

**TEST REPORT**

**Report Number: 3088284-004**

**Project Number: 3088284**

**Evaluation of the Residential Gateway**

**Model Number: NC800**

**FCC ID: Q3O-NC800-GW223R1**

**Tested to the Criteria in  
FCC Part 15 Subpart C (15.247)**

**For**

**Flextronics Design: South Africa**

Test Performed by:  
Intertek  
731 Enterprise Drive  
Lexington, KY 40510

Test Authorized by:  
Flextronics Design: South Africa  
260 Surrey Avenue, Ferndale  
Randburg, South Africa 2194

Prepared By: Jason Centers Date: 1/21/2006

Jason Centers, Senior Project Engineer

Approved By: Bryan C. Taylor Date: 1/21/2006

Bryan C. Taylor, EMC Team Leader

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

**Intertek**

731 Enterprise Drive, Lexington, KY 40510

Telephone: 859-226-1000 Fax: 859-226-1040 Web: [www.etlsemko.com](http://www.etlsemko.com)



**TABLE OF CONTENTS**

|          |                                                                                                           |           |
|----------|-----------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> | <b>JOB DESCRIPTION .....</b>                                                                              | <b>4</b>  |
| 1.1      | COMPANY INFORMATION .....                                                                                 | 4         |
| 1.2      | TEST SAMPLE INFORMATION .....                                                                             | 4         |
| 1.3      | SYSTEM SUPPORT EQUIPMENT .....                                                                            | 5         |
| 1.4      | CABLES USED DURING TESTING .....                                                                          | 5         |
| 1.5      | SYSTEM BLOCK DIAGRAM(S) .....                                                                             | 6         |
| 1.6      | MODE(S) OF OPERATION / ENGINEERING JUDGMENTS .....                                                        | 7         |
| <b>2</b> | <b>EXECUTIVE SUMMARY.....</b>                                                                             | <b>8</b>  |
| 2.1      | MODIFICATIONS REQUIRED FOR COMPLIANCE .....                                                               | 8         |
| <b>3</b> | <b>TEST FACILITY.....</b>                                                                                 | <b>9</b>  |
| 3.1      | TEST EQUIPMENT.....                                                                                       | 9         |
| <b>4</b> | <b>CONDUCTED RF POWER, 6DB BANDWIDTH, AND POWER DENSITY .....</b>                                         | <b>10</b> |
| 4.1      | TEST PROCEDURE (FCC RULE: §15.247(B), RSS-210 RULE §6.2.2(O)(B) CONDUCTED RF POWER)10                     |           |
| 4.1.1    | Conducted Output Power Criteria .....                                                                     | 10        |
| 4.2      | TEST PROCEDURE (FCC RULE: §15.247(A), RSS-210 RULE §6.2.2(O)(B) 6DB BANDWIDTH)..                          | 10        |
| 4.2.1    | 6dB Bandwidth Criteria .....                                                                              | 10        |
| 4.3      | TEST PROCEDURE (FCC RULE: §15.247(D), RSS-210 RULE §6.2.2(O)(B) POWER DENSITY)...                         | 11        |
| 4.3.1    | Power Density Criteria .....                                                                              | 11        |
| 4.4      | TEST RESULTS .....                                                                                        | 11        |
| <b>5</b> | <b>MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS .....</b>                                              | <b>13</b> |
| 5.1      | TEST PROCEDURE (FCC RULE: §15.247(B)(5), RSS-102 §4.3) .....                                              | 13        |
| 5.2      | TEST RESULTS .....                                                                                        | 13        |
| <b>6</b> | <b>OUT OF BAND EMISSIONS AT ANTENNA TERMINALS .....</b>                                                   | <b>14</b> |
| 6.1      | TEST PROCEDURE (FCC RULE §15.247(C), RSS-210 RULE §6.2.2(O)(E1)) .....                                    | 14        |
| 6.1.1    | Out of Band Emissions at Antenna Terminals Criteria.....                                                  | 14        |
| 6.2      | TEST RESULTS .....                                                                                        | 15        |
| <b>7</b> | <b>FIELD STRENGTH OF SPURIOUS RADIATION (GENERAL REQUIREMENTS AND RESTRICTED BAND REQUIREMENTS) .....</b> | <b>17</b> |
| 7.1      | TEST PROCEDURE (FCC RULE §15.247(C), RSS-210 §6.2.2(O)(E1) FOR RADIATED MEASUREMENTS).....                | 17        |
| 7.1.1    | Field Strength of Spurious Radiation Criteria.....                                                        | 17        |

|          |                                                  |           |
|----------|--------------------------------------------------|-----------|
| 7.2      | TEST RESULTS .....                               | 18        |
| <b>8</b> | <b>POWER LINE CONDUCTED EMISSIONS.....</b>       | <b>36</b> |
| 8.1      | TEST PROCEDURE (FCC §15.207, ICES-003 §5.3)..... | 36        |
| 8.1.1    | Power Line Conducted Emissions Criteria .....    | 36        |
| 8.2      | TEST RESULTS .....                               | 37        |
| <b>9</b> | <b>RECEIVER SPURIOUS EMISSIONS .....</b>         | <b>38</b> |
| 9.1      | TEST PROCEDURE (FCC §15.109, ICES-003 §5.6)..... | 38        |
| 9.1.1    | Receiver Spurious Emissions Criteria.....        | 38        |
| 9.2      | TEST RESULTS .....                               | 39        |

## 1 JOB DESCRIPTION

### 1.1 Company Information

| Company Information      |                                                           |
|--------------------------|-----------------------------------------------------------|
| <b>Manufacturer:</b>     | Flextronics Design: South Africa                          |
| <b>Address:</b>          | 260 Surrey Avenue, Ferndale<br>Randburg South Africa 2194 |
| <b>Contact Name:</b>     | Warren Tromp                                              |
| <b>Telephone Number:</b> | 011 27 126439260                                          |
| <b>Fax Number:</b>       | 011 27 2930555                                            |
| <b>Email Address:</b>    | warren.tromp@za.flextronics.com                           |

### 1.2 Test Sample Information

The model NC800 Residential Gateway enables networking between two 10/100BaseT ports, wireless 802.11b/g ports, and the internet over a CDMA connection. It is powered by 12VDC and comes with an AC to DC power adapter. There are two hinged monopole antennas mounted on the back side of the NC800 for 802.11b/g communication. The CDMA antenna is externally mounted (via suction cups) and comes equipped with a 6 foot long coaxial cable to connect to the WAN port on the NC800.

| Test sample                               |                                             |                           |                                  |                                  |
|-------------------------------------------|---------------------------------------------|---------------------------|----------------------------------|----------------------------------|
| <b>Model Number:</b>                      | NC800                                       |                           |                                  |                                  |
| <b>Serial Number:</b>                     | WG395W530X                                  |                           |                                  |                                  |
| <b>FCC ID:</b>                            | Q3O-NC800-GW223R1                           |                           |                                  |                                  |
| <b>Device Category:</b>                   | Mobile                                      |                           |                                  |                                  |
| <b>RF Exposure Category:</b>              | General Population/Uncontrolled Environment |                           |                                  |                                  |
| <b>Transmission Modes:</b>                | <b>802.11b</b>                              | <b>802.11g</b>            | <b>CDMA Cell</b>                 | <b>CDMA PCS</b>                  |
| <b>Frequency Range, MHz:</b>              | 2412MHz – 2462MHz                           | 2412MHz – 2462MHz         | 824.7 – 848.31MHz                | 1850 – 1910 MHz                  |
| <b>Maximum Conducted RF Output Power:</b> | 18.12dBm                                    | 17.81dBm                  | 24.3dBm                          | 24.1dBm                          |
| <b>Antenna Type:</b>                      | Hinged Monopole                             | Hinged Monopole           | Monopole with Suction Cup Mounts | Monopole with Suction Cup Mounts |
| <b>Antenna Location:</b>                  | Back Left and Right Sides                   | Back Left and Right Sides | Externally Mounted               | Externally Mounted               |
| <b>Antenna Gain:</b>                      | -2.4dB                                      | -2.4dB                    | -1dB                             | -2dB                             |
| <b>Power Supply</b>                       | <b>Manufacturer</b>                         | <b>Model Number</b>       |                                  | <b>Serial Number</b>             |
|                                           | ITE                                         | FW SM/30.1215.0-2170SE    |                                  | Not Labeled                      |

### 1.3 System Support Equipment

Table 1-1 contains the details of the support equipment associated with the Equipment Under Test during the testing.

*Table 1-1: System Support Equipment*

| Description            | Manufacturer | Model Number | Serial Number |
|------------------------|--------------|--------------|---------------|
| 802.11 Wireless Laptop | Compaq       | Nc6000       | CNU512035T    |
| 10/100BaseT Computer   | IBM          | NetVista     | Not Labeled   |

### 1.4 Cables Used During Testing

Table 1-2 contains the details of the cables used during the testing.

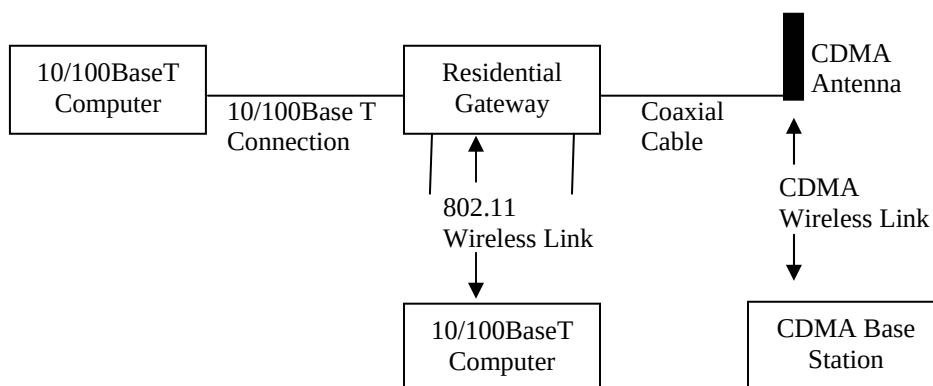
*Table 1-2: Interconnecting Cables Used During Testing*

| Cables             |        |           |          |                              |                             |
|--------------------|--------|-----------|----------|------------------------------|-----------------------------|
| Description        | Length | Shielding | Ferrites | Connection                   |                             |
|                    |        |           |          | From                         | To                          |
| Serial Cable       | 6 ft   | Yes       | None     | Comm. Port                   | Comm. on Laptop             |
| AC Power Cable     | 5 ft   | None      | None     | AC Power Source              | AC Input of AC/DC Converter |
| DC Power Cable     | 5 ft   | None      | None     | DC Output of AC/DC Converter | 12VDC Input of the NC800    |
| CDMA Antenna Cable | 6 ft   | Yes       | None     | WAN Port on the NC800        | CDMA Antenna                |

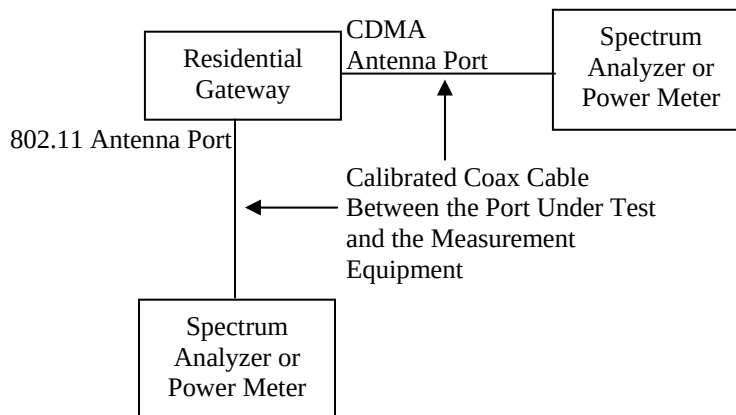
## 1.5 System Block Diagram(s)

The diagrams below detail the interconnection of the EUT and its accessories during the testing.

*Figure 1-1: Radiated Test Configuration*



*Figure 1-2: Conducted Test Configuration*



## 1.6 Mode(s) of operation / Engineering Judgments

The Residential Gateway was powered by the AC to DC power supply provided with the sample.

For 802.11b mode, the test commands from the Broadcom “WL” package were used to force 802.11b transmissions at maximum output power.

Test commands were not provided for 802.11g mode. In order to force transmission at the “g” data rates, the online configuration utility provided with the Residential Gateway was used to select channels, and a large (~4Gigabyte) file was transferred from the wired Ethernet computer to the wireless 802.11b/g laptop.

The Residential Gateway comes equipped with two 802.11 antennas and typically automatically chooses the one with the best reception. Initial conducted output power measurements indicated that the “main” antenna port had higher output powers. Therefore all testing was done on that port.

The Residential Gateway comes equipped with a CDMA antenna port (SMA connector) and a removable CDMA antenna. For radiated testing, the CDMA antenna was connected to the Residential Gateway. For conducted measurements the antenna was removed and a calibrated coaxial cable inserted between the CDMA port and the measuring equipment (spectrum analyzer or power meter). For the CDMA transmissions, a base station simulator was used to force the Residential Gateway to transmit at maximum output power.

## 2 EXECUTIVE SUMMARY

Testing performed for: Flextronics Design: South Africa

Equipment Under Test: NC800

Receipt of Test Sample: 11/22/2005

Test Start Date: 11/22/2005

Test End Date: 12/22/2005

| FCC RULE                  | DESCRIPTION OF TEST                                                                          | RESULT           | PAGE |
|---------------------------|----------------------------------------------------------------------------------------------|------------------|------|
| §15.247(a)(b)(d)          | Conducted RF Power, 6dB Bandwidth, and Power Density                                         | <b>Compliant</b> | 11   |
| §15.247(b)(5)             | Maximum Permissible Exposure (MPE) Calculations                                              | <b>Compliant</b> | 13   |
| §15.247(c)                | Out of Band Emissions at Antenna Terminals                                                   | <b>Compliant</b> | 15   |
| c15.247(c) and §15.209(f) | Field Strength of Spurious Radiation (General Requirements and Restricted Band Requirements) | <b>Compliant</b> | 17   |
| §15.107, §15.207          | Power Line Conducted Emissions                                                               | <b>Compliant</b> | 37   |
| §15.109                   | Receiver Spurious Emissions                                                                  | <b>Compliant</b> | 38   |

### 2.1 Modifications required for compliance

No modifications were implemented by Intertek. All results in this report pertain to the un-modified sample provided to Intertek.

### 3 TEST FACILITY

All testing was completed at the INTERTEK-Lexington location at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 2003. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.



For radiated immunity testing, removable ferrite tiles are positioned between the transmitting antenna and the area occupied by the equipment under test. The remaining tests typically are performed outside the chamber on the conducting ground reference plane.

The Industry Canada filing number for this site is 2055. The FCC registration number is 485103. The VCCI registration numbers are R-2056, C-2214, and T-195.

#### 3.1 Test Equipment

| Description            | Manufacturer      | Model Number             | Serial Number | Calibration due date |
|------------------------|-------------------|--------------------------|---------------|----------------------|
| Environmental Chamber  | Thermotron        | SM-8C                    | 32692         | 1/17/2006            |
| Signal Generator       | HP                | 83620B                   | 3614A00199    | 8/17/2006            |
| Horn Antenna           | EMCO              | 3115                     | 6556          | 7/27/2006            |
| Horn Antenna           | Antenna Research  | DRG-118/A                | 1086          | 7/6/2006             |
| Dipole Antenna         | CDI               | Roberts                  | 1             | 1/31/2006            |
| EMI Receiver           | Rohde & Schwarz   | ESI 26                   | 1088.7490     | 8/16/2006            |
| EMI Receiver           | Agilent           | E7405A                   | 2142          | 10/12/2006           |
| LISN                   | Solar Electronics | 6338-57-PJ-50-N          | 1583          | 5/12/2006            |
| LISN                   | Solar Electronics | 6338-57-PJ-50-N          | 1584          | 5/12/2006            |
| Bilog Antenna          | EMCO              | 3142B                    | 1674          | 10/12/2006           |
| Preamplifier           | Miteq             | AFS44-00102000-30-10P-44 | 987410        | 6/7/2006             |
| Digital Multimeter     | Fluke             | 87                       | 2021          | 2/3/2006             |
| Base Station Simulator | Agilent           | 8960                     | GB43046102    | 10/10/2006           |
| High Pass Filter       | Filtek            | HP12/3000-5AB            | 15857-01      | 10/21/2006           |

## 4 CONDUCTED RF POWER, 6DB BANDWIDTH, AND POWER DENSITY

### 4.1 Test Procedure (FCC Rule: §15.247(b), RSS-210 Rule §6.2.2(o)(b) Conducted RF Power)

The antenna port of the Residential Gateway was connected to the input of a peak power meter. The power was read directly from the power meter and corrected for cable loss to obtain the power at the antenna terminals. .

#### 4.1.1 Conducted Output Power Criteria

The maximum allowable transmitter power for antennas with gains of 6dBi or less is 1watt (30dBm).

### 4.2 Test Procedure (FCC Rule: §15.247(a), RSS-210 Rule §6.2.2(o)(b) 6dB Bandwidth)

The antenna port of the Residential Gateway was connected to the input of a spectrum analyzer. The analyzer amplitude was offset for the associated cable loss. The analyzer resolution and video bandwidths were set to 100kHz and the max hold function was turned on. A marker peak search was performed on the resultant trace to find the peak amplitude. Markers were then positioned on either side of the peak amplitude such that they were 6dB lower than that amplitude. The 6dB bandwidth was the frequency difference between the marker on the lower side and the marker on the higher side of the peak amplitude.

#### 4.2.1 6dB Bandwidth Criteria

The minimum 6dB bandwidth shall be at least 500kHz

### 4.3 Test Procedure (FCC Rule: §15.247(d), RSS-210 Rule §6.2.2(o)(b) Power Density)

The antenna port of the Residential Gateway was connected to the input of a spectrum analyzer. The analyzer amplitude was offset for the associated cable loss. The analyzer resolution and video bandwidths were set to 3 kHz and the max hold function was turned on. The frequency span was set to 600kHz around the highest amplitude occurring in the peak emission envelope. The total sweep time was calculated as follows:

$$\text{Sweep time (Sec.)} = (\text{Fstop} - \text{Fstart}) / \text{Resolution Bandwidth}$$

$$\text{Sweep time (Sec)} = 600\text{kHz} / 3\text{kHz}$$

$$\text{Sweep time (Sec)} = 200 \text{ Seconds}$$

A peak search was then performed on the resultant trace. The amplitude of that peak was recorded as the maximum power density in dBm.

#### 4.3.1 Power Density Criteria

The peak power spectral density shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

### 4.4 Test Results

The Residential Gateway met the RF power output, 6dB bandwidth, and power density requirements of FCC Part 15 Subpart C (15.247). The test results are located in Table 4-1.

Conducted power measurements were performed on all channels, modulation modes and data rates. For the middle channels, power density measurements were performed on all channels, modes and data rates. For the other channels power density measurements were performed on the channels with the highest and lowest measured conducted power. Then the 6dB bandwidth measurements were performed on the highest data rate for each type of modulation in a given mode (b or g).

Table 4-1 RF Output Power, 6dB Bandwidth, Power Density Measurements

| Frequency MHz   | Mode    | Data Rate (Mbps) | Conducted Power (dBm) | Conducted Power (mW) | Power Density (dBm) | 6dB Bandwidth MHz |
|-----------------|---------|------------------|-----------------------|----------------------|---------------------|-------------------|
| 2437 Channel 6  | 802.11b | 1                | 18.1                  | 64.57                | -14.85              | 10.32             |
|                 |         | 2                | 18.12                 | 64.86                | -12.42              | 10.12             |
|                 |         | 5.5              | 16.8                  | 47.86                | -7.2                |                   |
|                 |         | 11               | 17.55                 | 56.89                | -7.1                | 10.72             |
|                 | 802.11g | 6                | 17.8                  | 60.26                | -11.54              | 16.58             |
|                 |         | 9                | 17.8                  | 60.26                | -10.73              |                   |
|                 |         | 12               | 17.65                 | 58.21                | -9.81               |                   |
|                 |         | 18               | 17.67                 | 58.48                | -9.92               |                   |
|                 |         | 24               | 17.62                 | 57.81                | -10.56              |                   |
|                 |         | 36               | 17.1                  | 51.29                | -10.93              |                   |
|                 |         | 48               | 16.9                  | 48.98                | -10.41              |                   |
|                 |         | 54               | 16.8                  | 47.86                | -10.03              | 16.53             |
| 2412 Channel 1  | 802.11b | 1                | 18.02                 | 63.39                | -15.06              | 10.32             |
|                 |         | 2                | 18                    | 63.10                |                     | 10.12             |
|                 |         | 5.5              | 16.64                 | 46.13                | -7.68               |                   |
|                 |         | 11               | 17.4                  | 54.95                |                     | 10.92             |
|                 | 802.11g | 6                | 17.81                 | 60.39                | -10.36              | 16.63             |
|                 |         | 9                | 17.77                 | 59.84                |                     |                   |
|                 |         | 12               | 17.65                 | 58.21                |                     |                   |
|                 |         | 18               | 17.64                 | 58.08                |                     |                   |
|                 |         | 24               | 17.61                 | 57.68                |                     |                   |
|                 |         | 36               | 17.4                  | 54.95                |                     |                   |
|                 |         | 48               | 16.8                  | 47.86                |                     |                   |
|                 |         | 54               | 16.7                  | 46.77                | -11.03              | 16.43             |
| 2462 Channel 11 | 802.11b | 1                | 17.9                  | 61.66                | -15.44              | 10.32             |
|                 |         | 2                | 17.86                 | 61.09                |                     | 10.32             |
|                 |         | 5.5              | 16.5                  | 44.67                | -8.05               |                   |
|                 |         | 11               | 17.26                 | 53.21                |                     | 10.72             |
|                 | 802.11g | 6                | 17.4                  | 54.95                | -10.29              | 16.63             |
|                 |         | 9                | 17.25                 | 53.09                |                     |                   |
|                 |         | 12               | 17.33                 | 54.08                |                     |                   |
|                 |         | 18               | 17.4                  | 54.95                |                     |                   |
|                 |         | 24               | 17.3                  | 53.70                |                     |                   |
|                 |         | 36               | 17.3                  | 53.70                |                     |                   |
|                 |         | 48               | 17.1                  | 51.29                |                     |                   |
|                 |         | 54               | 17.1                  | 51.29                | -10.63              | 16.53             |

## 5 MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS

The § 1.1310 Radiofrequency radiation exposure limits are listed in the table below.

|                                                            | Frequency Range (MHz) | Power Density Limit (mW/cm <sup>2</sup> ) |
|------------------------------------------------------------|-----------------------|-------------------------------------------|
| <b>Limits for Occupational/Controlled Exposures</b>        | 0.3-3.0               | 100                                       |
|                                                            | 3.0-30                | 900/ Frequency <sup>2</sup>               |
|                                                            | 30-300                | 1.0                                       |
|                                                            | 300-1500              | Frequency/300                             |
|                                                            | 1500-100,000          | 5.0                                       |
| <b>Limits for General Population/Uncontrolled Exposure</b> | 0.3-1.34              | 100                                       |
|                                                            | 1.34-30               | 180/Frequency <sup>2</sup>                |
|                                                            | 30-300                | 0.2                                       |
|                                                            | 300-1500              | Frequency/1500                            |
|                                                            | 1500-100,000          | 1.0                                       |

### 5.1 Test Procedure (FCC Rule: §15.247(b)(5), RSS-102 §4.3)

The radiated RF power (calculated using the stated antenna gain and the measured conducted output power) was used to calculate the maximum RF exposure at a 20 cm distance using the formula:

$$\text{Maximum RF Exposure at 20cm} = (\text{EIRP in mW}) / (4\pi(20\text{cm})^2)$$

The maximum measured output power was 18.12dBm or 64.8mW.

Applying the stated gain of the transmitting antenna (-2.4dB) to this value, a maximum radiated power (ERP) of 15.72dBm or 37.32mW is obtained.

In order to convert to EIRP a 2.15dB factor is added to the ERP to get 17.87dBm or 61.23mW (Isotropic).

Substituting this into the equation above, we get a Maximum RF Exposure (MPE) at 20cm of:

$$\text{MPE at 20cm} = 61.23\text{mW} / (4\pi(20\text{cm})^2)$$

$$\text{MPE at 20cm} = .012\text{mW/cm}^2$$

### 5.2 Test Results

The worst case MPE at 20cm of 0.012mW/cm<sup>2</sup> is much less than the 1 mW/cm<sup>2</sup> limit for general population/uncontrolled exposure shown in the table above.

## 6 OUT OF BAND EMISSIONS AT ANTENNA TERMINALS

### 6.1 Test Procedure (FCC Rule §15.247(c), RSS-210 Rule §6.2.2(o)(e1))

The antenna port of the Residential Gateway was connected to the input of a spectrum analyzer. The analyzer resolution was set to 100kHz. The video bandwidth was set to 300kHz. The Residential Gateway was set to transmit at its highest output power level and with the modulation scheme that produced the highest conducted output power level. The spectrum analyzer was scanned from 30MHz to 26GHz using the max hold function to detect any out of band spurious emissions. The resulting trace was corrected for the cable loss between the test sample and the spectrum analyzer.

#### 6.1.1 Out of Band Emissions at Antenna Terminals Criteria

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, the RF power shall be at least 20dB below that of the carrier.

## 6.2 Test Results

The Residential Gateway met the out of band emission at antenna terminal requirements. The following plots illustrate the output power of channels 1, 6, and 11 and also show that there are no spurious emissions within 20dB of the peak carrier power.

Figure 6-1: Out of band emissions at antenna terminals – Channel 1, 6, and 11 (802.11b Mode)

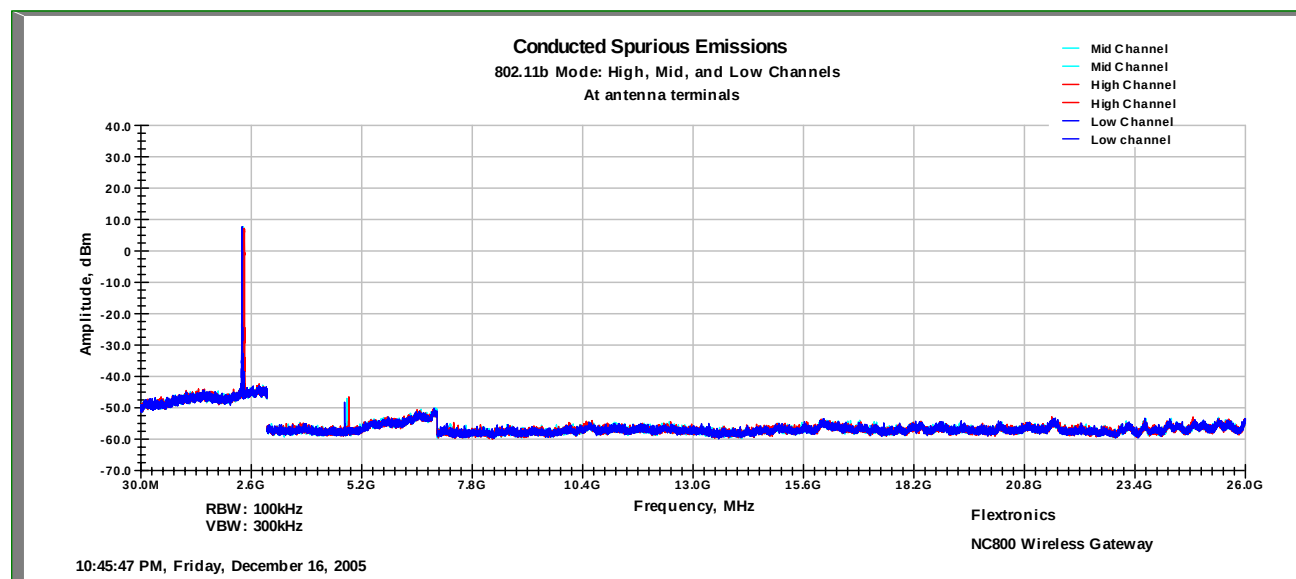


Figure 6-2: Out of band emissions at antenna terminals – Channel 1, 6, and 11 (802.11b Mode) (Zoomed Around Carrier Frequencies)

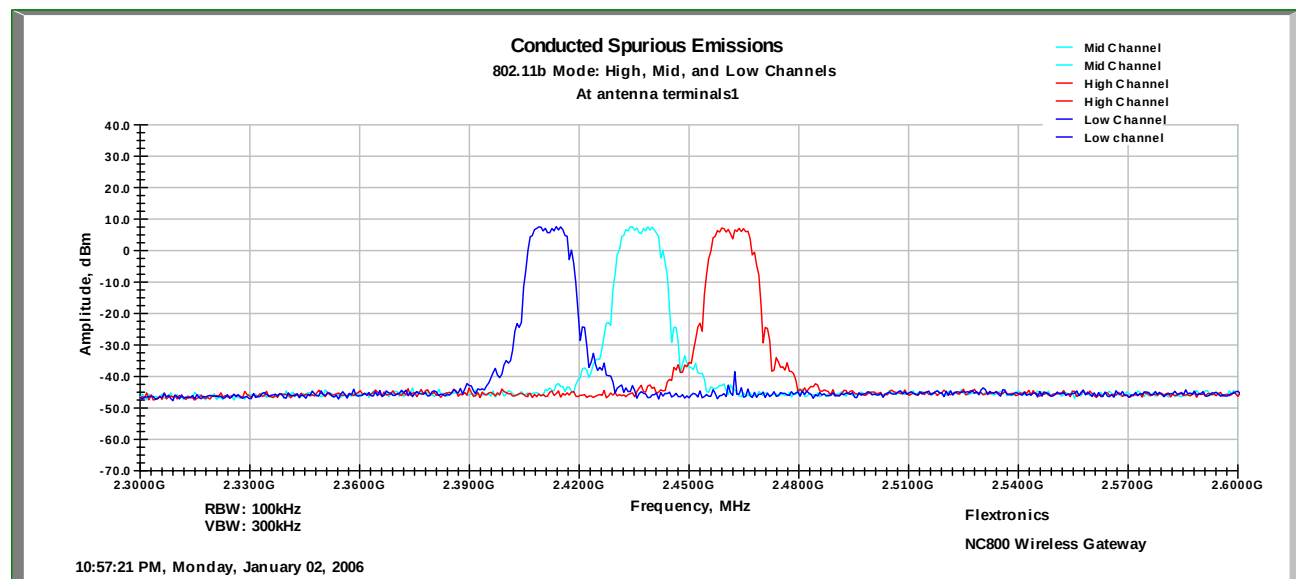


Figure 6-3: Out of band emissions at antenna terminals – Channel 1, 6, and 11 (802.11g Mode)

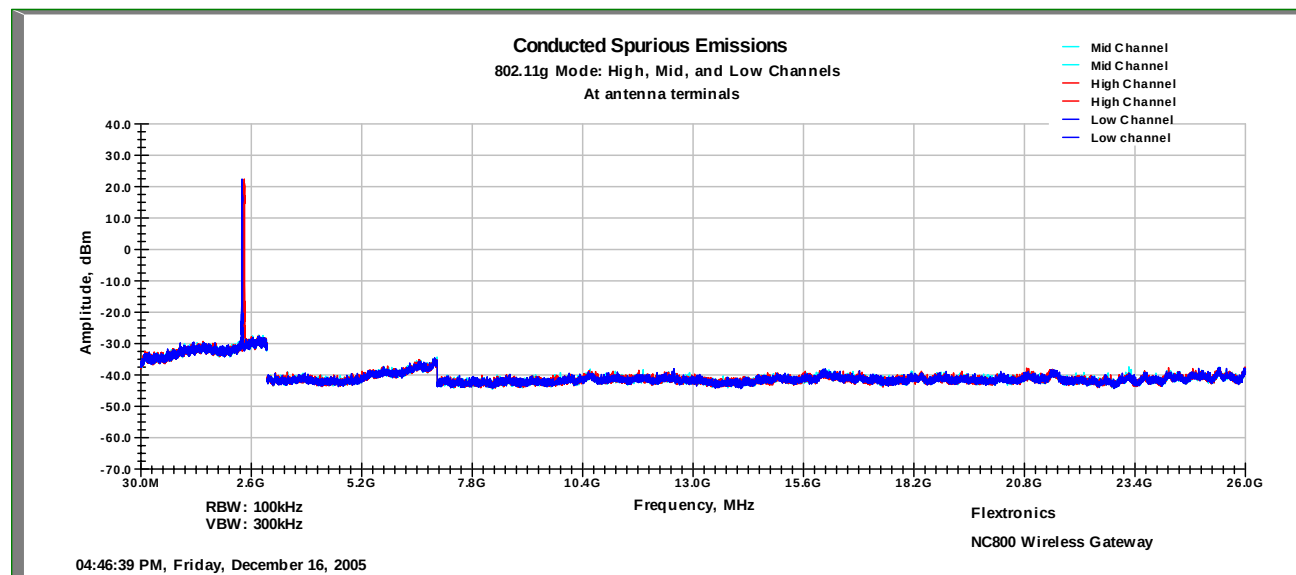
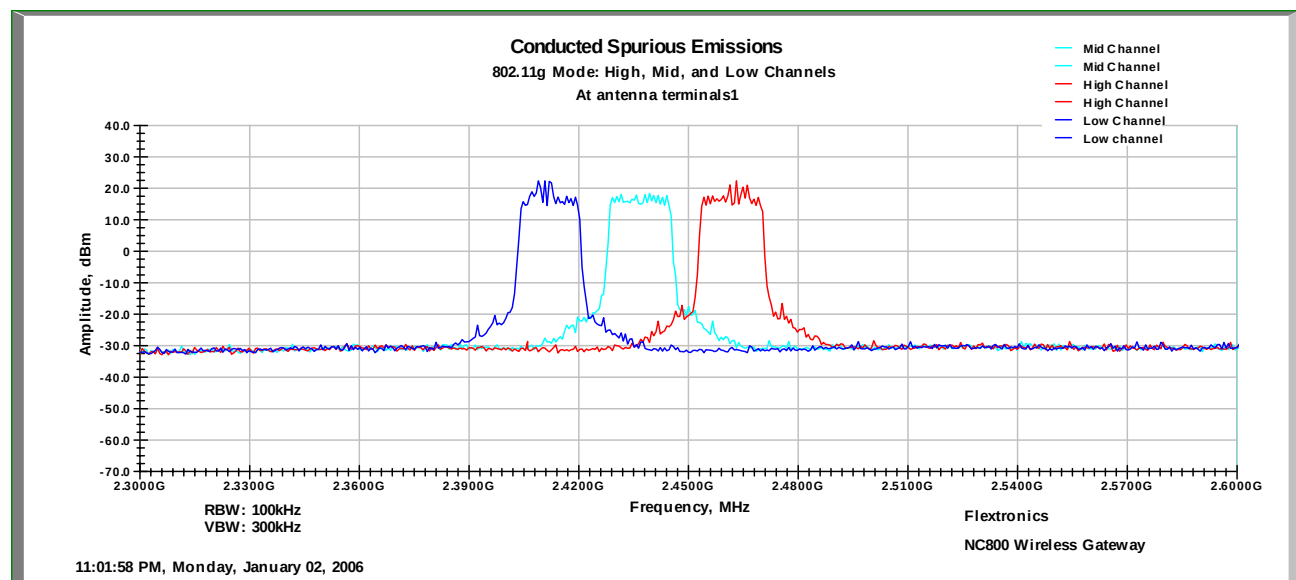


Figure 6-4: Out of band emissions at antenna terminals – Channel 1, 6, and 11 (802.11g Mode) (Zoomed Around Carrier Frequencies)



## 7 FIELD STRENGTH OF SPURIOUS RADIATION (GENERAL REQUIREMENTS AND RESTRICTED BAND REQUIREMENTS)

### 7.1 Test Procedure (FCC Rule §15.247(c), RSS-210 §6.2.2(o)(e1) for Radiated Measurements)

The Residential Gateway was placed on a non-conductive turntable. It was then set to transmit at its highest output power level and with the modulation scheme that produced the highest conducted output power level. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequencies (low, middle, and high channels) in each operating band. Once spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-B section 2.2.12 (Radiated Spurious Emissions).

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and at the spurious emissions frequency.

Also, a scan was performed looking specifically at the band edge of channel 11 in order to show that the restricted band ranging from 2483.5MHz to 2500 MHz was not intruded upon. To perform this measurement, the spectrum analyzer was manually set to show the band edge of channel 11 and the entire restricted band. The amplitude was offset to account for cable loss, antenna factor, and preamplifier gain. The turntable and tower were maximized with the analyzer set to max hold.

#### 7.1.1 Field Strength of Spurious Radiation Criteria

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, the RF power shall be at least 20dB below that of the carrier. In addition, emissions within the restricted bands as specified in §15.205(a), must also comply with the limits specified in §15.209(a). Those Limits are in the table below.

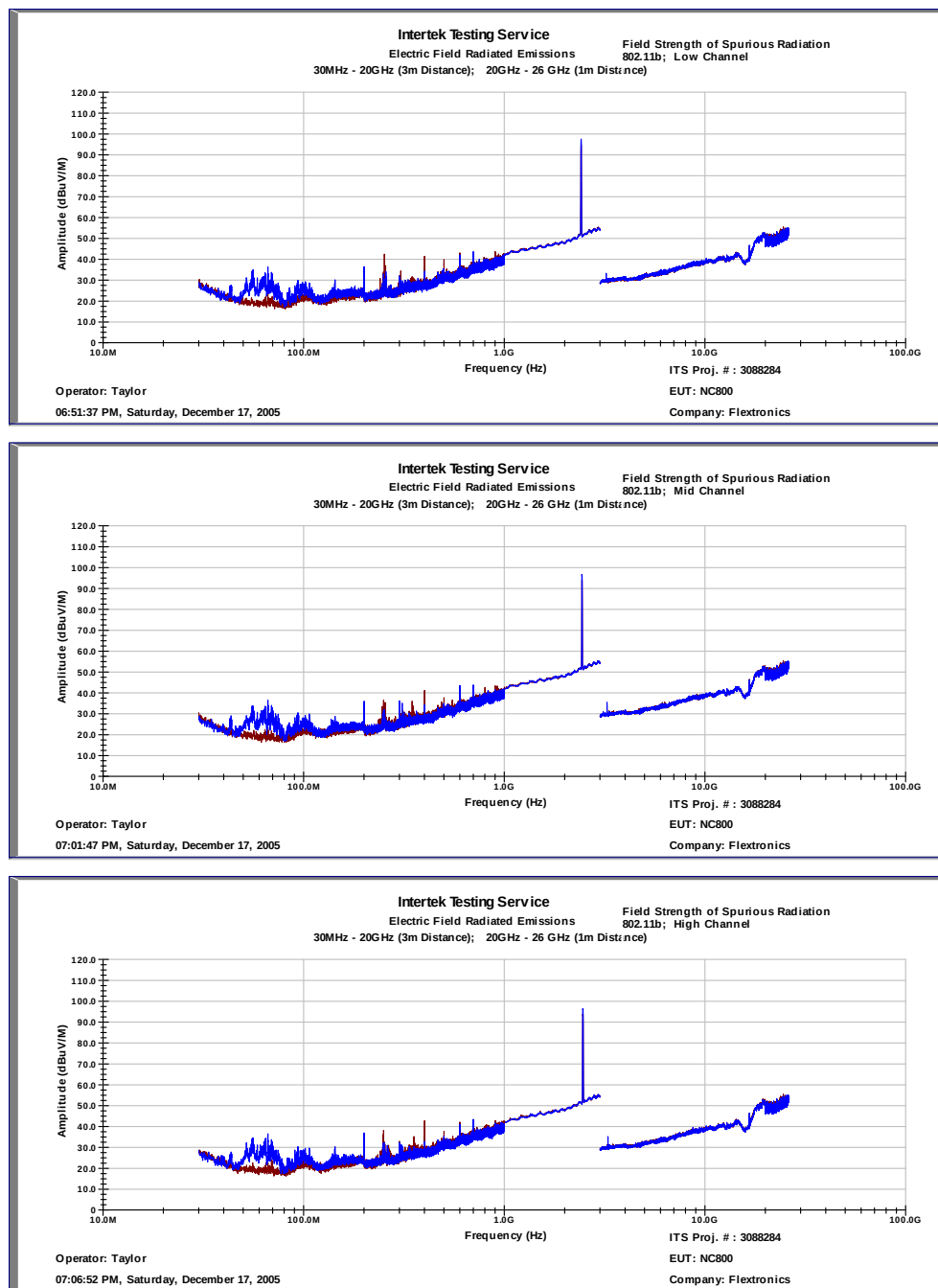
Table 7-1 Radiated Emission Limit for FCC §15.209(a)

| Radiated Emission Limits at 3 meters |                              |
|--------------------------------------|------------------------------|
| Frequency (MHz)                      | Quasi-Peak limits, dB (μV/m) |
| 30 to 88                             | 40.0                         |
| 88 to 216                            | 43.5                         |
| 216 to 960                           | 46.0                         |
| 960 and up                           | 54.0                         |

## 7.2 Test Results

The Residential Gateway met the field strength of spurious radiation requirements of FCC §15.209 and §15.247(c). See Figure 7-1 through Figure 7-2 for the graphical peak scans. These plots clearly show that all spurious emissions are attenuated below the carrier by at least 20dB. See Figure 7-3 through Figure 7-18 for plots showing the peak and average measurements on the restricted bands immediately adjacent to the carrier frequencies.

*Figure 7-1: Field Strength of Spurious Radiation High, Mid, and Low Channels; 802.11b Mode  
(30MHz – 26GHz)*



*Figure 7-2: Field Strength of Spurious Radiation High, Mid, and Low Channels; 802.11g Mode  
(30MHz – 26GHz)*

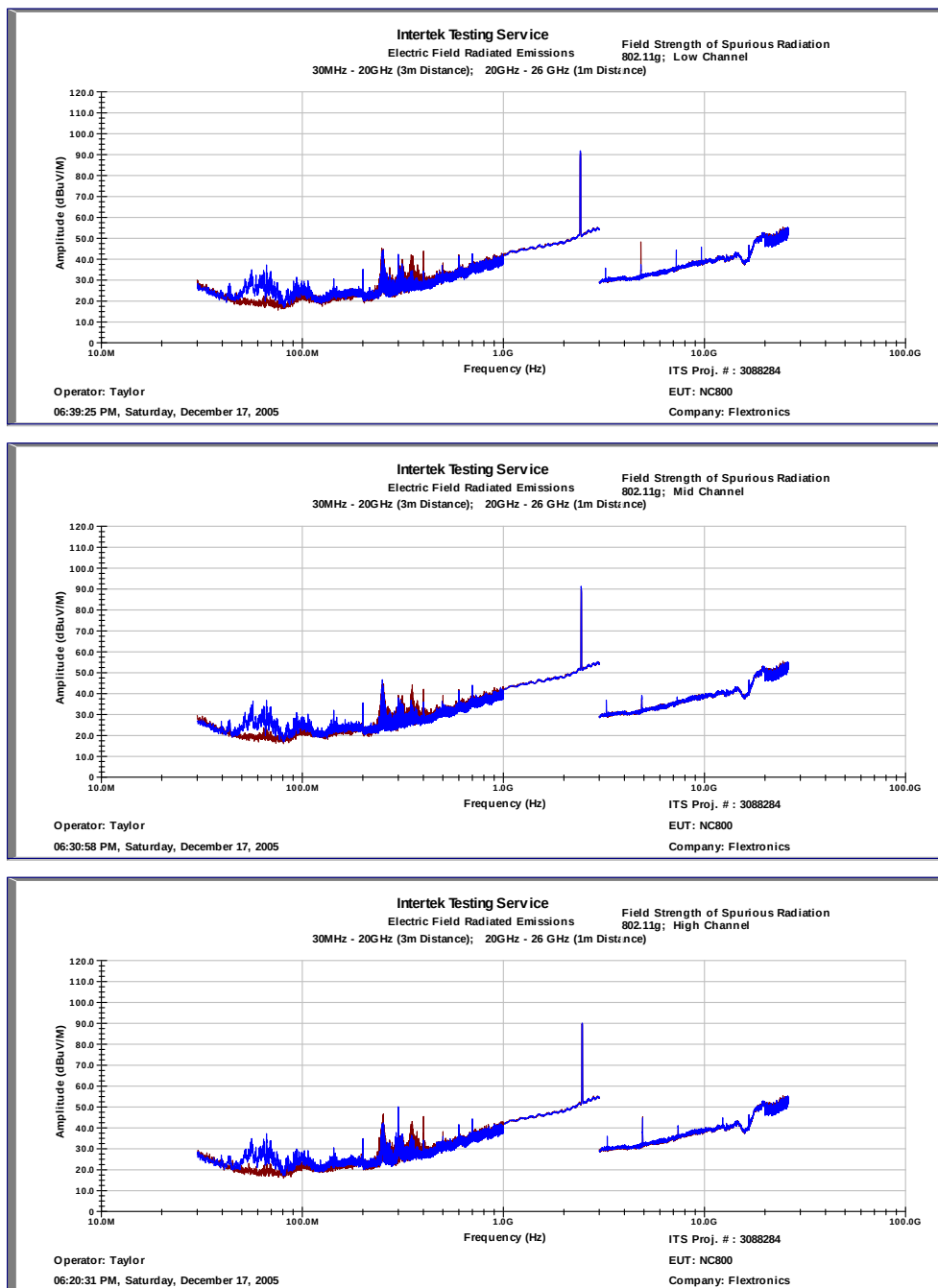


Figure 7-3: Low Ch. Restricted Band; 802.11b Mode; Vertical Polarity; Peak Detection

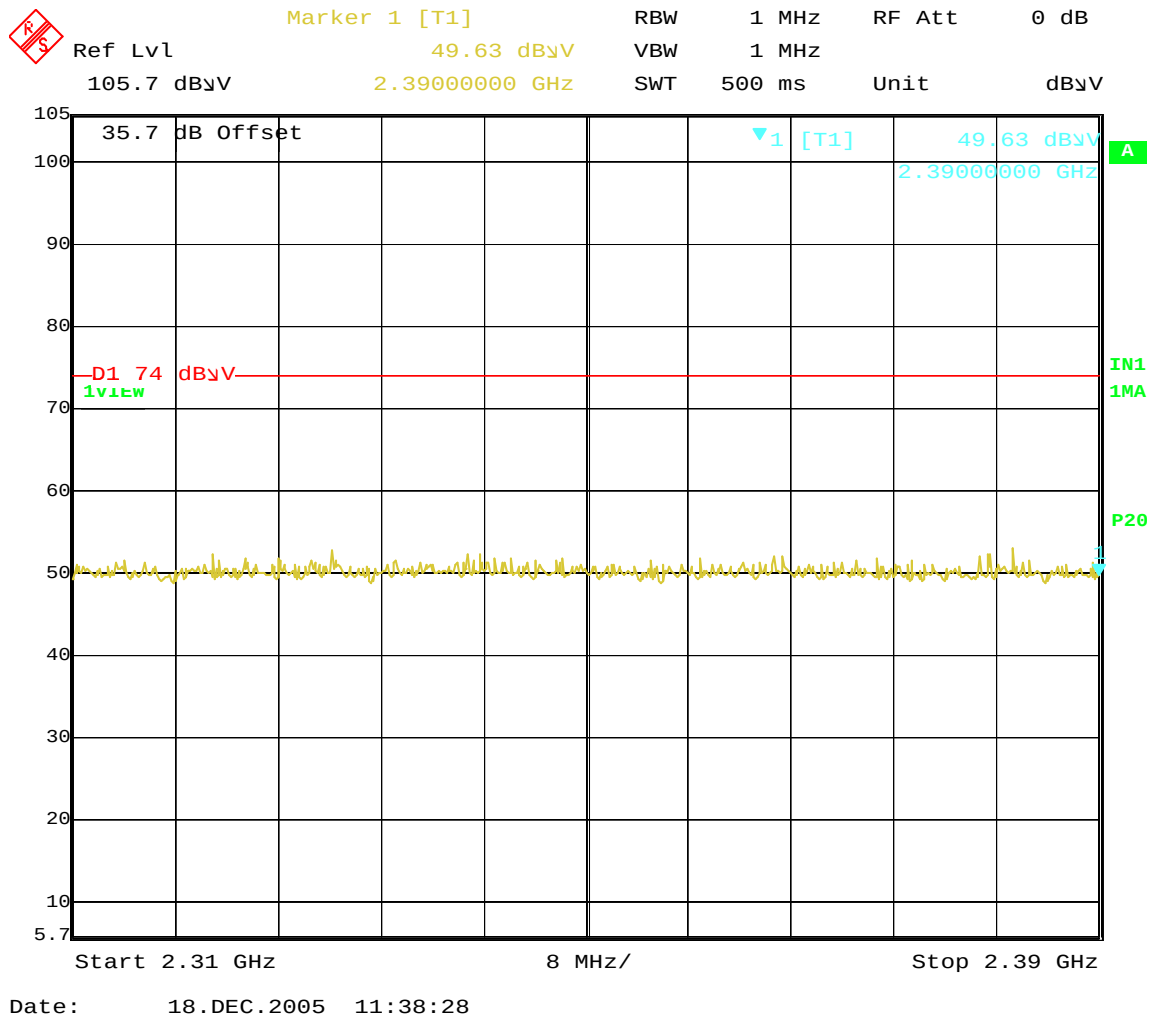


Figure 7-4: Low Ch. Restricted Band; 802.11b Mode; Vertical Polarity; Avg. Detection

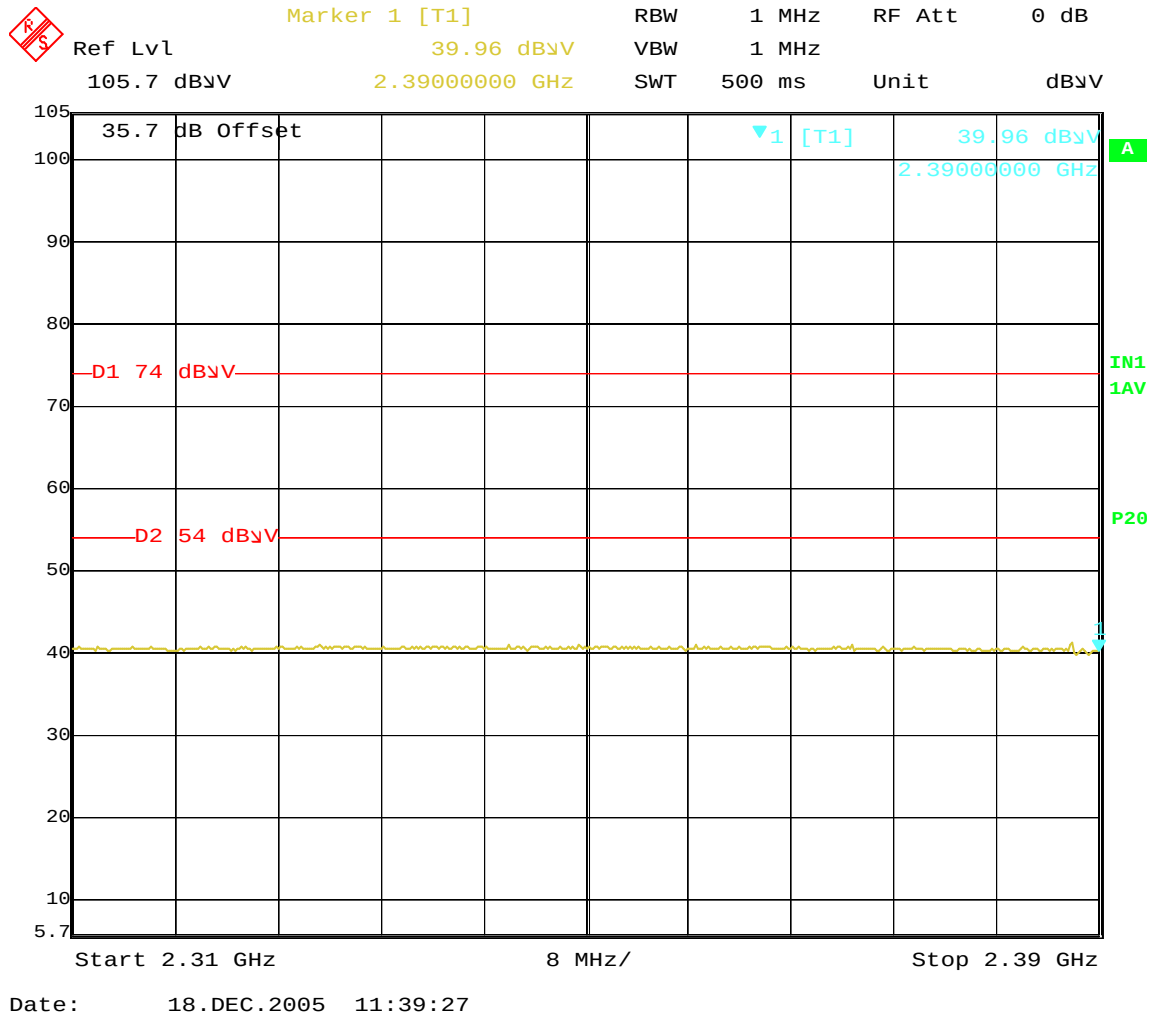


Figure 7-5: Low Ch. Restricted Band; 802.11b Mode; Horizontal Polarity; Peak Detection

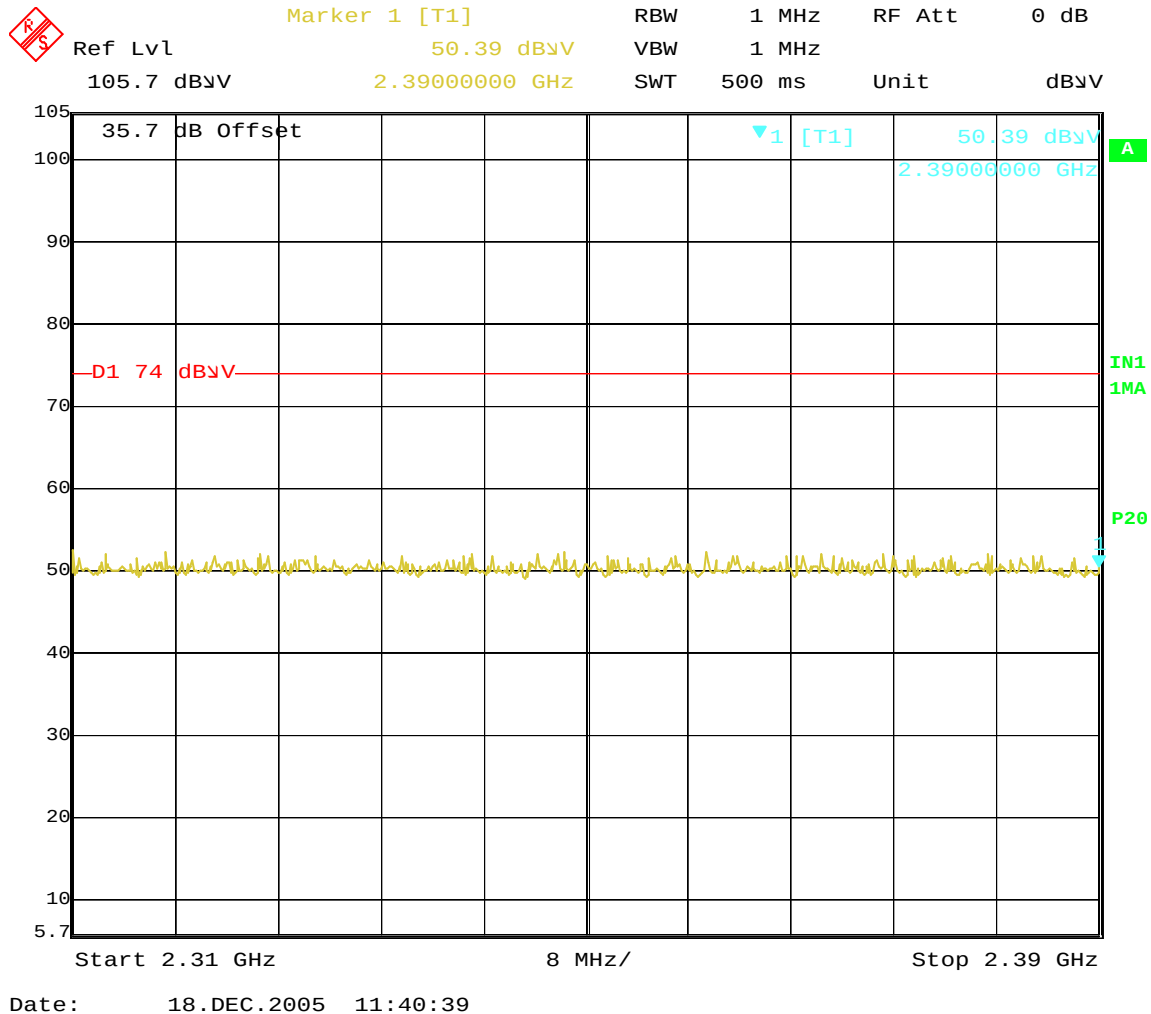


Figure 7-6: Low Ch. Restricted Band; 802.11b Mode; Horizontal Polarity; Avg. Detection

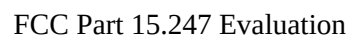


Figure 7-7: High Ch. Restricted Band; 802.11b Mode; Vertical Polarity; Peak Detection

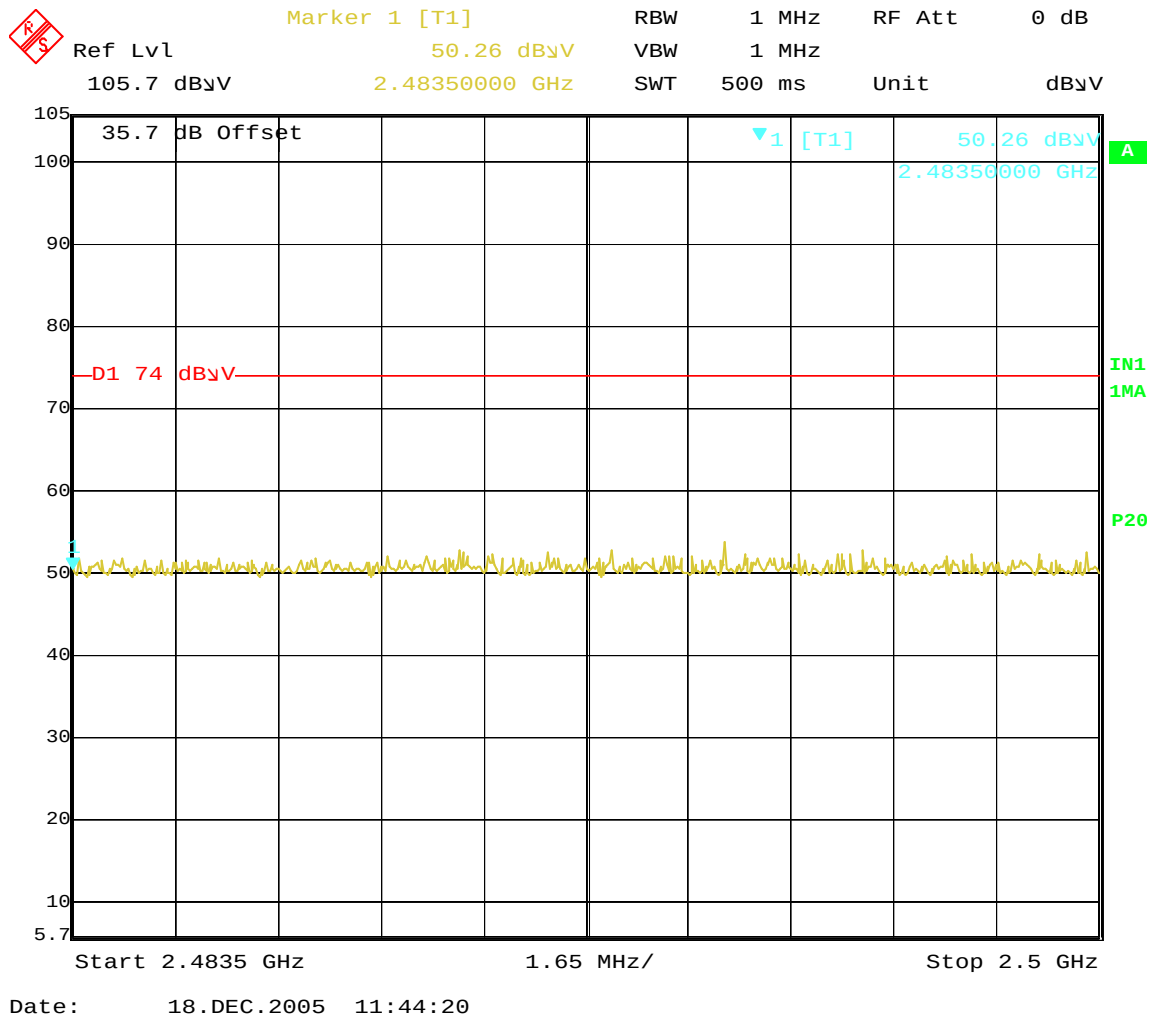


Figure 7-8: High Ch. Restricted Band; 802.11b Mode; Vertical Polarity; Avg. Detection

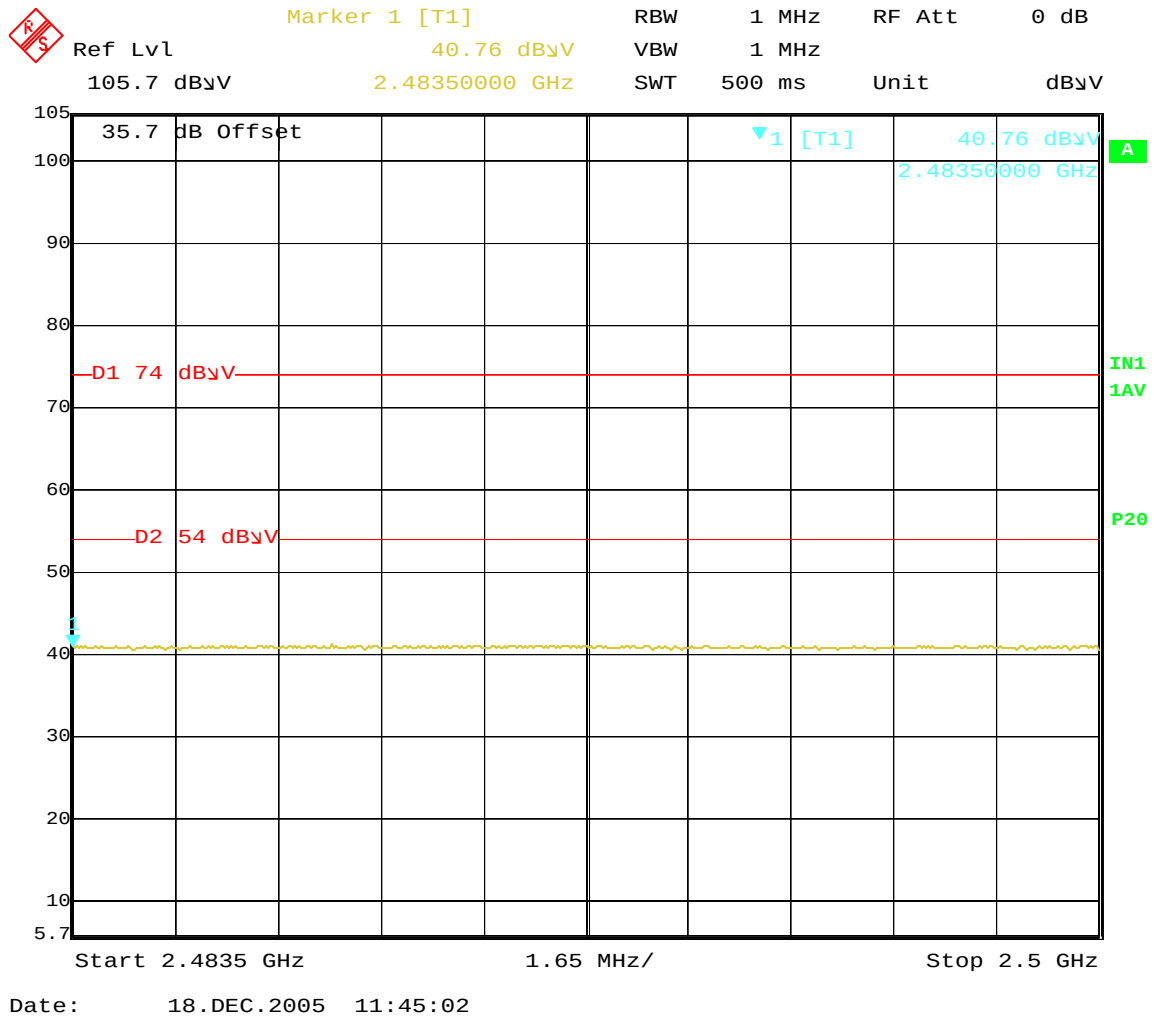


Figure 7-9: High Ch. Restricted Band; 802.11b Mode; Horizontal Polarity; Peak Detection

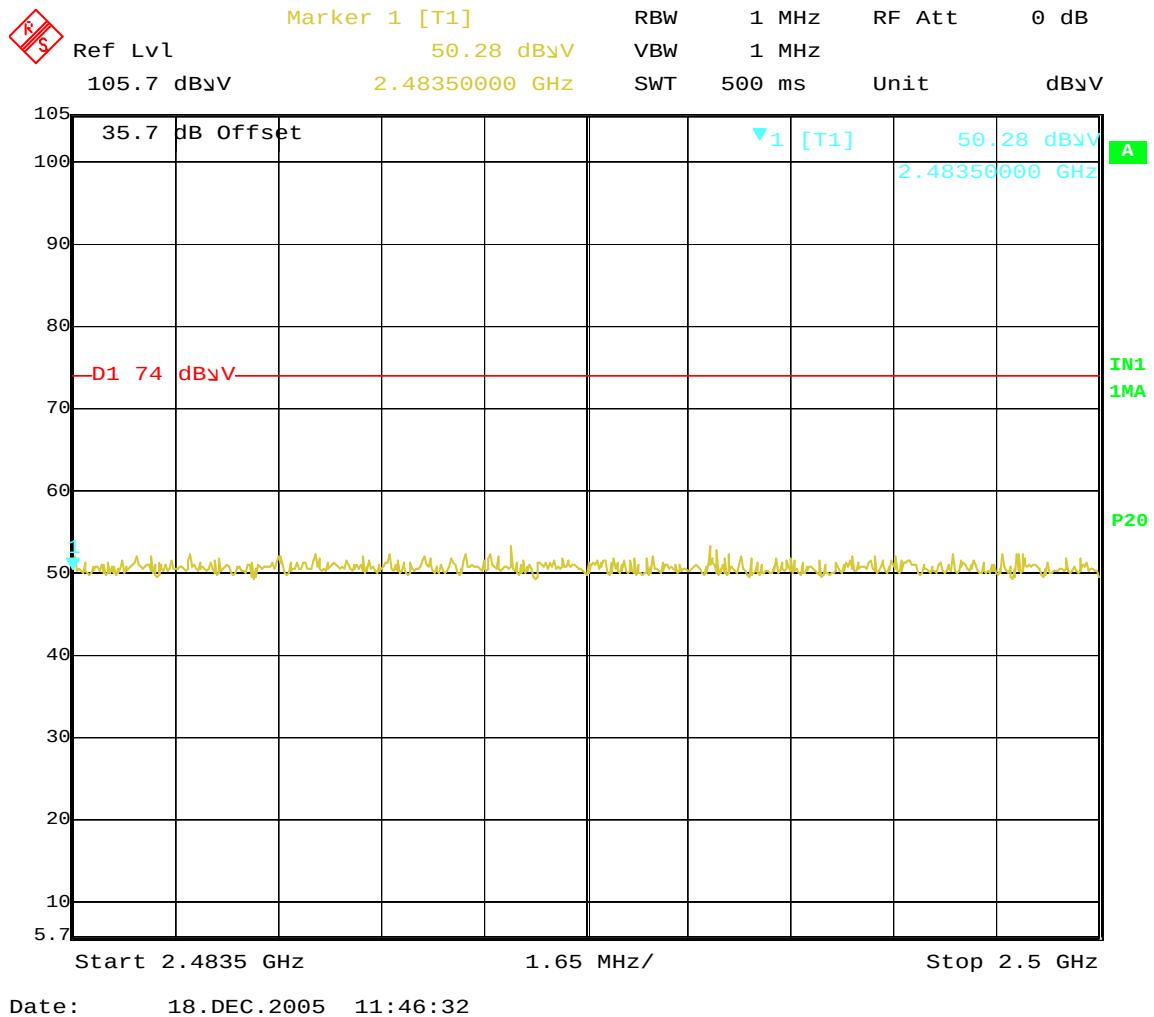


Figure 7-10: High Ch. Restricted Band; 802.11b Mode; Horizontal Polarity; Avg. Detection

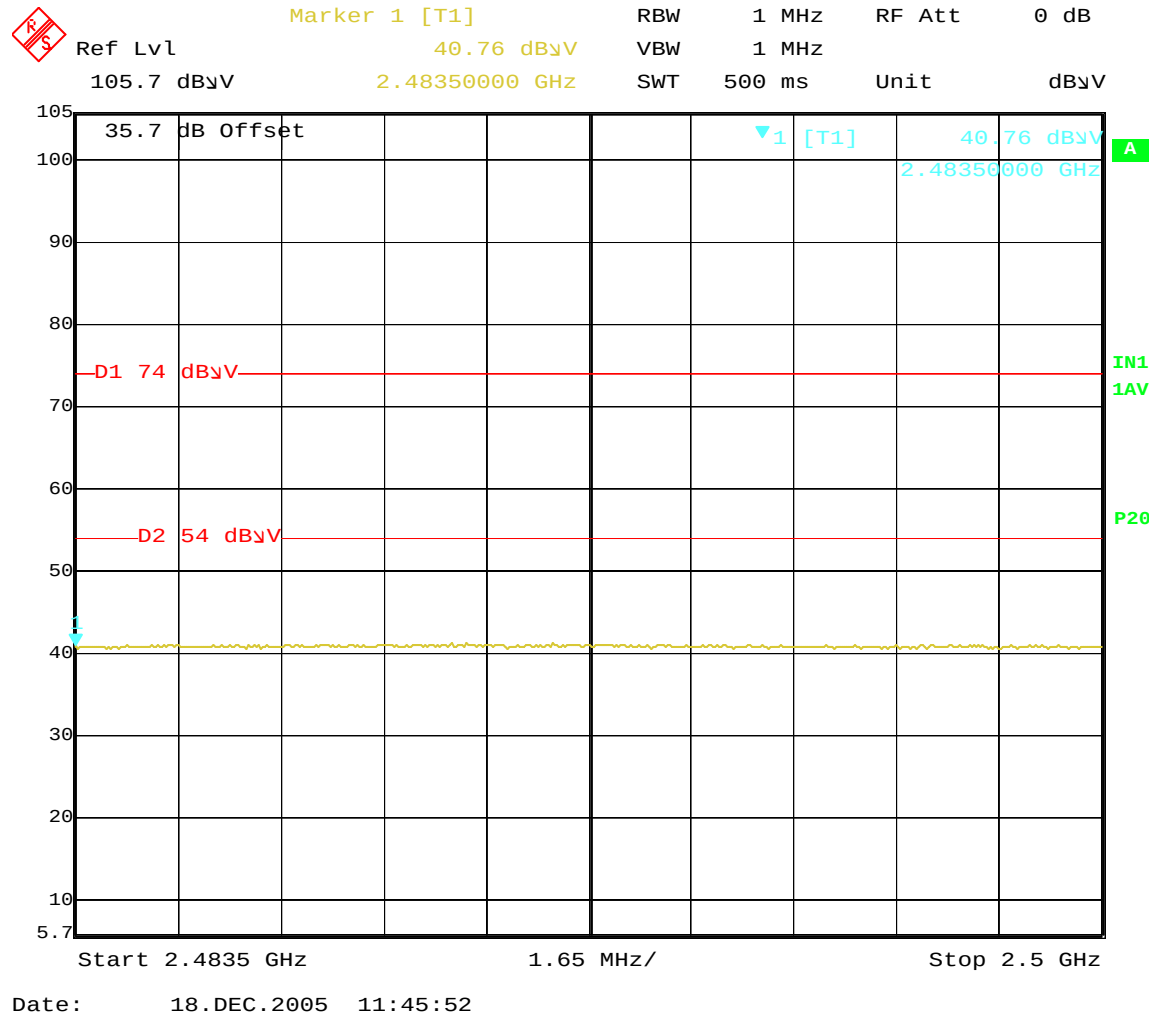


Figure 7-11: Low Ch. Restricted Band; 802.11g Mode; Vertical Polarity; Peak Detection

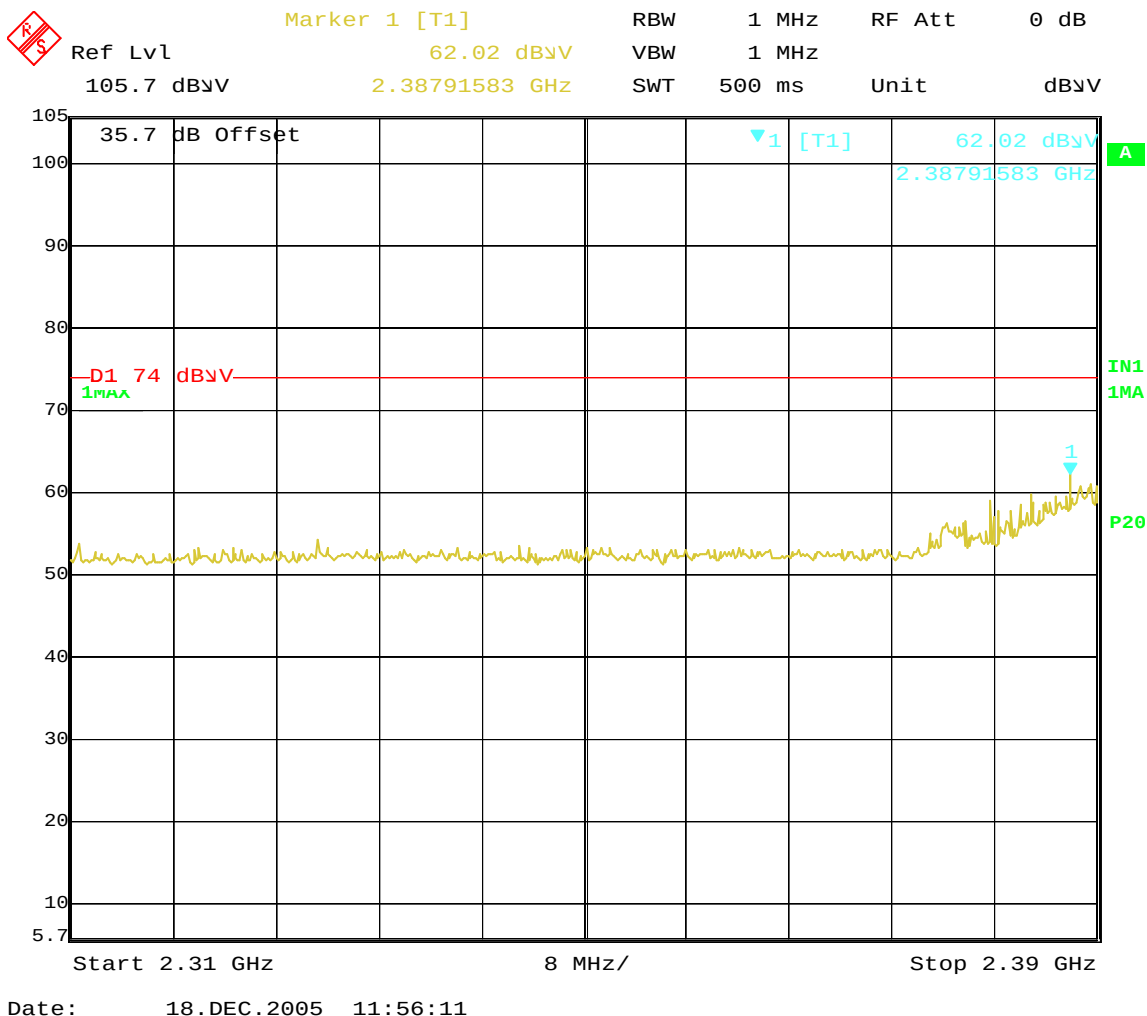
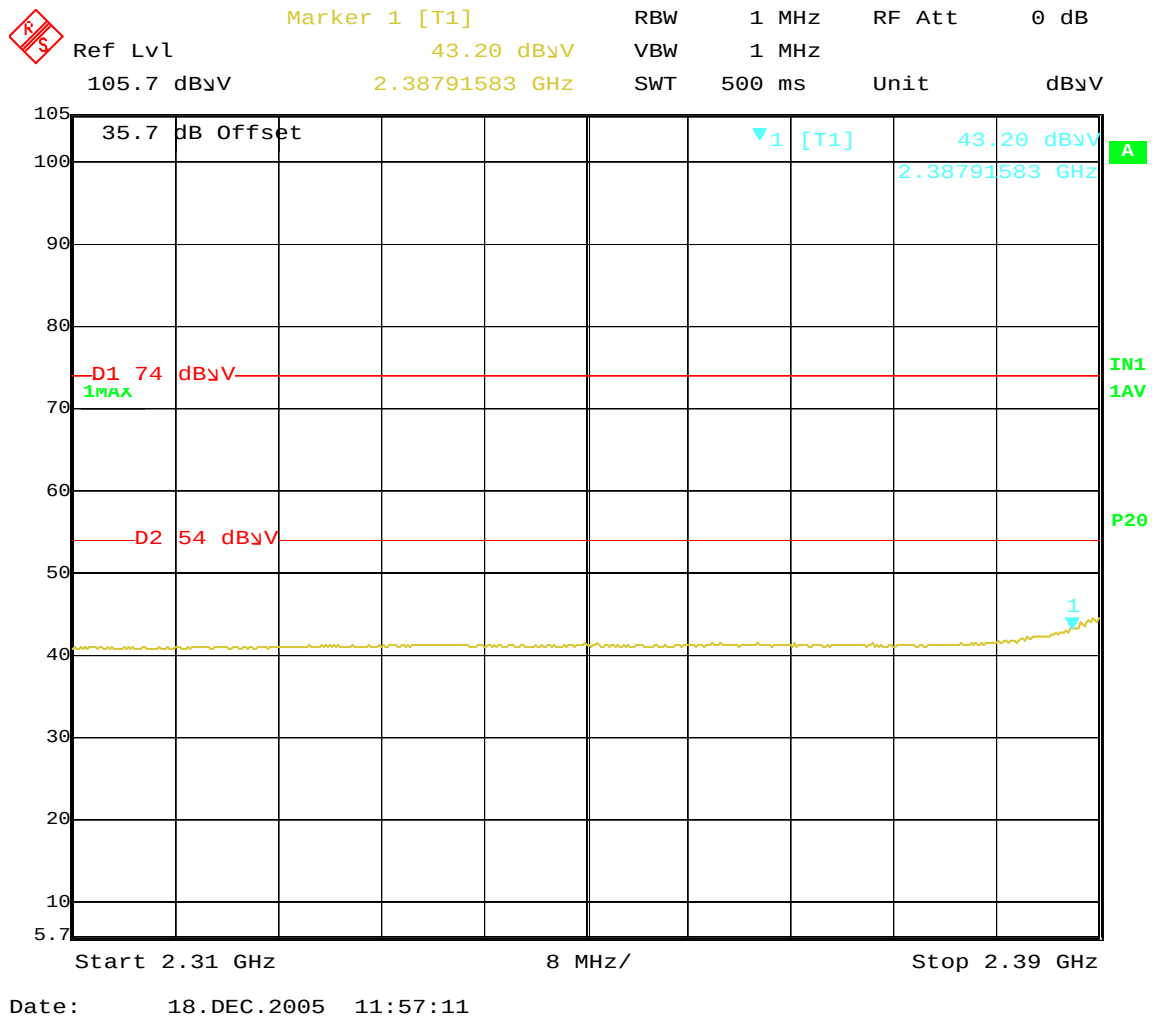


Figure 7-12: Low Ch. Restricted Band; 802.11g Mode; Vertical Polarity; Avg. Detection



Ref Lvl 105.7 dBμV

Marker 1 [T1] 55.98 dBμV

RBW 1 MHz

VBW 1 MHz

SWT 500 ms

RF Att 0 dB

Unit dBμV

35.7 dB Offset

▼1 [T1] 55.98 dBμV

2.38935872 GHz

D1 74 dBμV

1MAX

IN1 1MA

P20

Start 2.31 GHz

8 MHz/

Stop 2.39 GHz

Date: 18.DEC.2005 11:59:23

Figure 7-14: Low Ch. Restricted Band; 802.11g Mode; Horizontal Polarity; Avg. Detection

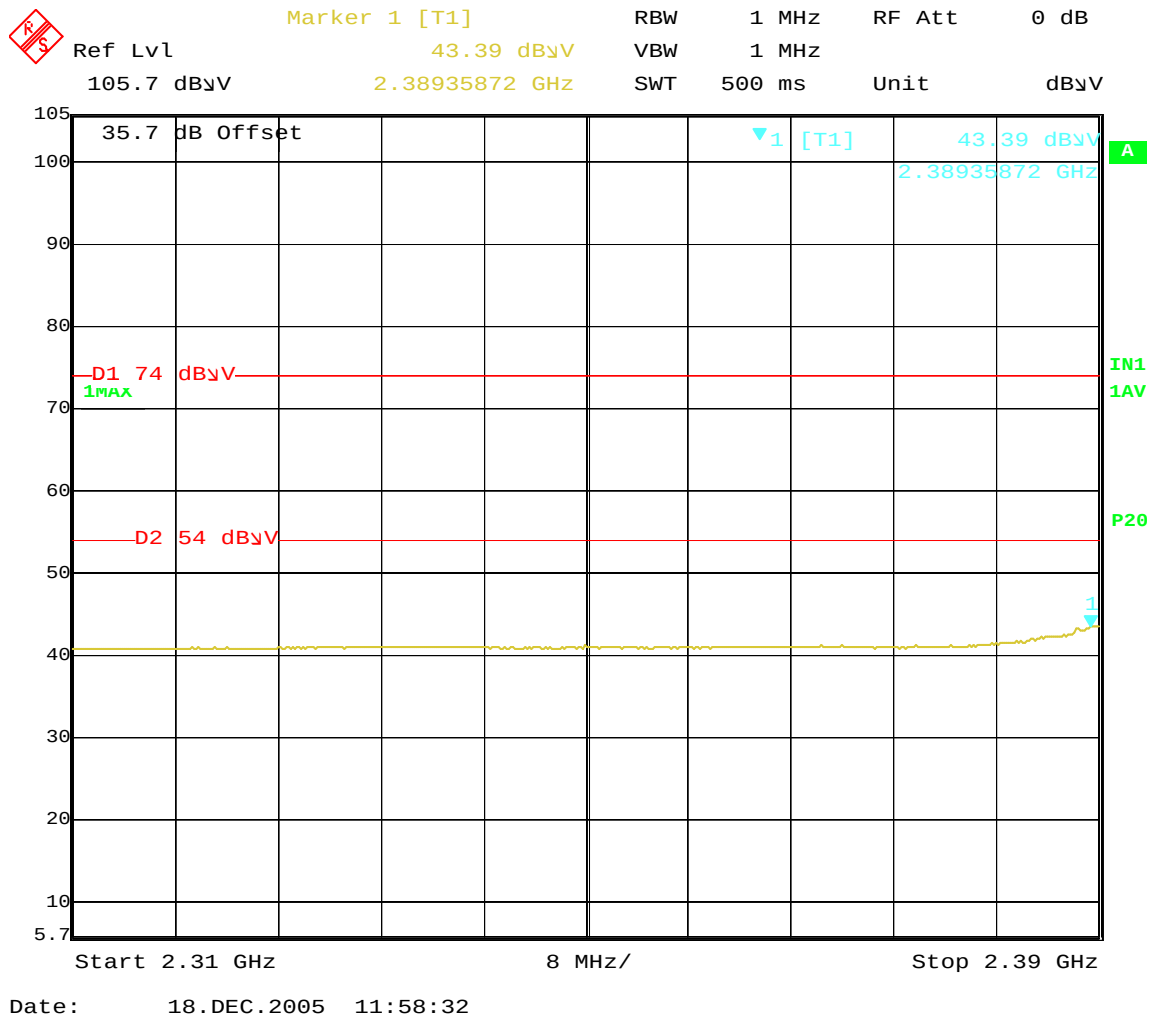


Figure 7-15: High Ch. Restricted Band; 802.11g Mode; Vertical Polarity; Peak Detection

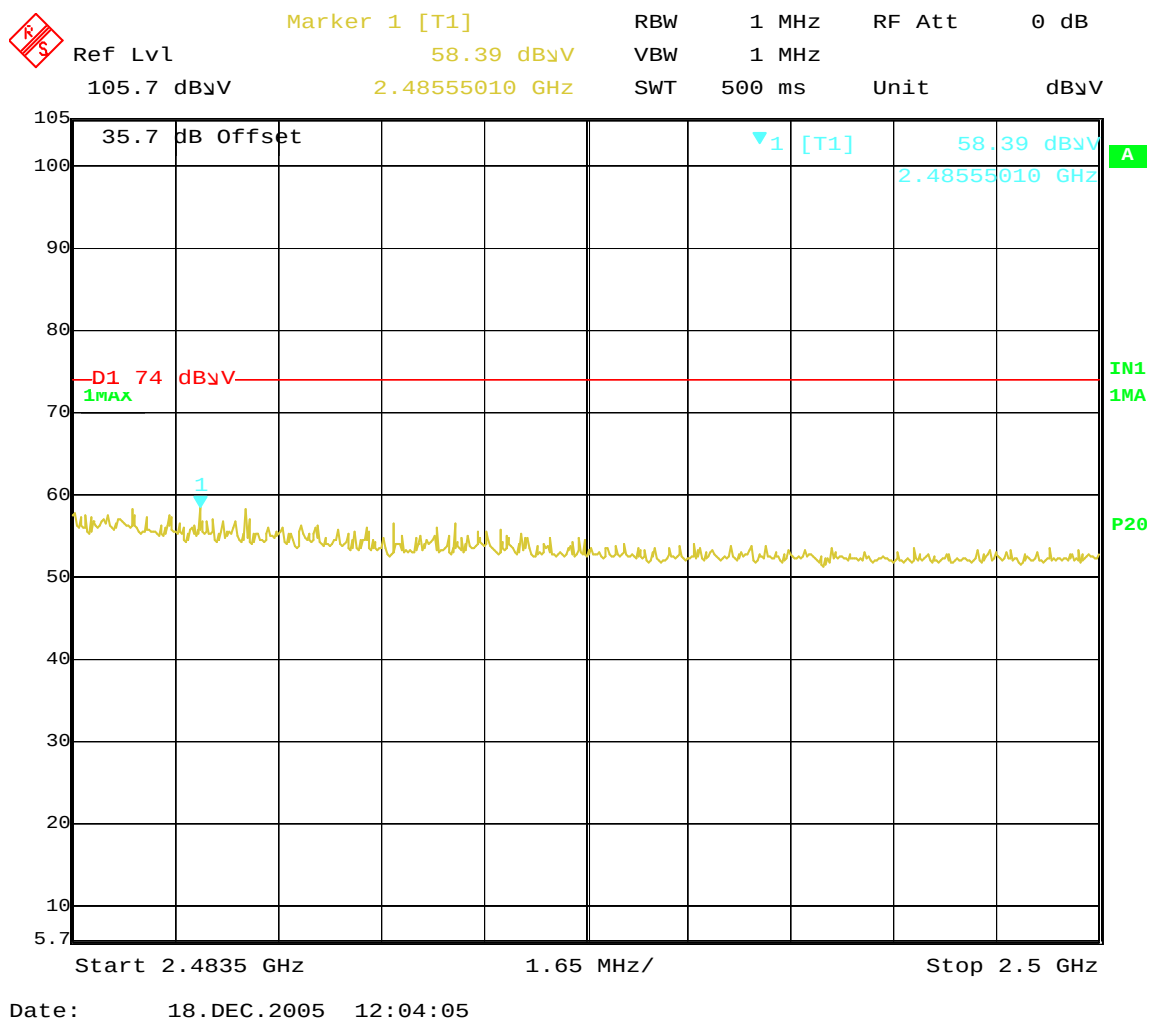


Figure 7-16: High Ch. Restricted Band; 802.11g Mode; Vertical Polarity; Avg. Detection

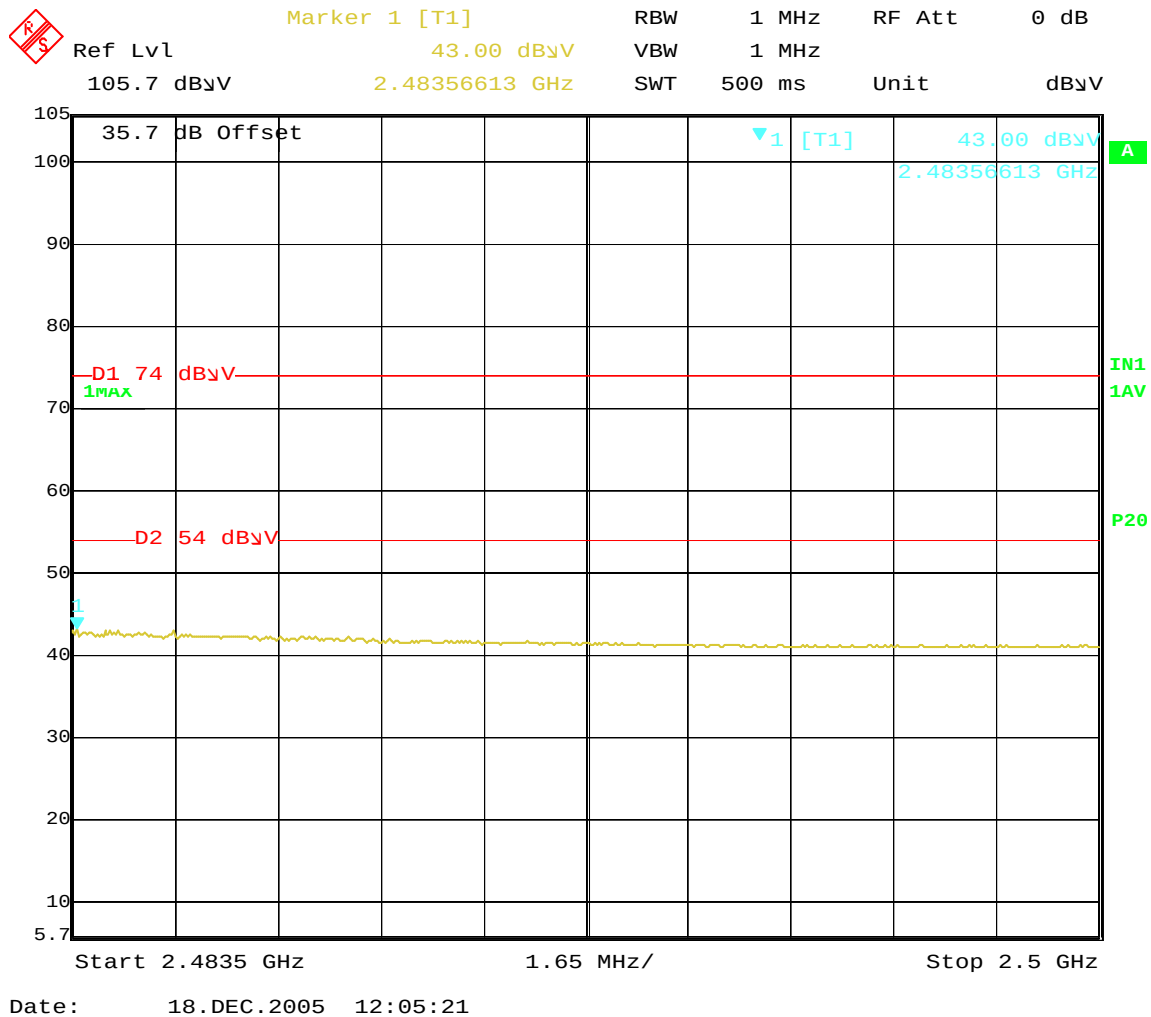


Figure 7-17: High Ch. Restricted Band; 802.11g Mode; Horizontal Polarity; Peak Detection

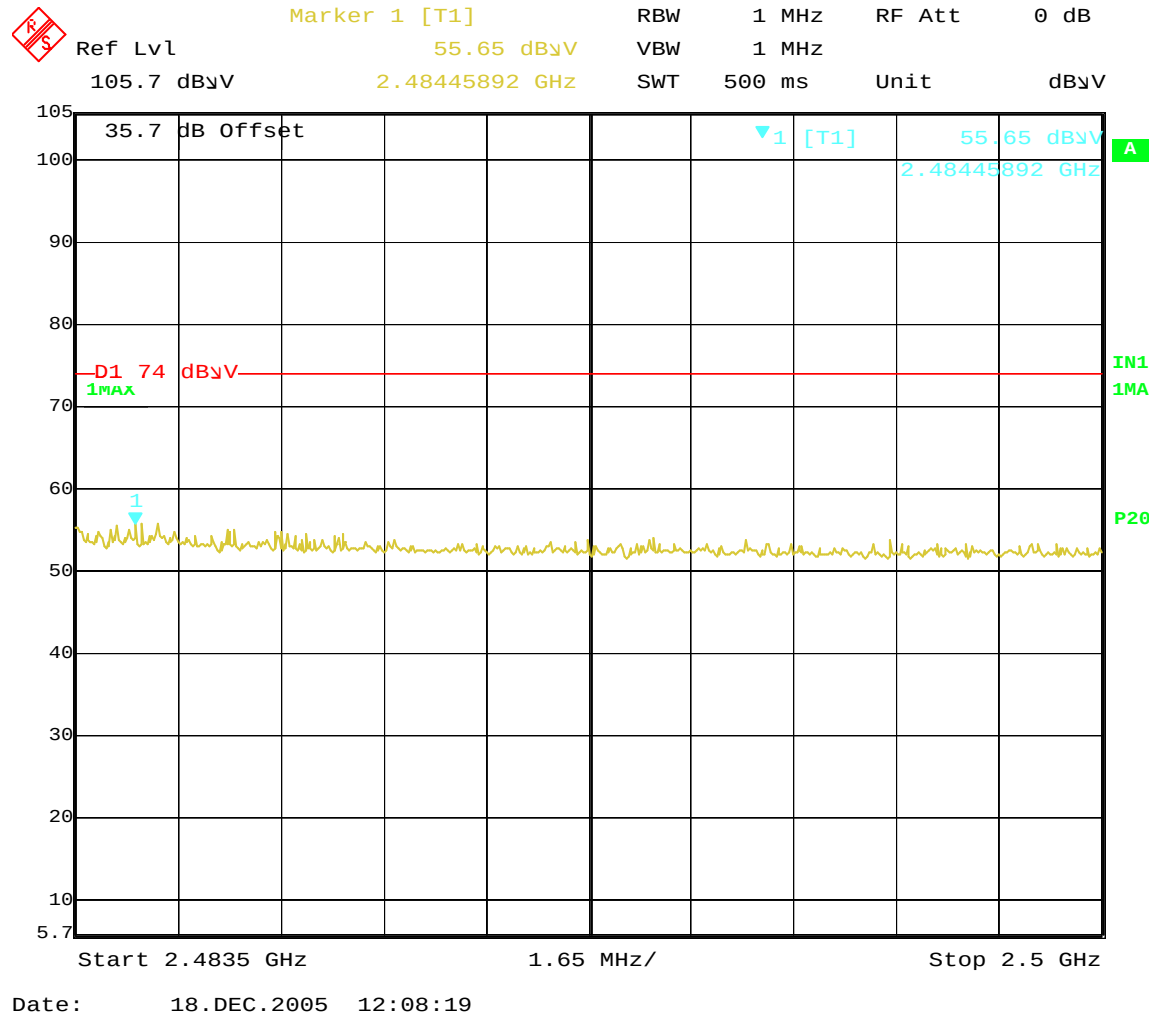
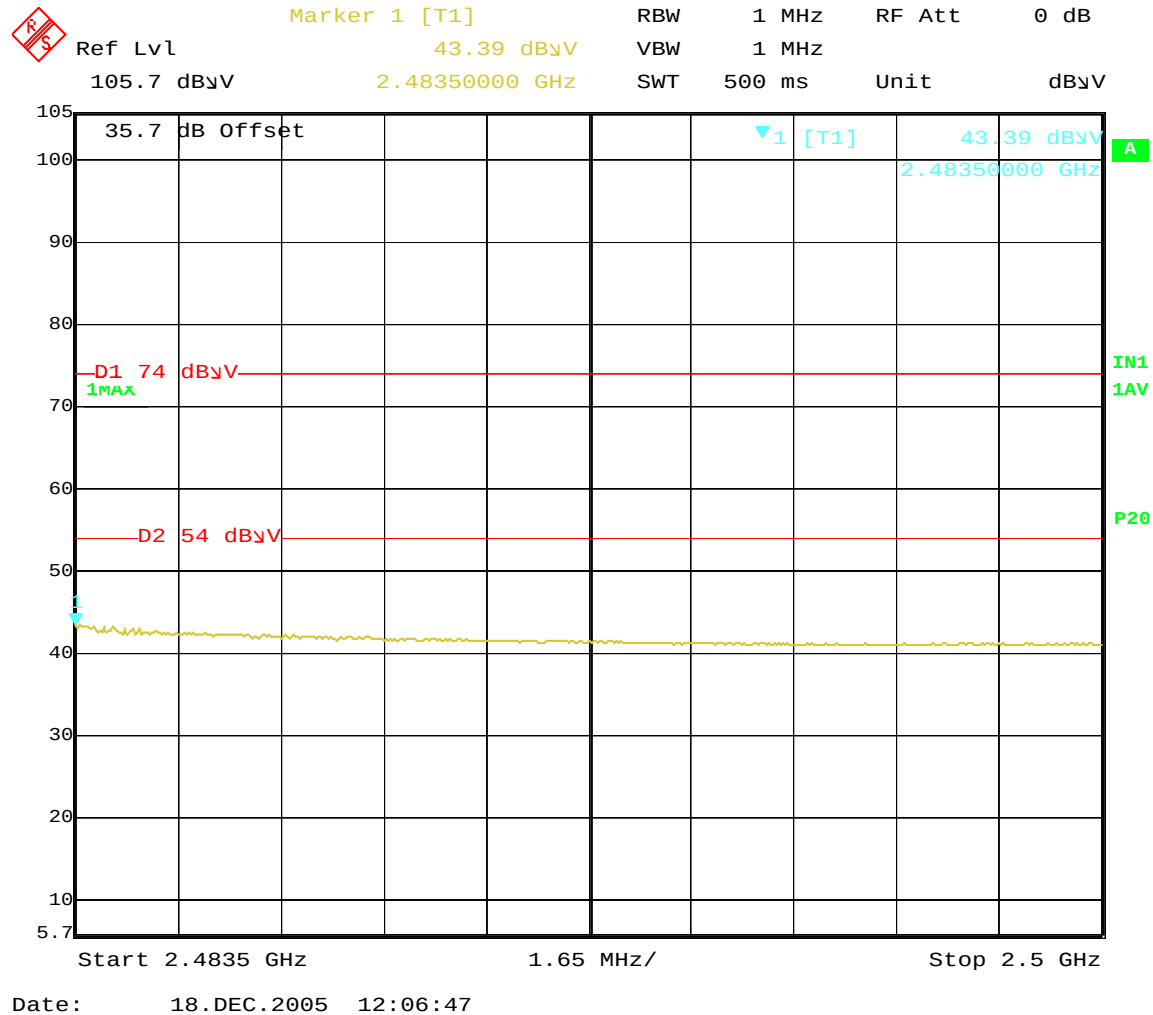


Figure 7-18: High Ch. Restricted Band; 802.11g Mode; Horizontal Polarity; Avg. Detection



## 8 POWER LINE CONDUCTED EMISSIONS

### 8.1 Test Procedure (FCC §15.207, ICES-003 §5.3)

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

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

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4: 2003.

#### 8.1.1 Power Line Conducted Emissions Criteria

The RF energy radiated back onto the public utility (AC Power Lines) shall not exceed the values in the following table when measured with the corresponding detector function.

*Table 8-1 Conducted Emission Limit for FCC §15.207(a)*

| Frequency Range<br>(MHz) | FCC Part 15.207(a)<br>Quasi Peak Limit<br>(dBuV) | FCC Part 15.207(a)<br>Average Limit<br>(dBuV) |
|--------------------------|--------------------------------------------------|-----------------------------------------------|
| 0.15 – 0.5 MHz           | 66 to 56                                         | 56 to 46                                      |
| 0.5 – 5.0 MHz            | 56                                               | 46                                            |
| 5.0 - 30 MHz             | 60                                               | 50                                            |

## 8.2 Test Results

The Residential Gateway met the power line conducted emission requirements of §15.207. The test results are located in Figure 8-1. The graphical data, measured with peak detection, was all below the class B quasi-peak and average limits.

Figure 8-1: FCC §15. Power Line Conducted Emissions (Lines 1 and 2)

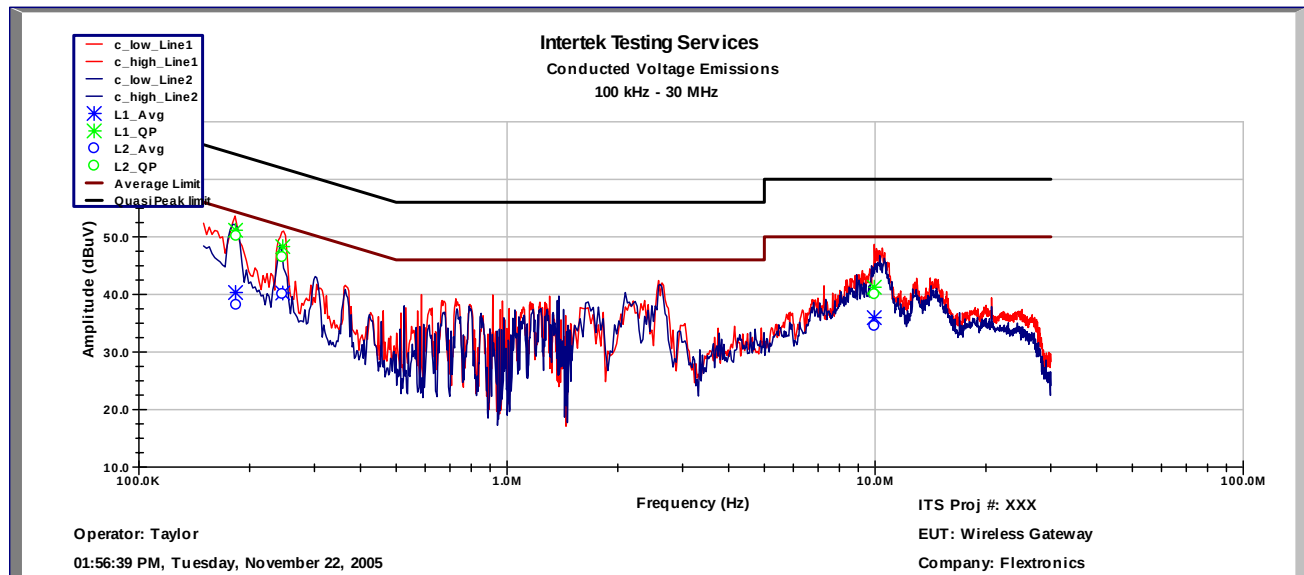


Figure 8-2: Quasi-peak and average detector readings for FCC §15.107 and §15.207 power line conducted emissions (Lines 1 and 2)

| Line   | Frequency (MHz) | Quasi-Peak (dBuV) | Quasi-Peak Limit (dBuV) | Quasi-Peak Delta (dB) | Average (dBuV) | Average Limit (dBuV) | Average Delta (dB) | Results   |
|--------|-----------------|-------------------|-------------------------|-----------------------|----------------|----------------------|--------------------|-----------|
| Line 1 | 183.1 KHz       | 51.13             | 64.34                   | -13.21                | 40.33          | 55.05                | -14.73             | Compliant |
| Line 1 | 245.9 KHz       | 48.31             | 61.89                   | -13.59                | 40.25          | 53.26                | -13.01             | Compliant |
| Line 1 | 9.94 MHz        | 41.23             | 60                      | -18.77                | 35.97          | 50                   | -14.03             | Compliant |
| Line 2 | 183.8 KHz       | 50.15             | 64.31                   | -14.16                | 38.19          | 55.03                | -16.84             | Compliant |
| Line 2 | 245.1 KHz       | 46.51             | 61.92                   | -15.41                | 40.08          | 53.28                | -13.2              | Compliant |
| Line 2 | 9.94 MHz        | 40.03             | 60                      | -19.97                | 34.5           | 50                   | -15.5              | Compliant |

## 9 RECEIVER SPURIOUS EMISSIONS

### 9.1 Test Procedure (FCC §15.109, ICES-003 §5.6)

Measurements are made over the frequency range of 30 MHz to five times the highest frequency operating within the device. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole. From 30 to 1000 MHz, a quasi-peak detector was used for measurement. Above 1000 MHz, average measurements were performed.

Measurements of the radiated field are made with the antenna located at a distance of 3 meters from the EUT. If the field-strength measurements at 3m cannot be made because of high ambient noise level or for other reasons, measurements may be made at a closer distance, for example 1m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

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

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

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

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

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

#### 9.1.1 Receiver Spurious Emissions Criteria

Table 9-1 Radiated Emission Limit for FCC §15.109

| Radiated Emission Limits at 3 meters |                              |
|--------------------------------------|------------------------------|
| Frequency (MHz)                      | Quasi-Peak limits, dB (µV/m) |
| 30 to 88                             | 40.0                         |
| 88 to 216                            | 43.5                         |
| 216 to 960                           | 46.0                         |
| 960 and up                           | 54.0                         |

## 9.2 Test Results

The Residential Gateway is **compliant** with the radiated disturbance requirements of FCC §15.109 for a class B device. The maximized quasi peak data can be found in Figure 9-2.

Figure 9-1 FCC §15.109 Worst Case Receiver Spurious Emission

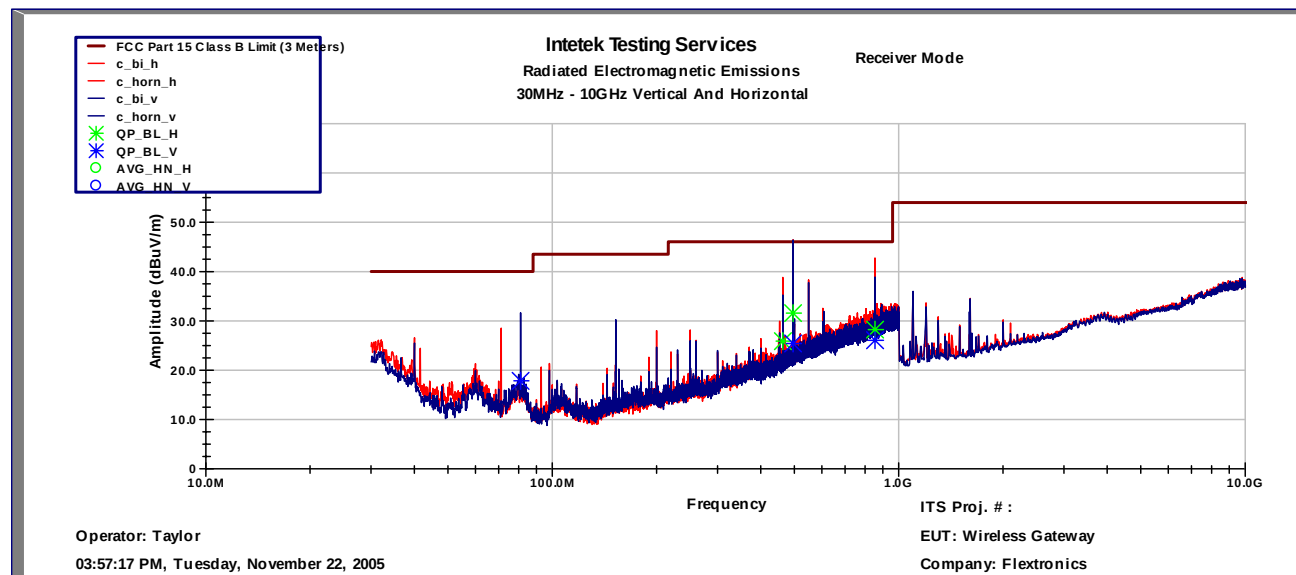


Figure 9-2 FCC §15.109 Maximized Quasi Peak and Average Emissions

| Frequency (MHz) | Polarity (H/V) | Cab. (dB) | Ant. (dB) | Corr. Reading. (dBuV/m) | Limit (dBuV/m) | Delta (dB) | Azimuth (deg) | Tower (cm) | Results   |
|-----------------|----------------|-----------|-----------|-------------------------|----------------|------------|---------------|------------|-----------|
| 462.88 MHz      | V              | 1.77      | 18.4      | 25.87                   | 46.02          | -20.15     | 179           | 112        | Compliant |
| 495.28 MHz      | V              | 1.86      | 19.03     | 31.56                   | 46.02          | -14.46     | 185           | 186        | Compliant |
| 853.7 MHz       | V              | 2.44      | 24        | 28.22                   | 46.02          | -17.8      | 154           | 325        | Compliant |
| 81.0 MHz        | V              | 0.73      | 8.18      | 17.83                   | 40             | -22.17     | 332           | 113        | Compliant |
| 495.3 MHz       | V              | 1.86      | 18.32     | 25.42                   | 46.02          | -20.6      | 129           | 100        | Compliant |
| 853.7 MHz       | V              | 2.44      | 22.5      | 26.06                   | 46.02          | -19.96     | 238           | 173        | Compliant |