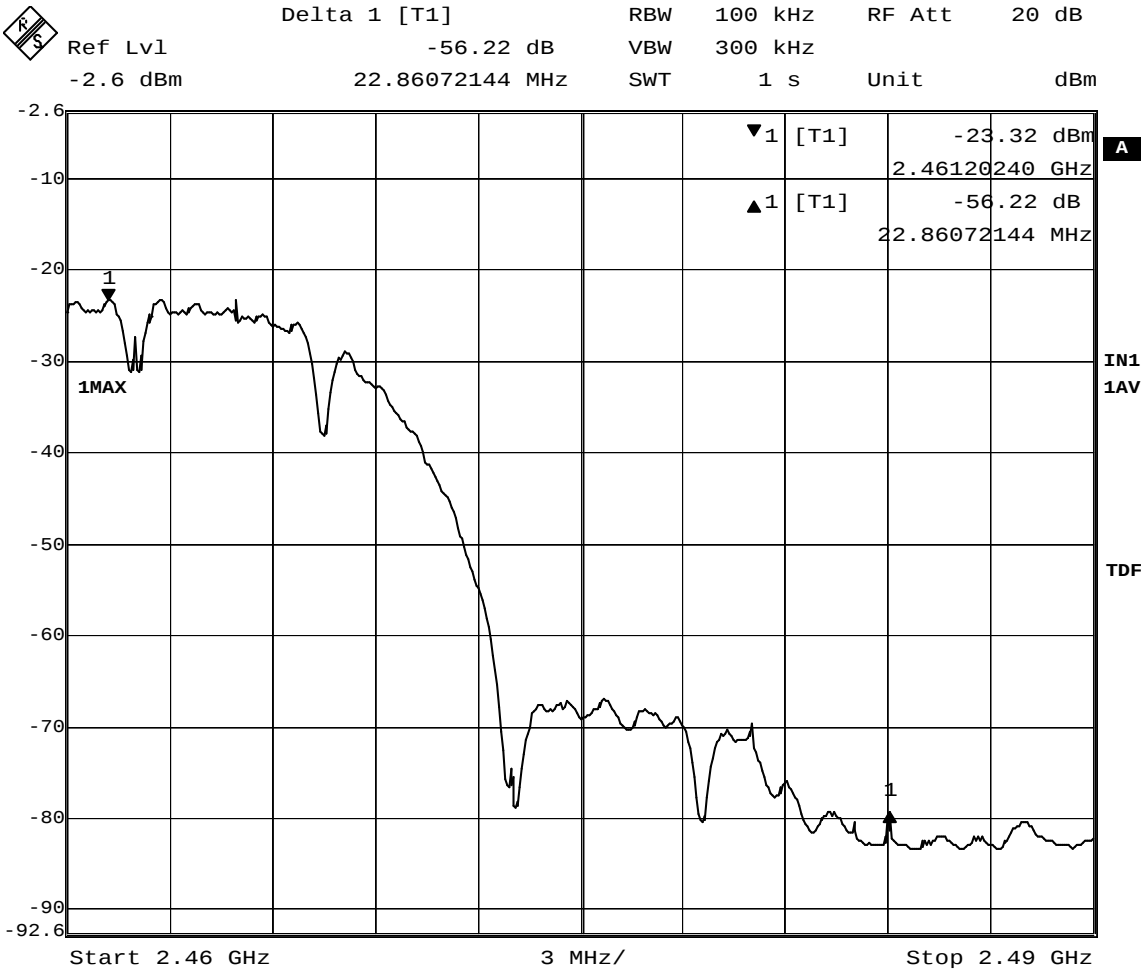
Date: 11.FEB.2009 15:35:02

Figure 15 - Channel 11, 802.11b, 2.4835GHz Bandedge



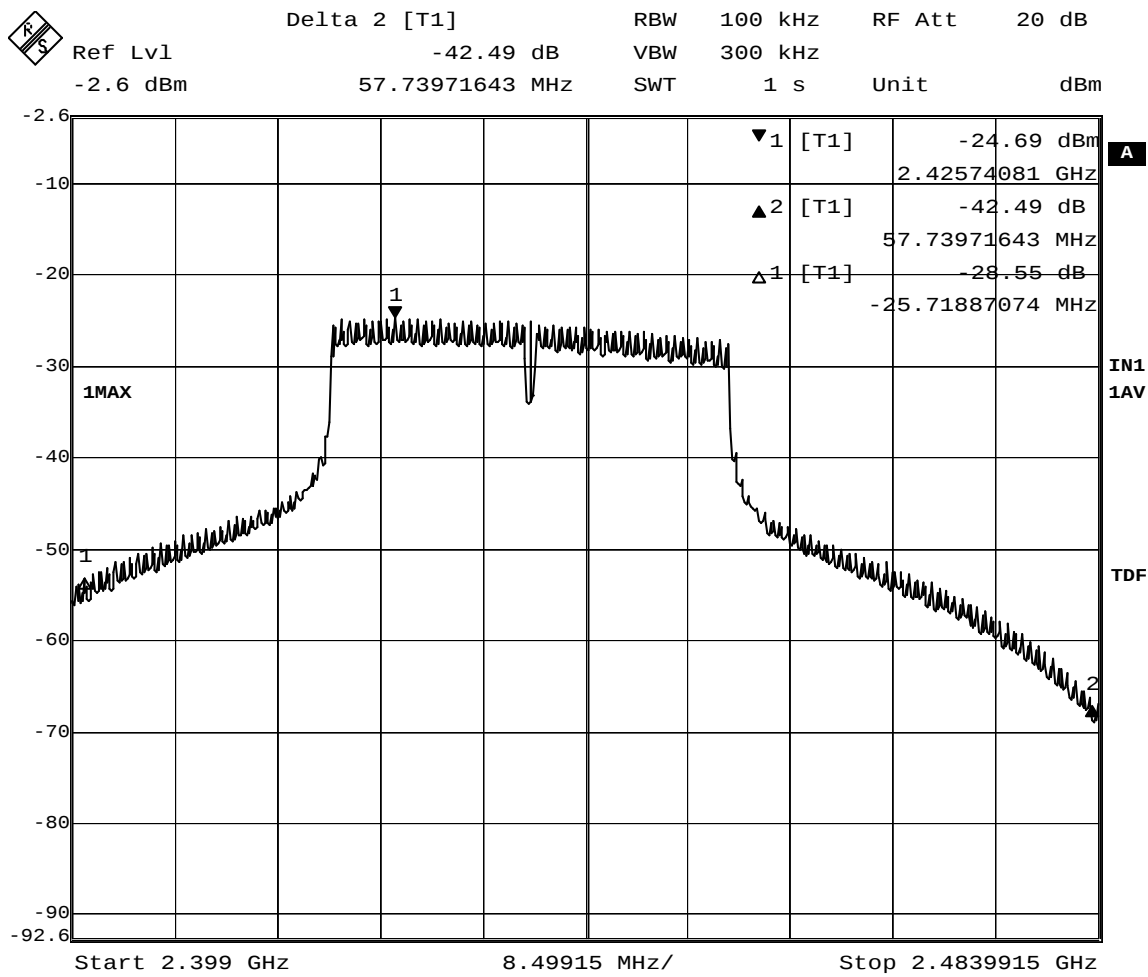
Date: 11.FEB.2009 15:32:36

Figure 16 - Channel 1, 802.11g, 2.4GHz Bandedge



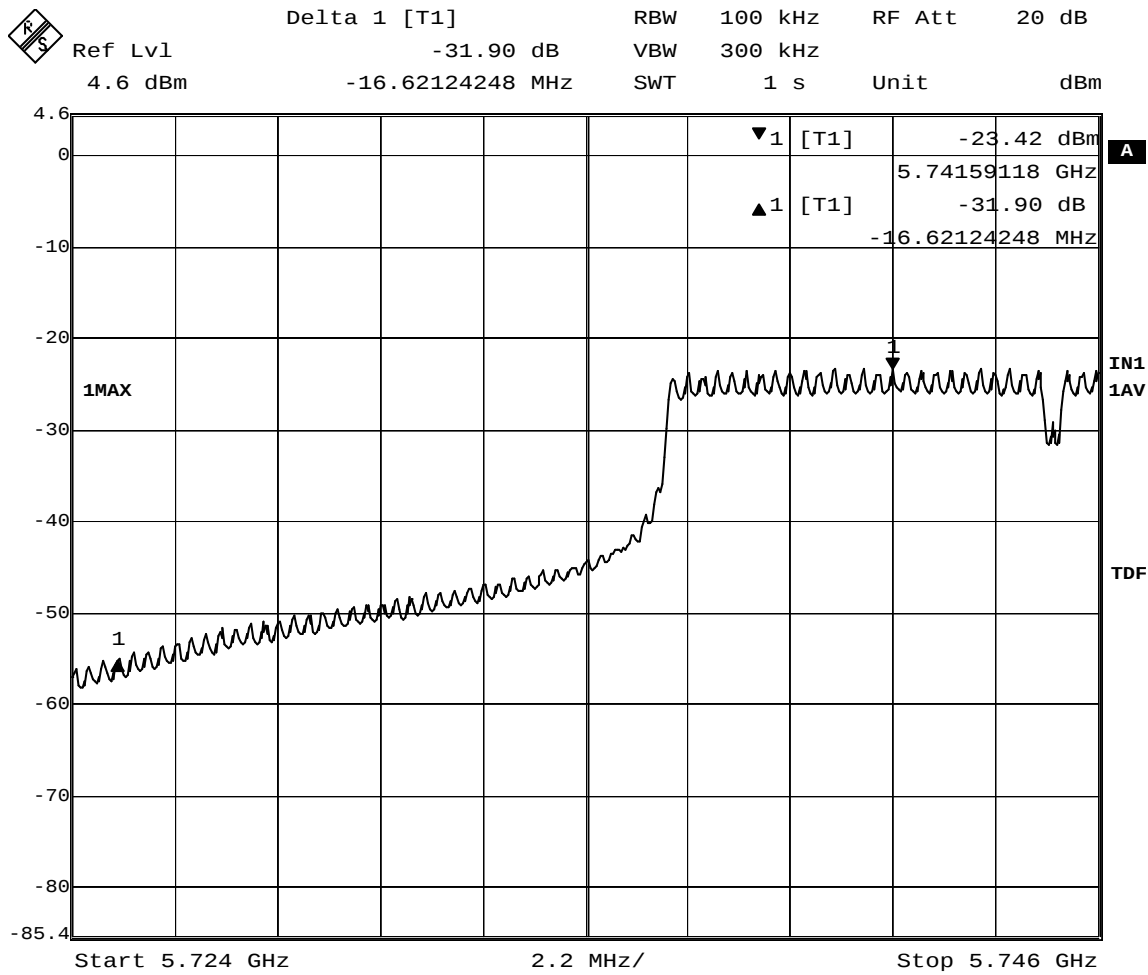
Date: 11.FEB.2009 15:36:01

Figure 17 - Channel 11, 802.11g, 2.4835GHz Bandedge



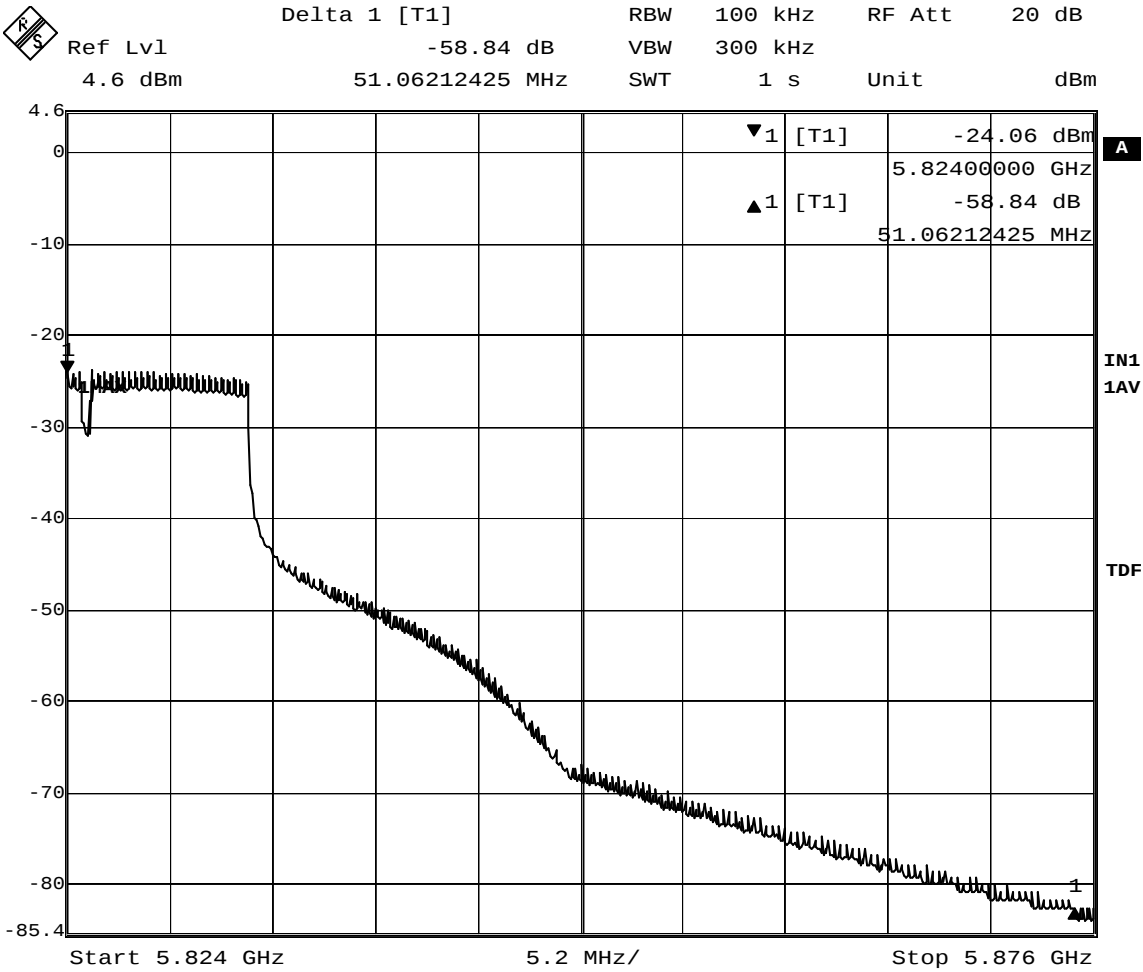
Date: 11.FEB.2009 15:39:02

Figure 18 - Channel 6, 802.11g super, 2.4GHz and 2.4835GHz Bandedge



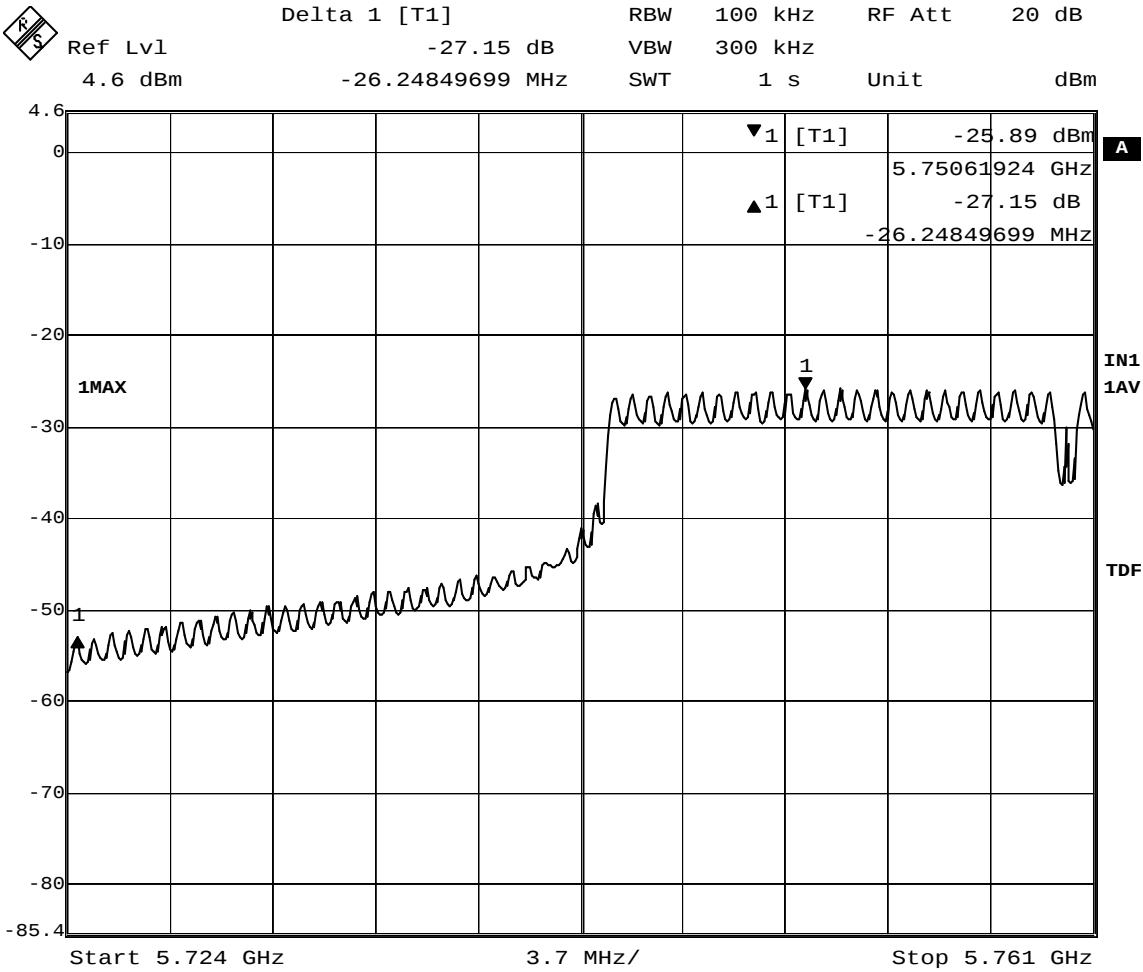
Date: 11.FEB.2009 15:41:22

Figure 19 - Channel 149, 802.11a, 5.725GHz Bandedge



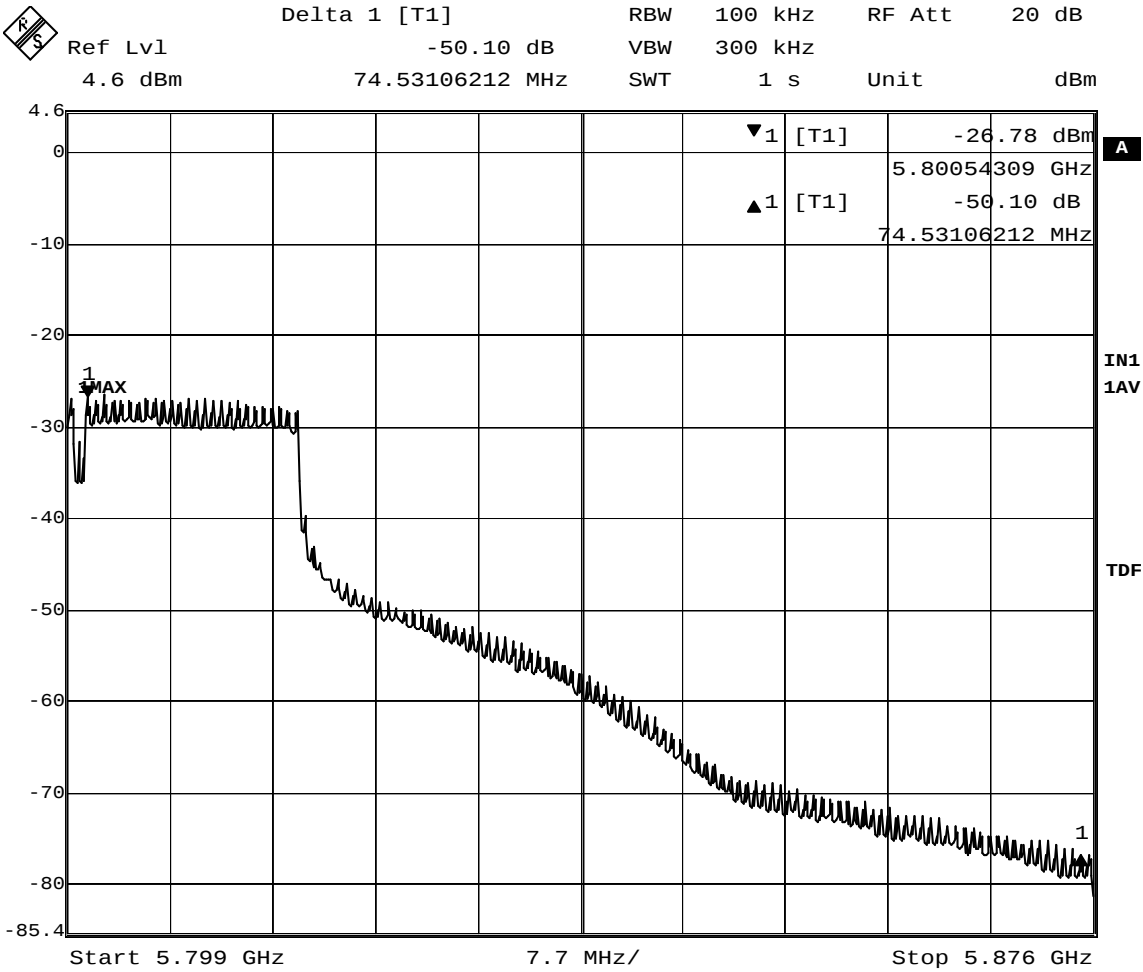
Date: 11.FEB.2009 15:43:57

Figure 20 - Channel 165, 802.11a, 5.875GHz Bandedge



Date: 11.FEB.2009 15:42:16

Figure 21 - Channel 152, 802.11a turbo, 5.725GHz Bandedge



Date: 11.FEB.2009 15:45:17

Figure 22 - Channel 160, 802.11a, 5.875GHz Bandedge

## **4.6 Power Spectral Density**

### **4.6.1 Power spectral density measurements**

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.

### **4.6.2 Test procedures**

The antenna output of the EUT was connected directly to the spectrum analyzer using a low-loss shielded coaxial cable. The spectrum analyzer was set to 3 kHz RBW and 30 kHz VBW, the sweep time was 500s. The power spectral density was measured and recorded at the frequency with the highest emission. The sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

### **4.6.3 Deviations from test standard**

No deviation.

### **4.6.4 Test setup**

See section 4.3

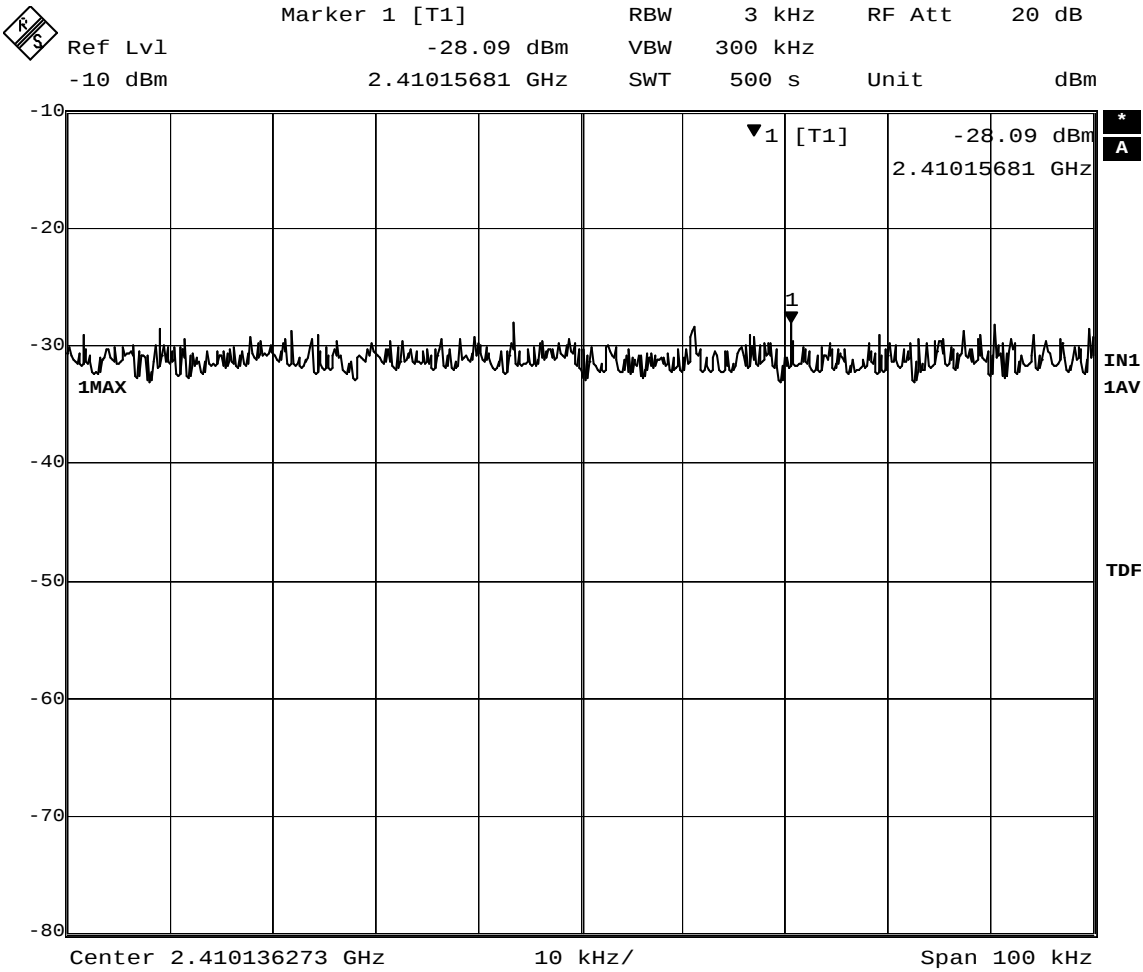
### **4.6.5 EUT operating conditions**

The EUT was powered by 120VAC/60Hz from the AC mains supply and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

|                          |                                 |                 |                     |
|--------------------------|---------------------------------|-----------------|---------------------|
| EUT                      | CM9 PCI Transmitter Module      | MODE            | Continuous transmit |
| INPUT POWER              | 5VDC, AC-DC power converter     | FREQUENCY RANGE | 2.412-5.800GHz      |
| ENVIRONMENTAL CONDITIONS | 45% $\pm$ 5% RH<br>20 $\pm$ 3°C | TECHNICIAN      | NJohnson            |

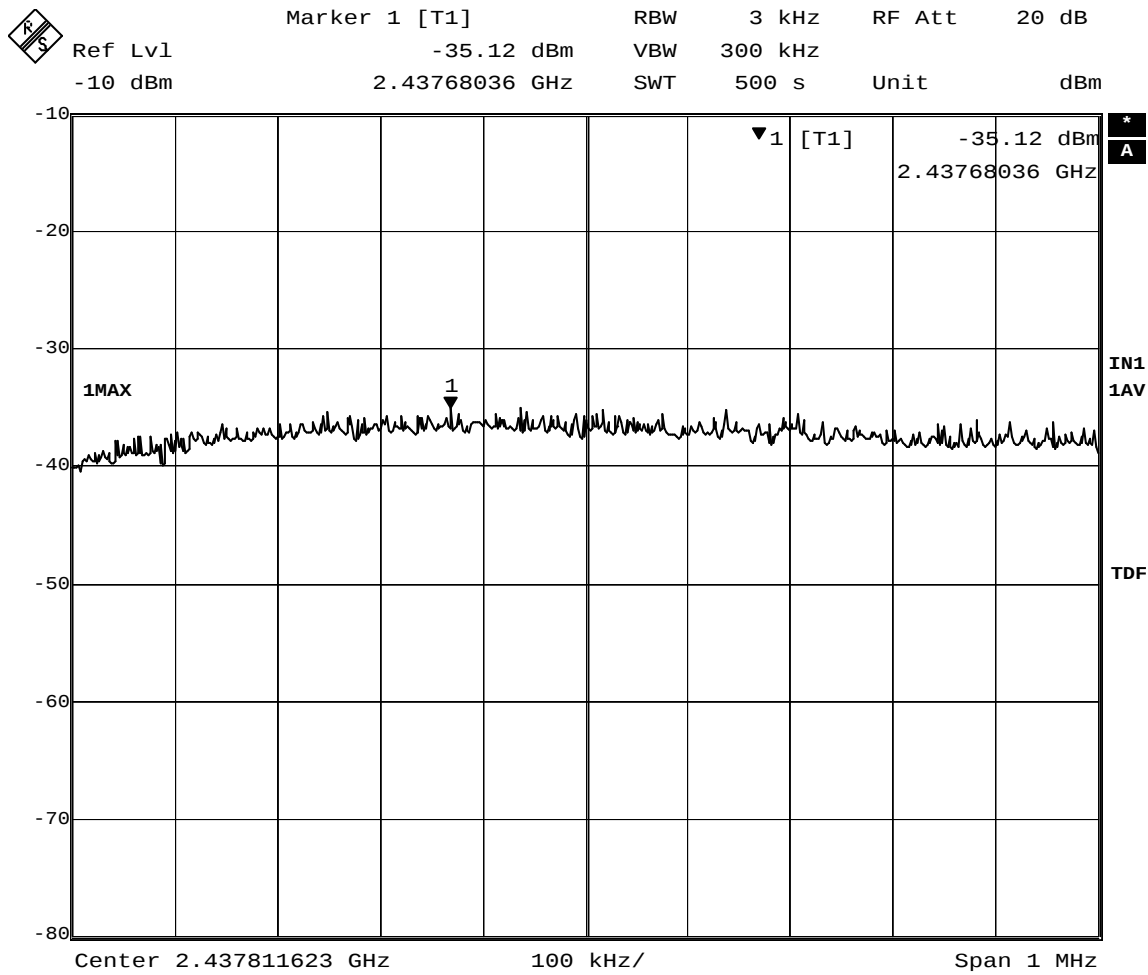
**Power Spectral Density**

| CHANNEL    | CHANNEL FREQUENCY (MHz) | RF POWER LEVEL IN # KHz BW (dBm) | MAXIMUM POWER LIMIT (dBm) | RESULT |
|------------|-------------------------|----------------------------------|---------------------------|--------|
| 1b         | 2.412                   | -28.09                           | 8.00                      | PASS   |
| 6b         | 2.437                   | -35.12                           | 8.00                      | PASS   |
| 11b        | 2.462                   | -36.33                           | 8.00                      | PASS   |
| 1g         | 2.412                   | -36.55                           | 8.00                      | PASS   |
| 6g         | 2.437                   | -35.59                           | 8.00                      | PASS   |
| 11g        | 2.762                   | -35.65                           | 8.00                      | PASS   |
| 6g super   | 5.737                   | -32.99                           | 8.00                      | PASS   |
| 149a       | 5.745                   | -35.78                           | 8.00                      | PASS   |
| 157a       | 5.785                   | -36.08                           | 8.00                      | PASS   |
| 165a       | 5.825                   | -30.64                           | 8.00                      | PASS   |
| 152a turbo | 5.760                   | -28.83                           | 8.00                      | PASS   |
| 160a turbo | 5.800                   | -32.85                           | 8.00                      | PASS   |



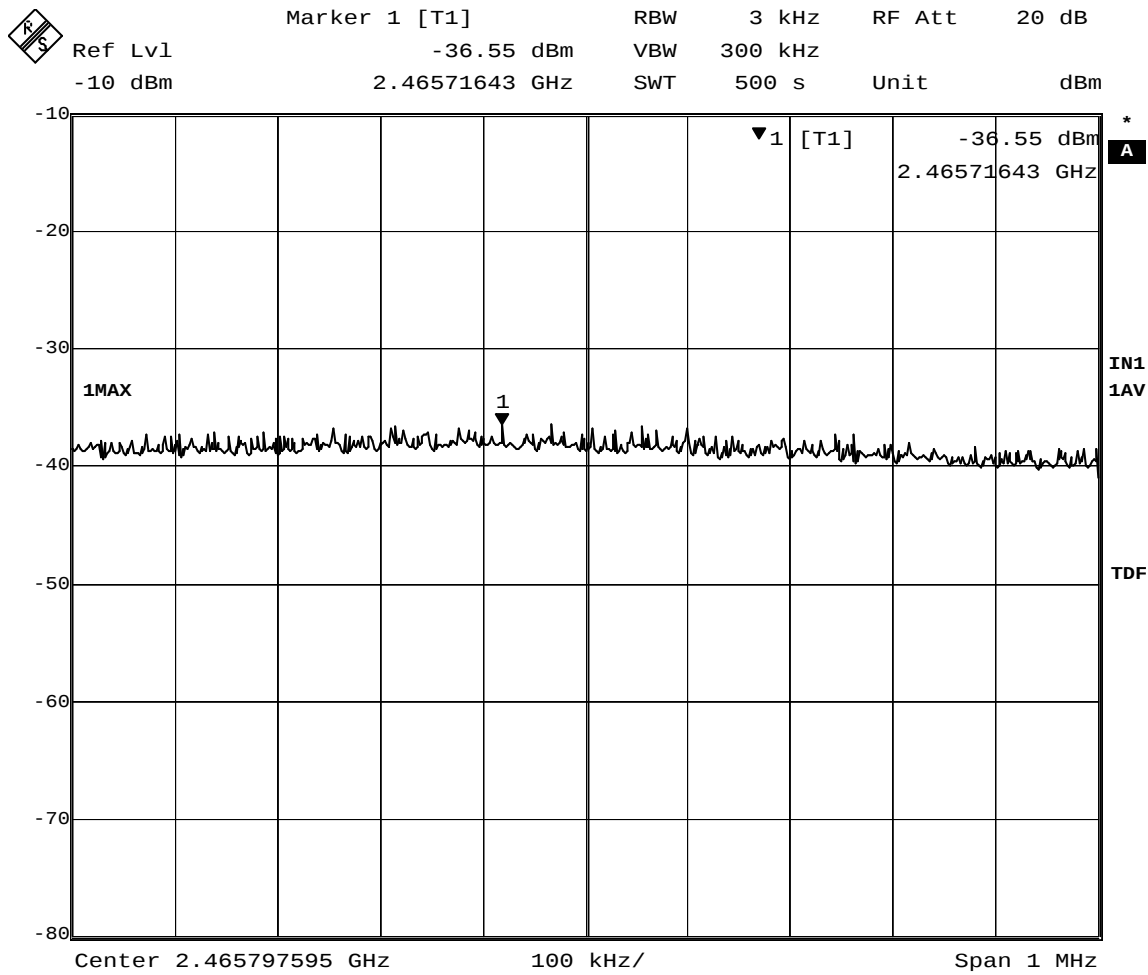
Date:            11.FEB.2009    10:25:28

Figure 23 - Channel 1, 802.11b, PSD



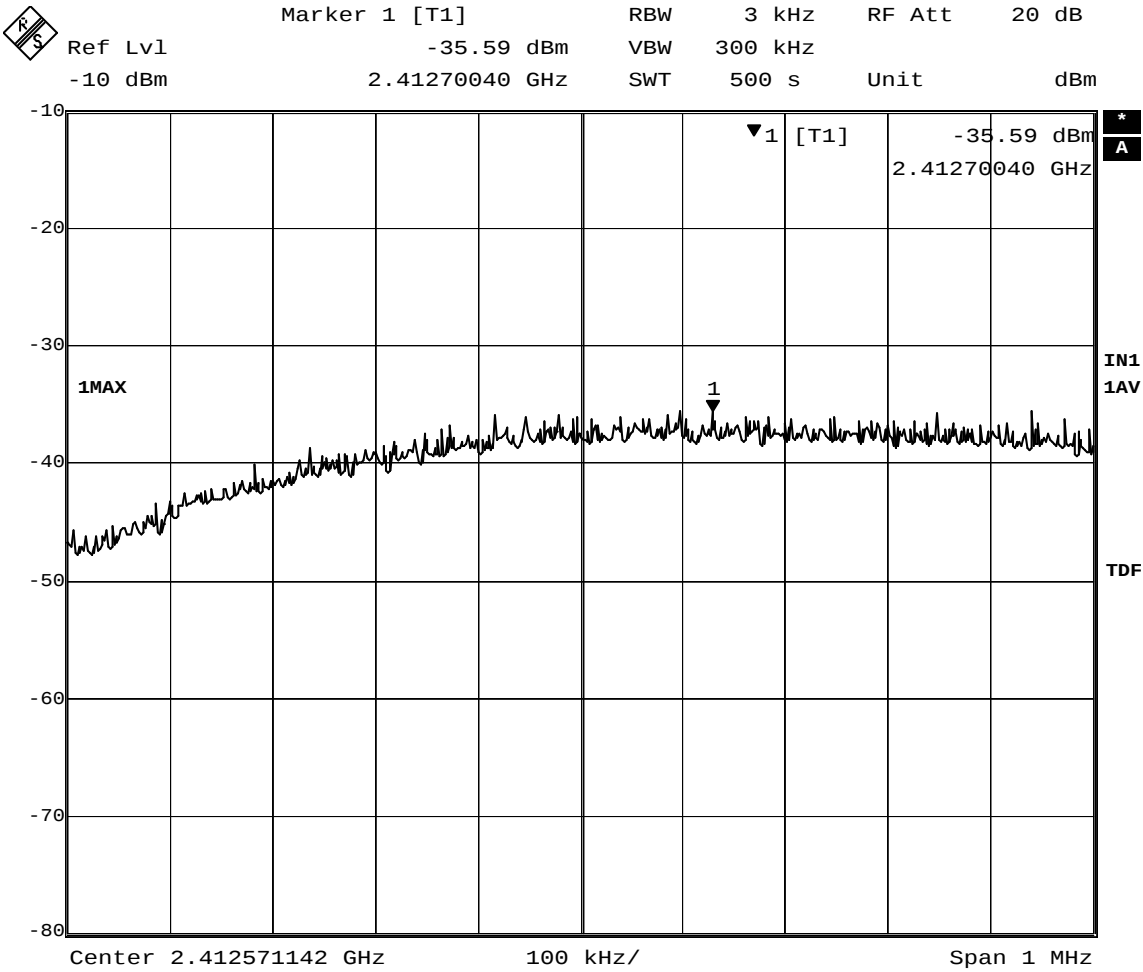
Date: 11.FEB.2009 10:37:25

Figure 24 - Channel 6, 802.11b, PSD



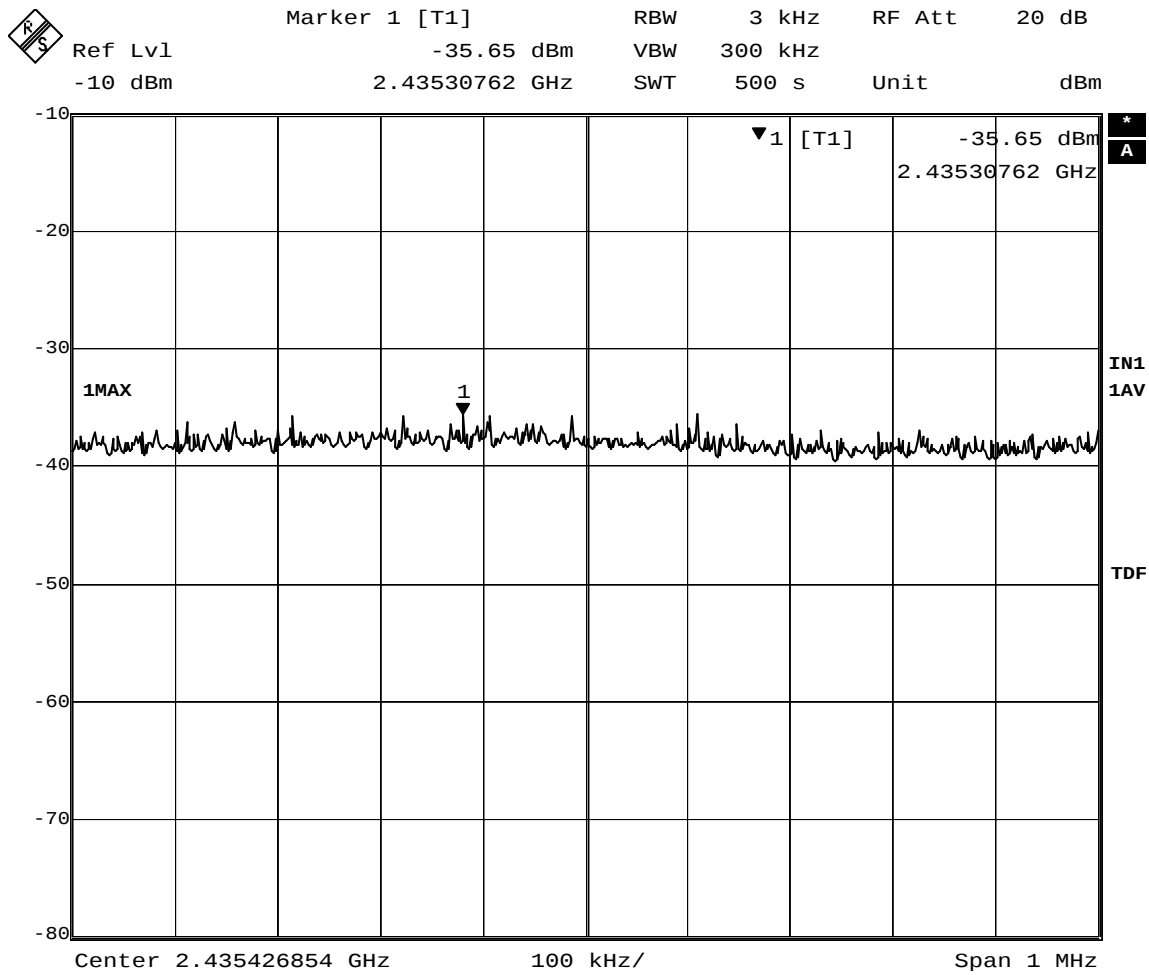
Date: 11.FEB.2009 10:34:58

Figure 25 - Channel 11, 802.11b, PSD



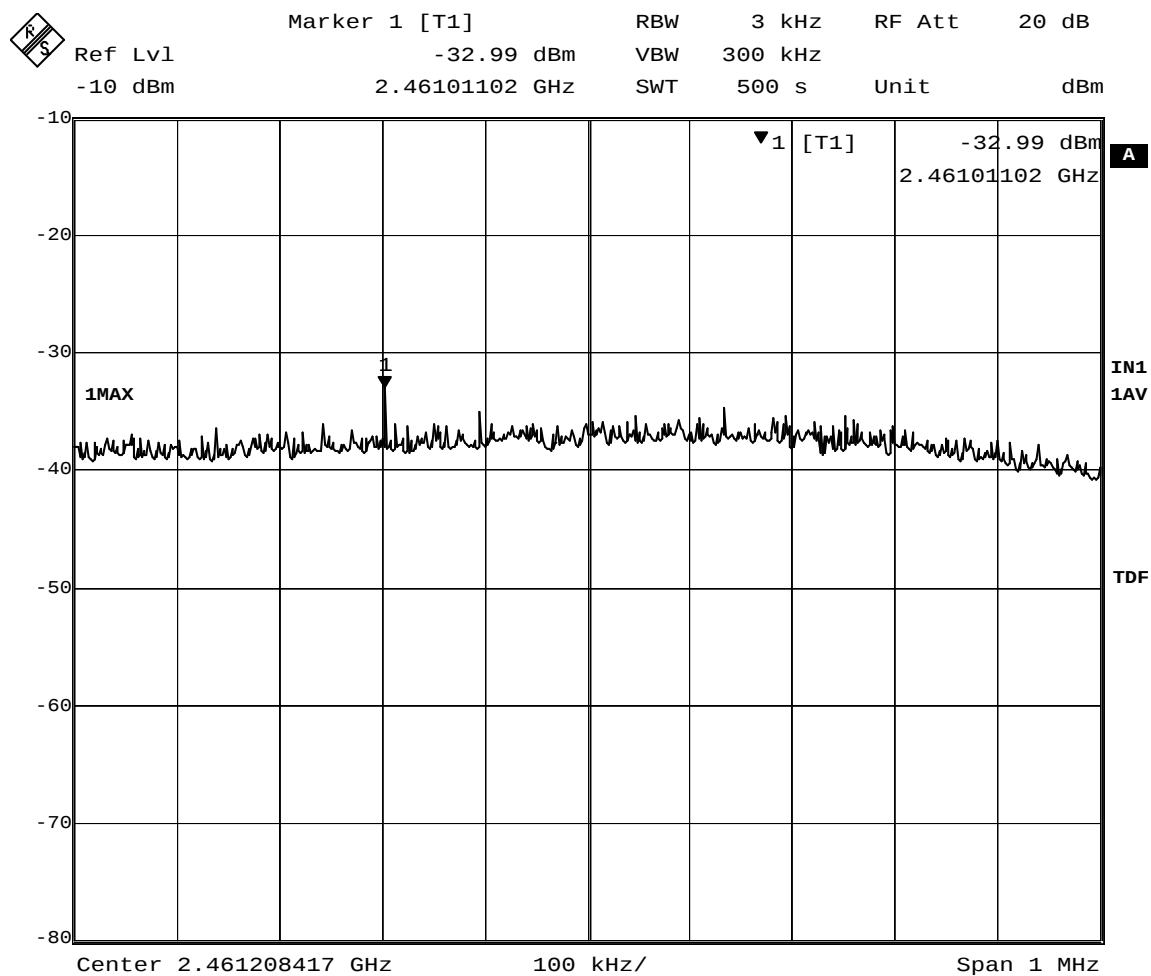
Date: 11.FEB.2009 10:40:58

Figure 26 - Channel 1, 802.11g, PSD



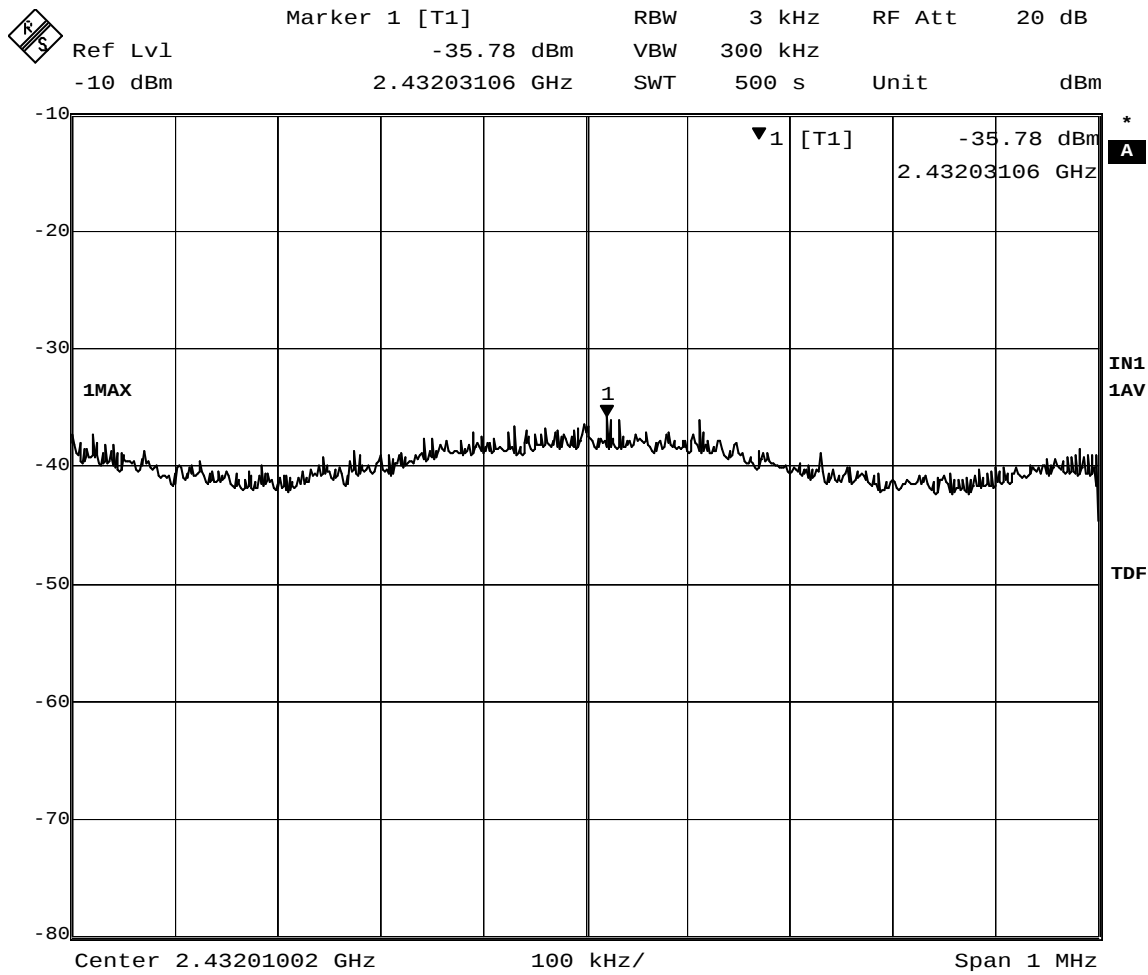
Date:        11.FEB.2009   10:43:42

Figure 27 - Channel 6, 802.11g, PSD



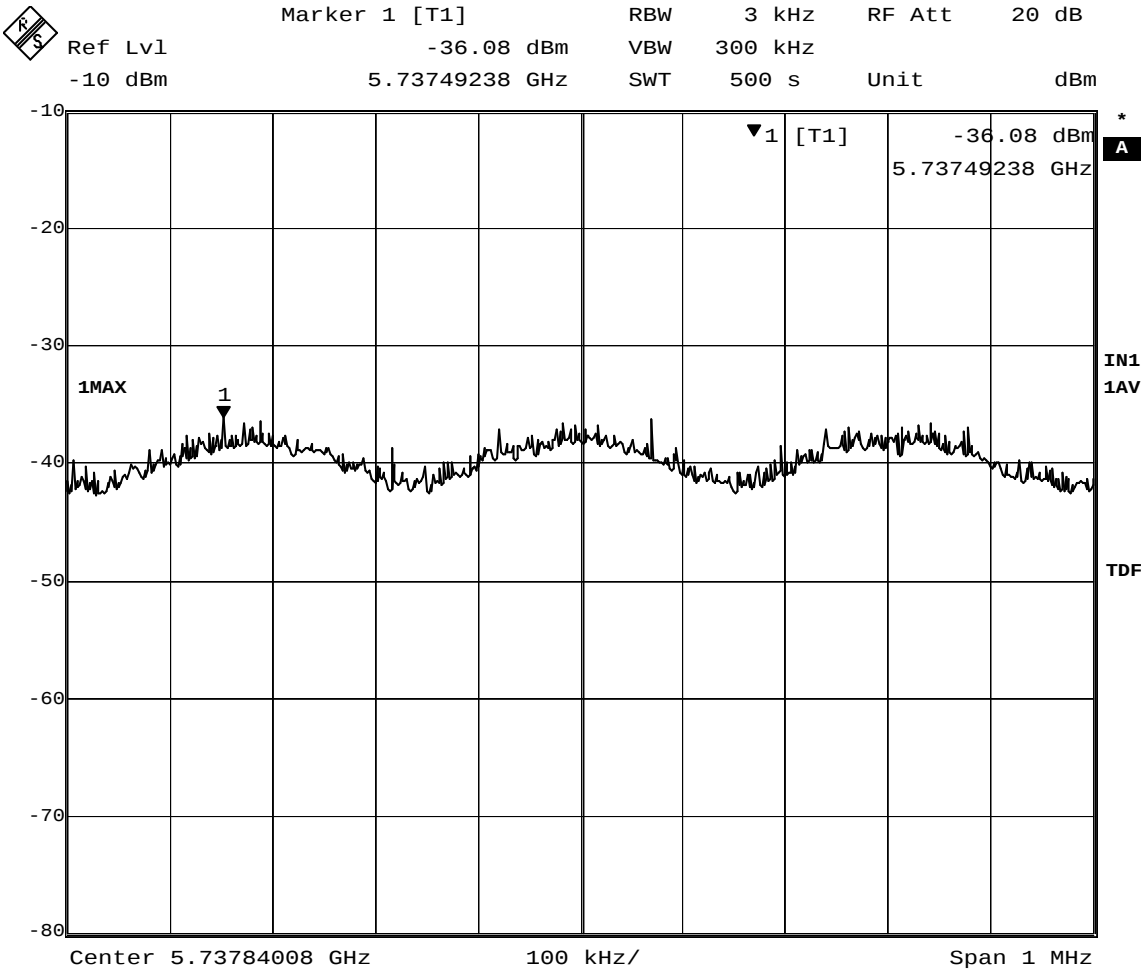
Date: 11.FEB.2009 10:57:09

Figure 28 - Channel 11, 802.11g, PSD



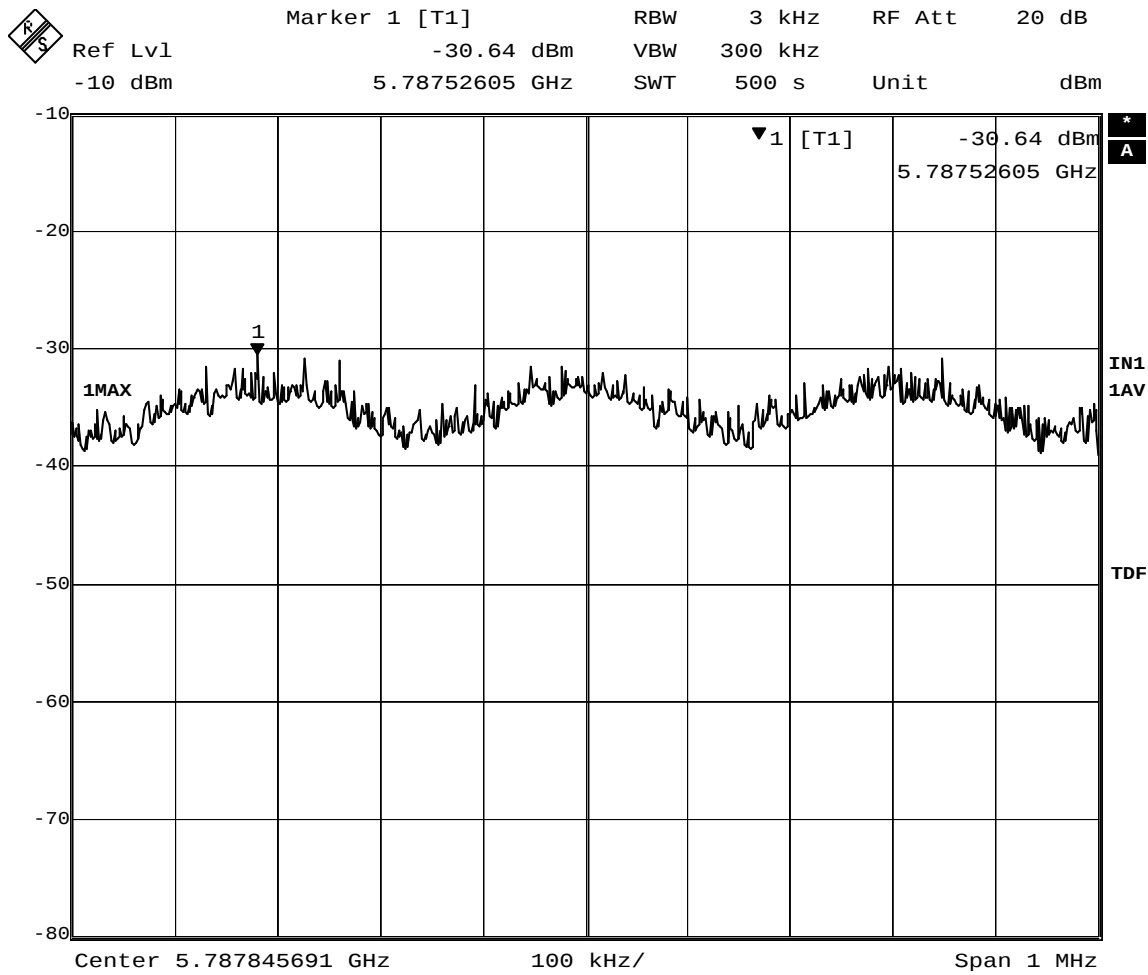
Date: 11.FEB.2009 11:07:47

Figure 29 - Channel 6, 802.11g super, PSD



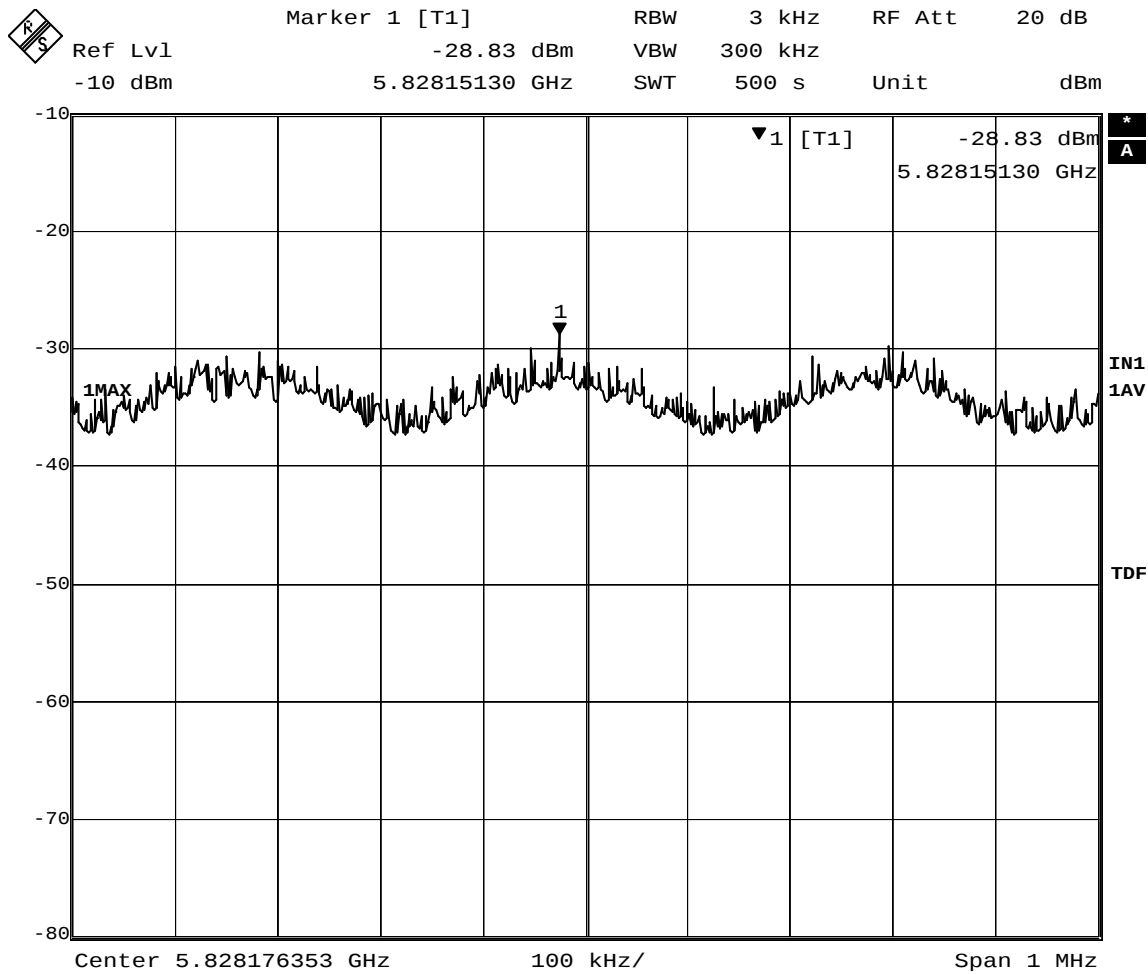
Date: 11.FEB.2009 11:24:53

Figure 30 - Channel 149, 802.11a, PSD



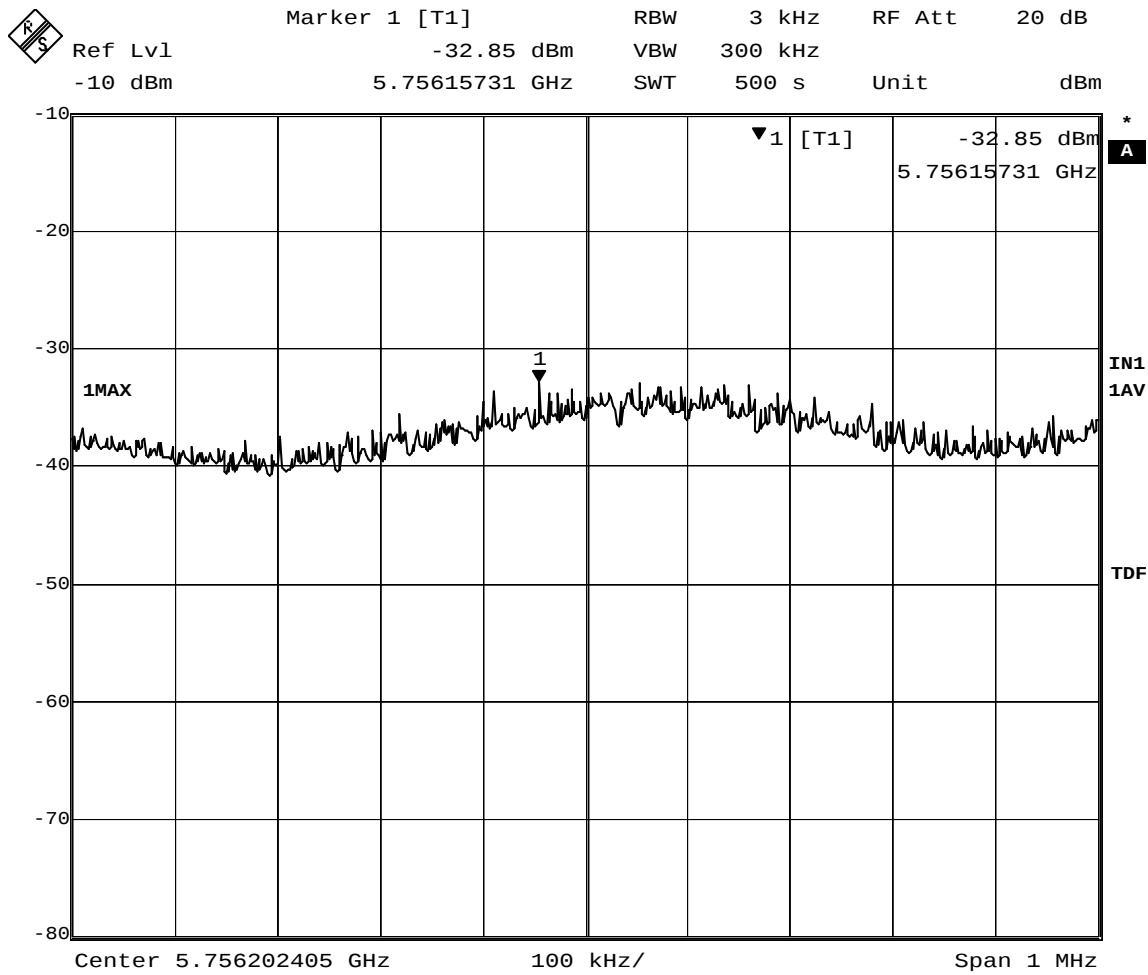
Date:            11.FEB.2009    11:29:24

Figure 31 - Channel 157, 802.11a, PSD



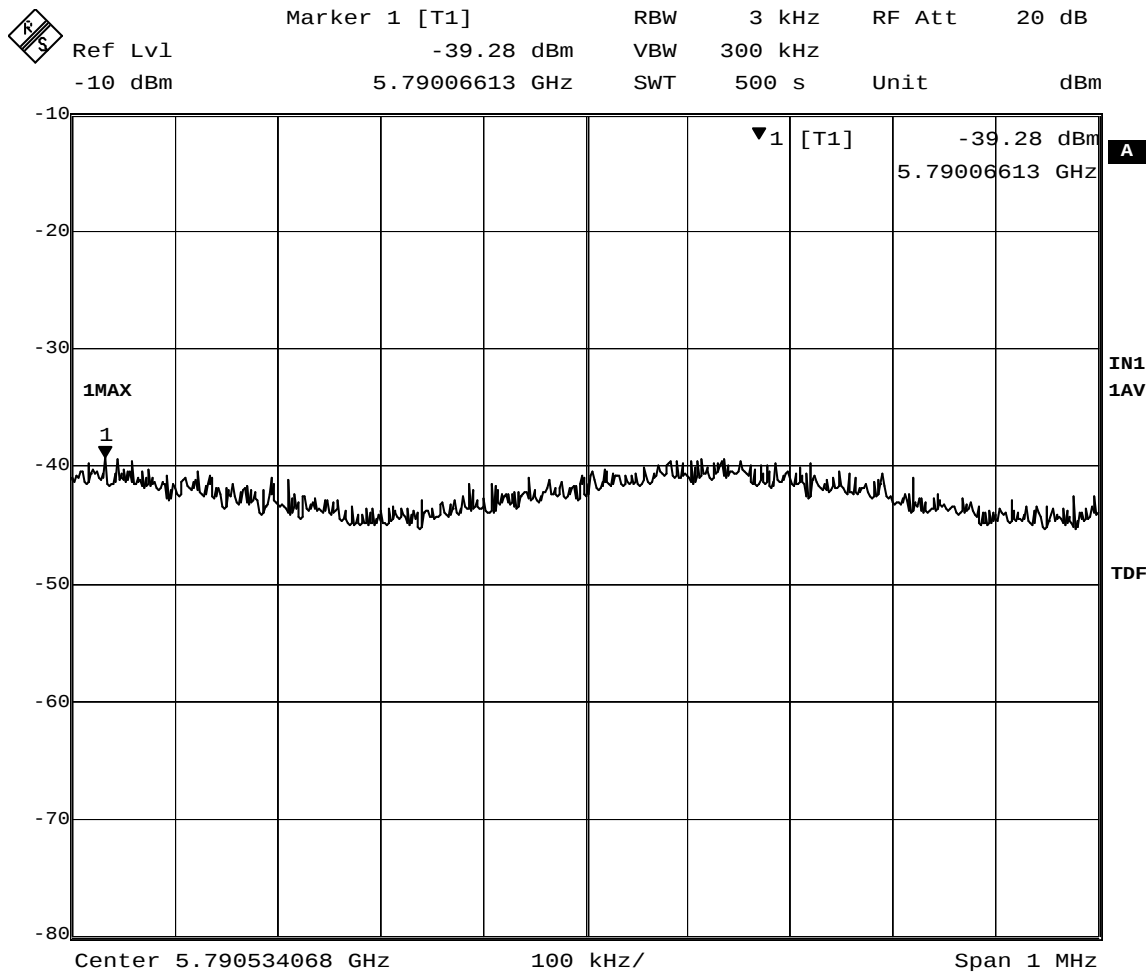
Date: 11.FEB.2009 11:34:27

Figure 32 - Channel 165, 802.11a, PSD



Date: 11.FEB.2009 11:47:19

Figure 33 - Channel 152, 802.11a turbo, PSD



Date:      11.FEB.2009    12:26:17

Figure 34 - Channel 160, 802.11a turbo, PSD

## 4.7 Conducted AC Mains Emissions

### 4.7.1 Limits for conducted emissions measurements

| FREQUENCY OF EMISSION<br>(MHz) | CONDUCTED LIMIT<br>(dB $\mu$ V) |          |
|--------------------------------|---------------------------------|----------|
|                                | Quasi-peak                      | Average  |
| 0.15-0.5                       | 66 to 56                        | 56 to 46 |
| 0.5-5                          | 56                              | 46       |
| 5-30                           | 60                              | 50       |

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
  3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 4.7.2 Test Procedures

- a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground. The EUT was powered by a 5VDC power supply.
- c. The frequency range from 150 kHz to 30 MHz was searched.

### 4.7.3 Deviation from the test standard

No deviation

#### 4.7.4 Test setup

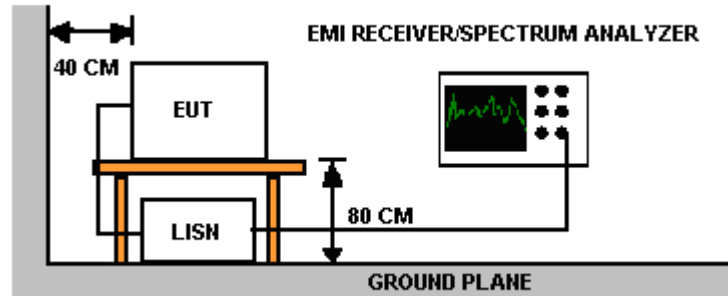


Figure 35 - Conducted Emissions Test Setup

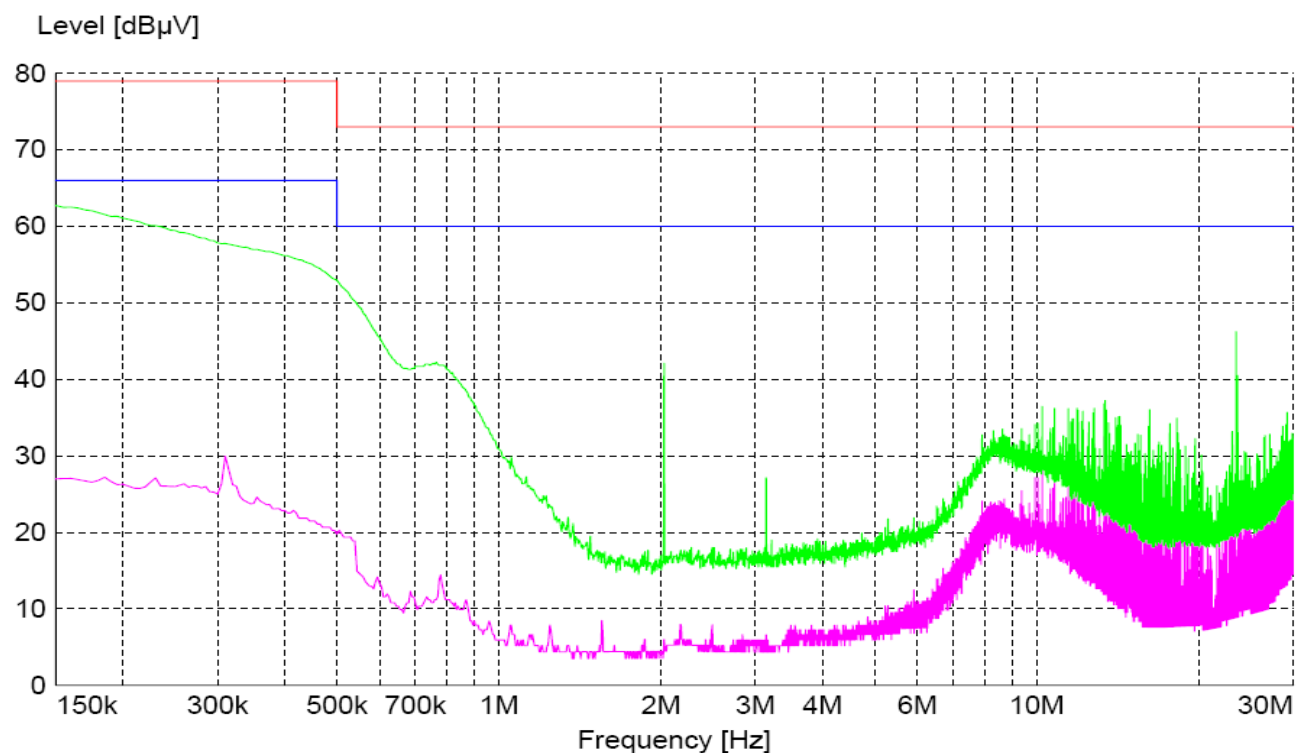
For actual test configuration, see photographs in Appendix A

#### 4.7.5 EUT operating conditions

The conducted emissions were tested from a 5VDC power supply from Power-One, M/N HA5-1.5/OVP-A while providing power to the EUT. The EUT was set to channel 152, 802.11a turbo because it produced the highest power output.

**4.3.6 Test Results**

|                          |                                 |                 |                                         |
|--------------------------|---------------------------------|-----------------|-----------------------------------------|
| EUT                      | CM9 PCI Transmitter Module      | MODE            | Continuous transmit, Channel 1, 802.11b |
| INPUT POWER              | 5VDC, AC-DC power converter     | FREQUENCY RANGE | 150kHz – 30MHz                          |
| ENVIRONMENTAL CONDITIONS | 45% $\pm$ 5% RH<br>20 $\pm$ 3°C | TECHNICIAN      | NJohnson                                |

**REMARKS:**

1. Q.P. and AV. are abbreviations for quasi-peak and average respectively.
2. All emission levels were greater than 20dB below the limit.

## **Appendix A: Test Photos**



**Figure 36 - RD2458-5-NM**



**Figure 37 - ECO9-5500**



**Figure 38 - ES24-14**



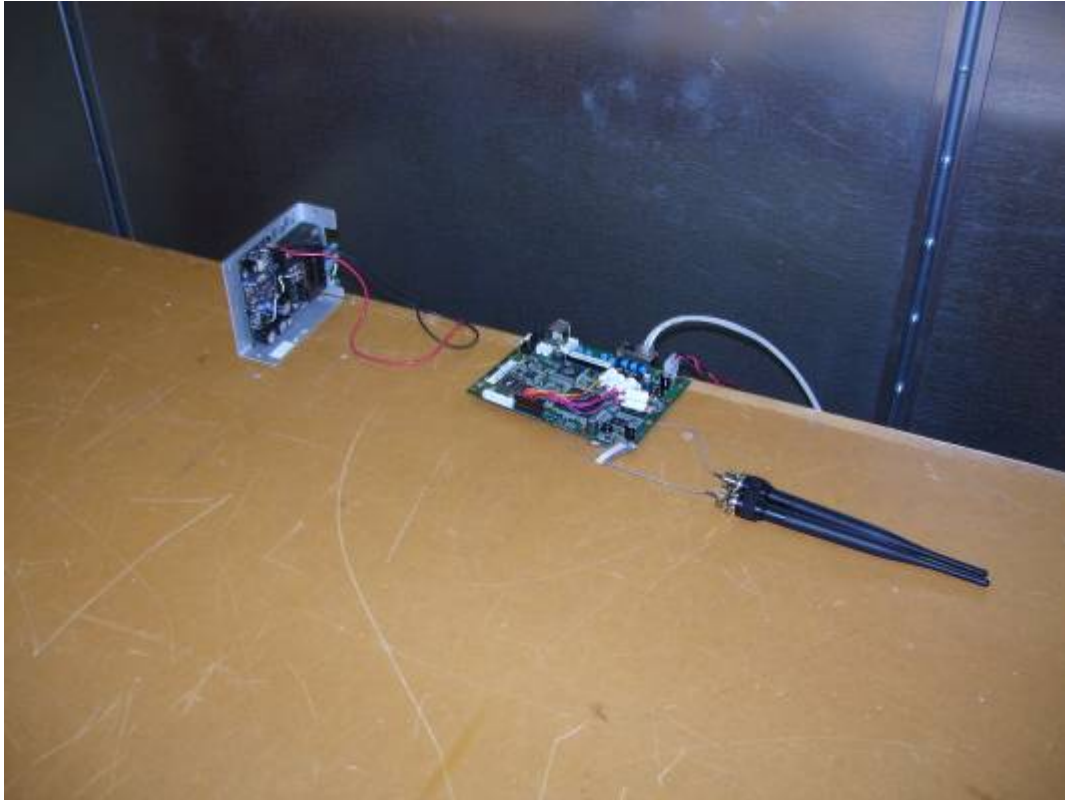
**Figure 39 - HG2414D**



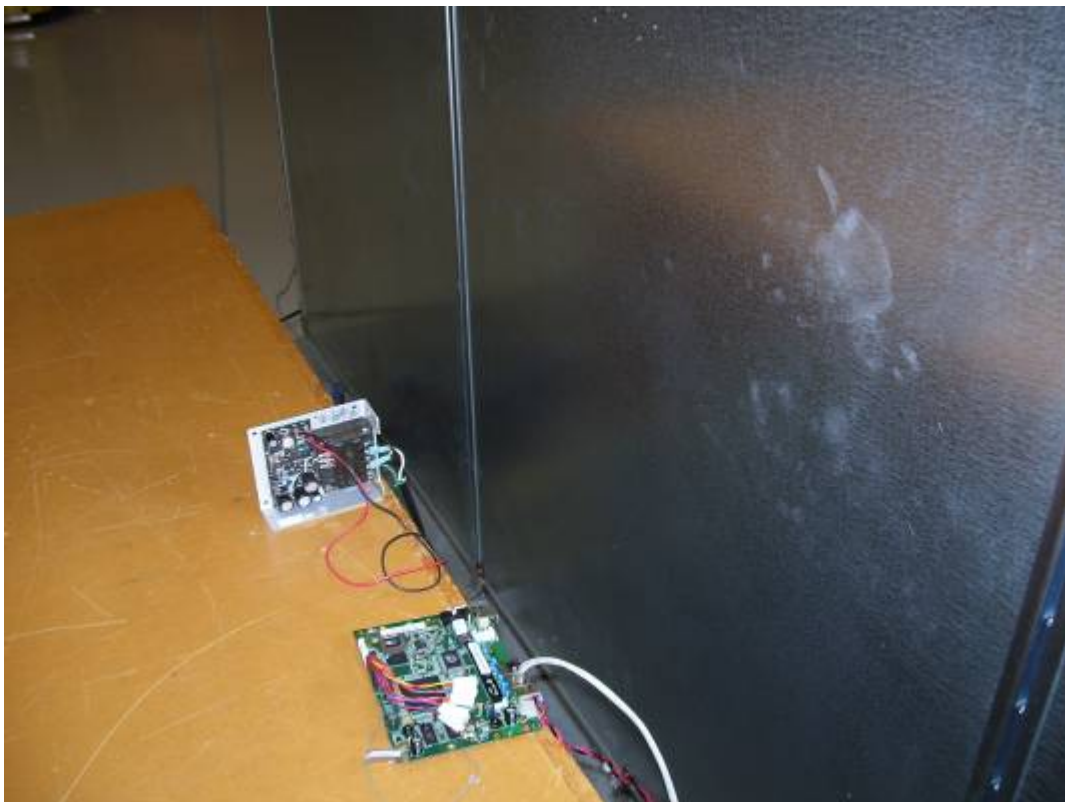
**Figure 40 - OD9-2400**



**Figure 41 - HG5822G**



**Figure 42 - Conducted Emissions Test Setup**



**Figure 43 - Conducted Emissions Test Setup**

## **Appendix B: Sample Calculation**

**Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF - (-CF + AG) + AV$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

$$FS = 55 + 12 - (-1.1 + 20) + 0 = 48.1 \text{ dB}\mu\text{V/m}$$

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(48.1 \text{ dB}\mu\text{V/m})/20] = 254.1 \mu\text{V/m}$$

AV is calculated by the taking the  $20 \cdot \log(T_{\text{on}}/100)$  where  $T_{\text{on}}$  is the maximum transmission time in any 100ms window.

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