**SK TECH CO., LTD.**



# Certificate of Compliance

| | | | |
|---|---|---|---|
| **Test Report No.:** | **SKTTRT-060929-024** | | |
| **NVLAP CODE:** | **200220-0** | | |
| **Applicant:** | **H&T Co., Ltd.** | | |
| **Applicant Address:** | #124-5 Ojeon-Dong Uiwang-City Gyeong-Gi-Do Korea | | |
| **Manufacturer:** | **H&T Co., Ltd.** | | |
| **Manufacturer Address:** | #124-5 Ojeon-Dong Uiwang-City Gyeong-Gi-Do Korea | | |
| **Device Under Test:** | **Mobile POS** | | |
| **FCC ID:** | **UL7-HIT6100** | **Model No.:** | **HIT-6100WL** |
| **Receipt No.:** | SKTEU06-0530 | **Date of receipt:** | August 25, 2006 |
| **Date of Issue:** | September 29, 2006 | | |
| **Location of Testing:** | **SK TECH CO., LTD.**<br>820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea | | |
| **Test Procedure:** | **ANSI C63.4 / 2003** | | |
| **Test Specification:** | **FCC Part 15 Rules** | | |
| **FCC Equipment Class:** | **DTS - Part 15 Digital Transmission System** | | |
| **Test Result:** | The above-mentioned device has been tested and passed. | | |

**Tested & Reported by**: *Chang-Min, Moon*

*2006-09-29*

*Signature* *Date*

**Approved by**: *Jae-Kyung, Bae*

*2006-09-29*

*Signature* *Date*

| | |
|---|---|
| **Other Aspects:** | |
| **Abbreviations:** | **· OK, Pass = passed · Fail = failed · N/A = not applicable** |

☞
- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **This test report must not be used to claim product endorsement by NVLAP or any agency of the U.S Government.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

NVLAP®

**NVLAP Lab. Code: 200220-0**

# >> CONTENTS <<

# 1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.247 for Digital Transmission System. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

# 2. TEST SITE

SK TECH Co., Ltd.

## 2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code: 200220-0 and DATech for DAR-Registration No.: TTI-P-G155/97-01

## 2.2 List of Test and Measurement Instruments

| Description | Manufacturer | Model # | Serial # | |
|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4405B | US40520856 | ☒ |
| EMC Spectrum Analyzer | Agilent | E7405A | US40240203 | ☒ |
| EMI Test Receiver | Rohde&Schwarz | ESIB40 | 100277 | ☒ |
| EMI Test Receiver | Rohde&Schwarz | ESVS10 | 825120/008 | |
| EMI Test Receiver | Rohde&Schwarz | ESVS10 | 834468/013 | |
| EMI Test Receiver | Rohde&Schwarz | ESHS10 | 835871/002 | |
| EMI Test Receiver | Rohde&Schwarz | ESHS10 | 862970/019 | ☒ |
| Artificial Mains Network | Rohde&Schwarz | ESH3-Z5 | 836679/018 | ☒ |
| Pre-amplifier | HP | 8447F | 3113A05153 | ☒ |
| Pre-amplifier | MITEQ | AFS44 | 1116321 | ☒ |
| Pre-amplifier | MITEQ | AFS44 | 1116322 | |
| Power Meter | Agilent | E4418B | US39402179 | |
| Power Meter | Agilent | E4417A | MY45100426 | ☒ |
| Power Sensor | Agilent | E9327A | MY44420696 | ☒ |
| Power Sensor | HP | 8485A | 3318A13916 | |
| Oscilloscope | Agilent | 54820A | US40240160 | |
| Diode detector | Agilent | 8473C | 1882A03173 | |
| VHF Precision Dipole Antenna (TX/RX) | Schwarzbeck | VHAP | 1014 / 1015 | |
| UHF Precision Dipole Antenna (TX/RX) | Schwarzbeck | UHAP | 989 / 990 | |
| Loop Antenna | Schwarzbeck | HFH2-Z2 | 863048/019 | |
| TRILOG Broadband Antenna | Schwarzbeck | VULB9168 | 9168-230 | ☒ |
| TRILOG Broadband Antenna | Schwarzbeck | VULB9160 | 3141 | ☒ |
| Biconical Antenna | Schwarzbeck | VHA9103 | 2265 | |
| Log-Periodic Antenna | Schwarzbeck | UHALP9107 | 1819 | |
| Horn Antenna | AH Systems | SAS-200/571 | 304 | |
| Horn Antenna | EMCO | 3115 | 00040723 | ☒ |
| Horn Antenna | EMCO | 3115 | 00056768 | |
| Vector Signal Generator | Agilent | E4438C | MY42080359 | |
| PSG analog signal generator | Agilent | E8257D-520 | MY45141255 | |
| DC Power Supply | HP | 6634A | 2926A-01078 | |
| DC Power Supply | HP | 6268B | 2542A-07856 | |
| Digital Multimeter | HP | HP3458A | 2328A14389 | |
| PCS Interface | HP | 83236B | 3711J00881 | |
| CDMA Mobile Test Set | HP | 8924C | US35360253 | |
| Hygro/Thermo Graph | SATO | PC-5000TRH-II | - | ☒ |
| Temperature/Humidity Chamber | All Three | ATH-50M | 20030425 | |

## 2.3 Test Date

Date of Application: August 25, 2006

Date of Test : August 29, 2006~ September 28, 2006

## 2.4 Test Environment

See each test item's description.

# 3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user's manual.

## 3.1 Rating and Physical Characteristics

| | |
|---|---|
| Type / Model No. | Mobile POS / HIT-6100WL |
| Power source | DC 7.4V Li-ion Battery |
| Local Oscillator or X-Tal | X-Tal: 3.6864 MHz, 14.7456 MHz, 22.1184 MHz, 24.576 MHz, 40 MHz |
| Transmit Frequency | 2412 ~ 2462 MHz (11 channels, 5MHz step) |
| Antenna Type | Dipole antenna (Model: HW-860-MCX, Gain: -14.03dBi) |
| Type of Modulation | IEEE 802.11b: DSSS (DBPSK - 1Mbps, DQPSK - 2Mbps, CCK - 5.5/11 Mbps)<br>IEEE 802.11g: OFDM (BPSK - 6/9Mbps, QPSK - 12/18Mbps, 16QAM – 24/36Mbps, 64QAM - 48/54Mbps) |
| RF Output power | 16 dBm for DSSS, 12 dBm for OFDM modulation |
| External Ports ** | - USB connection to PC for data communication<br>- DC Power Source Jack |

** The test report for compliance with FCC Part 15B as a Class B digital device should be issued with other test report number.

## 3.2 Equipment Modifications

None.

## 3.3 Submitted Documents

Block diagram

Schematic diagram

Antenna Specification

Part List

User manual

# 4. MEASUREMENT CONDITIONS

## 4.1 Description of test configuration

The measurements were taken in continuous transmitting mode. The operating frequency and modulation types of the EUT could be changed in the test mode on it.

Initial investigations were performed with all modulation types. Final testing was performed while the transmitter continuously operating with the modulation rate of 11 Mbps (CCK) and 9 Mbps (BPSK) as worst case.

## 4.2 List of Peripherals

| Equipment Type | Manufacturer | Model | Cable Description |
|---|---|---|---|
| AC/DC adaptor | AULT KOREA Corp. | PW118 | 3.3m Unshielded Power Line<br>AC input: 100 ~ 250V, 50~60Hz, 0.5A<br>DC output: 9V / 2A |
| Cradle | H&T Co., Ltd. | HITC6101 | - |

## 4.3 Uncertainty

| Measurement Item | Combined Standard Uncertainty<br>Uc | Expanded Uncertainty<br>U = KUc (K = 2) |
|---|---|---|
| Conducted RF power | ± 1.49 dB | ±2.98dB |
| Radiated disturbance | ± 2.30 dB | ±4.60dB |
| Conducted disturbance | ± 1.96 dB | ± 3.92dB |

# 5. TEST AND MEASUREMENTS

### Summary of Test Results

| Requirement | CFR 47 Section | Report Section | Test Result |
|---|---|---|---|
| Antenna Requirement | 15.203, 15.247(b)(4) | 5.1 | PASS |
| 6dB Bandwidth | 15.247(a)(2) | 5.2 | PASS |
| Maximum Peak Output Power | 15.247(b)(3), (4) | 5.3 | PASS |
| Spurious Emission, Band Edge, and Restricted bands | 15.247(d), 15.205(a), 15.209(a) | 5.4 | PASS |
| Peak Power Spectral Density | 15.247(e) | 5.5 | PASS |
| Conducted Emissions | 15.207(a) | 5.6 | PASS |
| RF Exposure | 15.247(i), 1.1307(b)(1) | 5.7 | PASS |

## 5.1 ANTENNA REQUIREMENT

### 5.1.1 Regulation

According to §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.1.2 Result: PASS

The transmitter has a permanently attached dipole antenna (Model: HW-860-MCX) and Unique Antenna Connector (MCX Plug). The directional gain of the antenna is maximum -14.03 dBi.

## 5.2 6dB BANDWIDTH

### 5.2.1 Regulation

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

### 5.2.2 Test Procedure

1. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable.
2. Set the spectrum analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = 20 MHz, Sweep = AUTO.
3. Set the spectrum analyzer to MAX HOLD mode and then set a reference level on it equal to the highest peak value.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

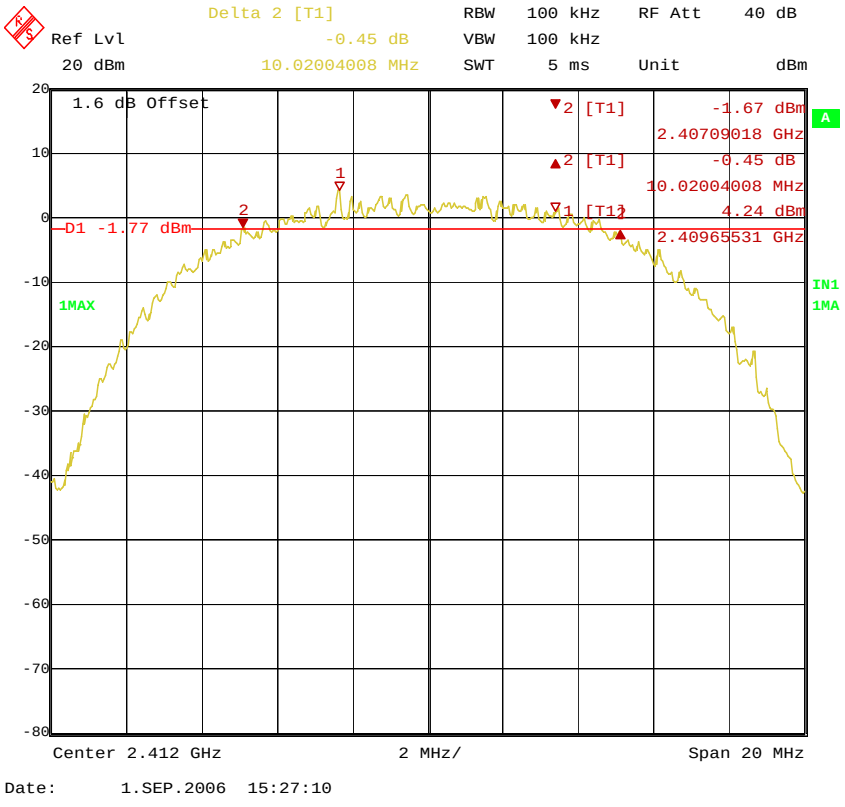
### 5.2.3 Test Results: PASS

**Table 1: Measured values of the 6dB Bandwidth (Conducted)**

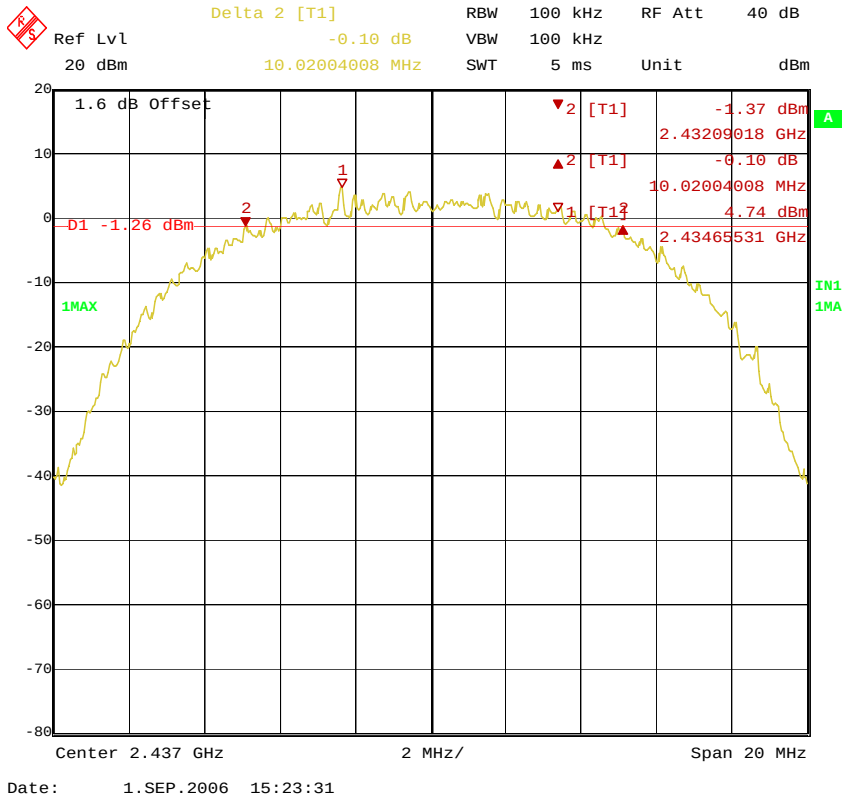
| Modulation | Operating frequency | Transfer Rate | 6dB Bandwidth | Limit |
|---|---|---|---|---|
| 802.11b | 2412 MHz | 11 Mbps | 10.02 MHz | ≥ 500 kHz |
| | 2437 MHz | 11 Mbps | 10.02 MHz | ≥ 500 kHz |
| | 2462 MHz | 11 Mbps | 10.02 MHz | ≥ 500 kHz |
| 802.11g | 2412 MHz | 9 Mbps | 16.59 MHz | ≥ 500 kHz |
| | 2437 MHz | 9 Mbps | 16.59 MHz | ≥ 500 kHz |
| | 2462 MHz | 9 Mbps | 16.59 MHz | ≥ 500 kHz |

## Figure 1. Plot of the 6dB Bandwidth (Conducted)

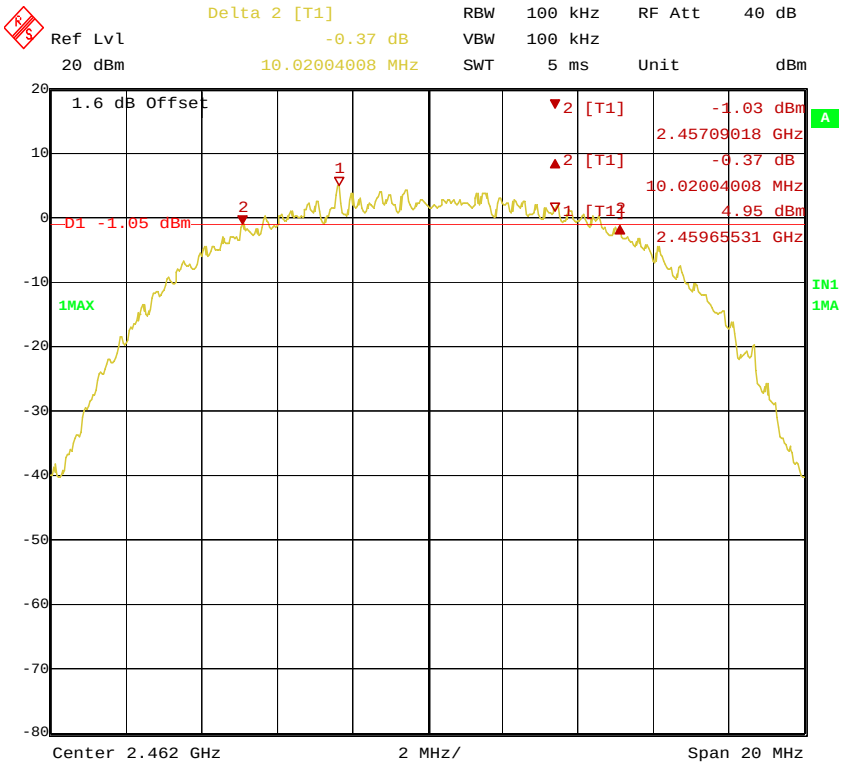
### Lowest Channel (operating at 2412 MHz): 802.11b, 11 Mbps



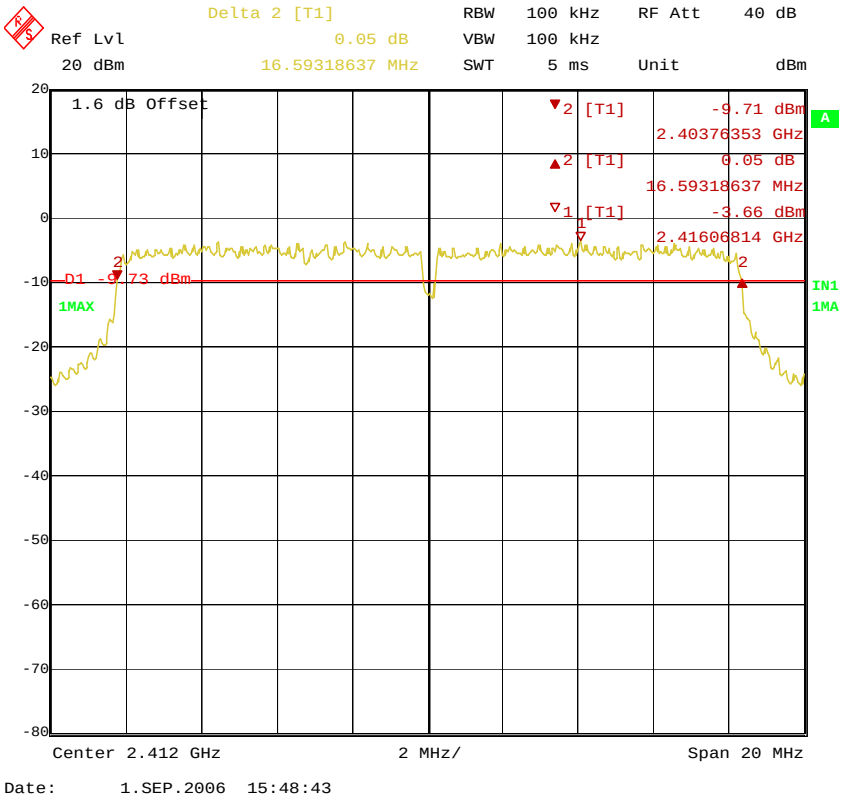

### Middle Channel (operating at 2437 MHz): 802.11b, 11 Mbps



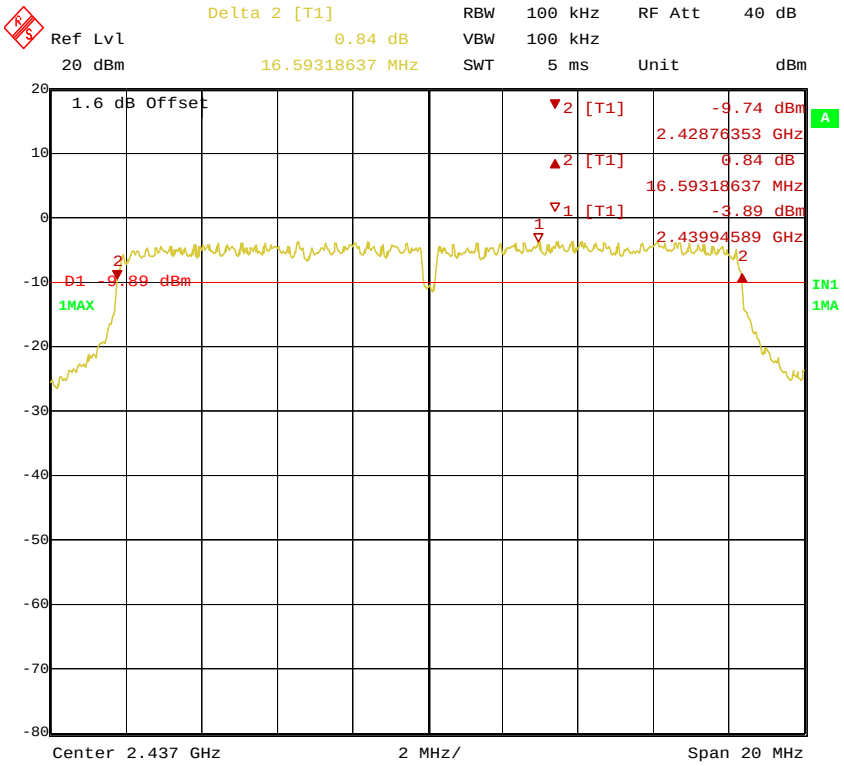
## Highest Channel (operating at 2462 MHz): 802.11b, 11 Mbps



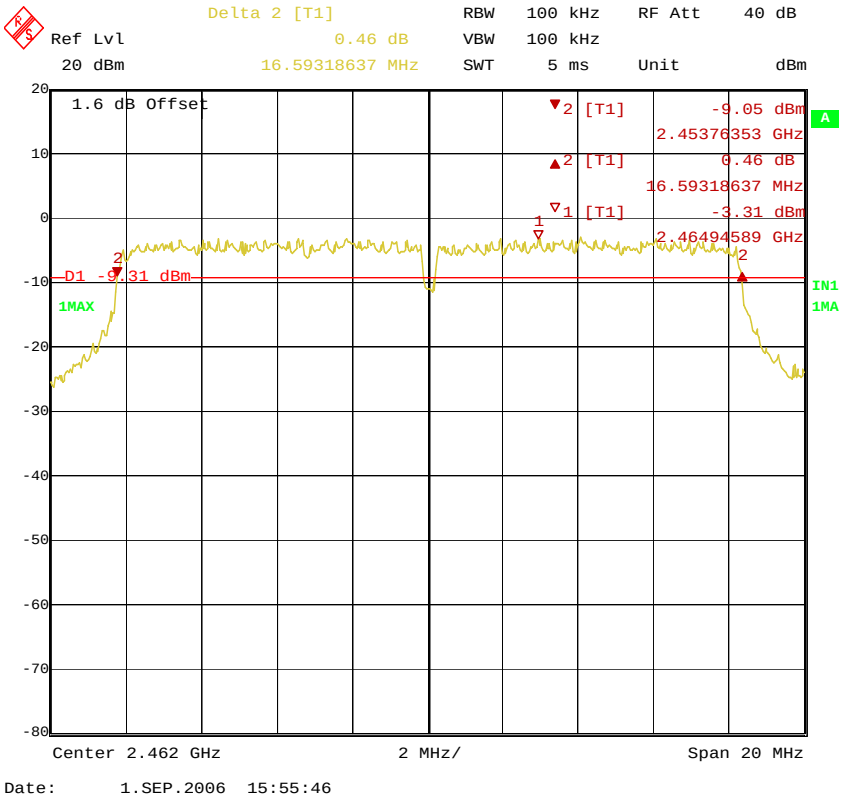

## Lowest Channel (operating at 2412 MHz): 802.11g, 9 Mbps



## Middle Channel (operating at 2437 MHz): 802.11g, 9 Mbps




## Highest Channel (operating at 2462 MHz): 802.11g, 9 Mbps



## 5.3 MAXIMUM PEAK OUTPUT POWER

### 5.3.1 Regulation

According to §15.247(b)(3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.3.2 Test Procedure

Conducted output power measurements were directly made by using Peak-Average power meter with peak power sensor.

### 5.3.3 Test Results: PASS

**Table 2: Measured values of the Maximum Peak Conducted Output Power (Conducted)**

| Modulation | Operating Frequency | Transfer Rate | AVERAGE POWER | | PEAK POWER | | Limit |
|---|---|---|---|---|---|---|---|
| | | | [dBm] | [mW] | [dBm] | [mW] | |
| 802.11b | 2412 MHz | 11 Mbps | 14.40 | 27.54 | 16.52 | 44.87 | 1 W |
| | 2437 MHz | | 14.38 | 27.41 | 16.42 | 43.85 | 1 W |
| | 2462 MHz | | 14.97 | 31.40 | 16.99 | 50.00 | 1 W |
| 802.11g | 2412 MHz | 9 Mbps | 10.90 | 12.30 | 19.16 | 82.41 | 1 W |
| | 2437 MHz | | 10.97 | 12.50 | 18.75 | 74.98 | 1 W |
| | 2462 MHz | | 11.57 | 14.35 | 19.41 | 87.29 | 1 W |

# 5.4 SPURIOUS EMISSIONS, BAND EDGE, AND RESTRICTED BANDS

## 5.4.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency (MHz) | Field strength (μV/m @ 3m) | Field strength (dBμV/m @ 3m) |
|---|---|---|
| 30–88 | 100 | 40.0 |
| 88–216 | 150 | 43.5 |
| 216–960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

### 5.4.2 Test Procedure

1) Band-edge Compliance of RF Conducted Emissions

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation
   RBW ≥ 1% of the span
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the TRILOG broadband antenna, and from 1000 MHz to 18000 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified

bandwidth.

6. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
7. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

### 5.4.3 Test Results: PASS

**Table 3: Measured values of the RF antenna port emissions (Conducted)**

| Frequency [MHz] | Reading [dBm] | Cable Loss [dB] | Actual [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|
| **IEEE 802.11b, 11Mbps** | | | | | |
| 2409.65 | 5.23 | 1.6 | 5.23 | - | |
| 2399.15 | -43.33 | 1.6 | -43.33 | -14.77 | 28.56 |
| 4824.00 | --- | | | | |
| | | | | | |
| 2434.65 | 5.34 | 1.6 | 5.34 | - | |
| 4874.00 | --- | | | | |
| | | | | | |
| 2463.50 | 5.41 | 1.6 | 5.41 | - | |
| 2483.70 | -45.59 | 1.6 | -45.59 | -14.59 | 30.00 |
| 4924.00 | --- | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| **IEEE 802.11g, 9Mbps** | | | | | |
| 2416.07 | -2.02 | 1.6 | -2.02 | - | |
| 2399.95 | -29.90 | 1.6 | -29.90 | -22.02 | 7.88 |
| 4824.00 | --- | | | | |
| | | | | | |
| 2440.07 | -1.86 | 1.6 | -1.86 | - | |
| 4874.00 | --- | | | | |
| | | | | | |
| 2464.94 | -1.62 | 1.6 | -1.62 | - | |
| 2483.62 | -40.36 | 1.6 | -40.36 | -21.62 | 18.74 |
| 4924.00 | --- | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Actual = Reading**

**Cable Loss was included in Reading as offset**

Remark "---" means the emission level was too low to be measured or in the noise floor.

**Table 4: Measured values of the Field strength of spurious emission (Radiated): 802.11b**

| Frequency [MHz] | Receiver Bandwidth [kHz] | Pol. [V/H] | Antenna Height [m] | Reading [dB(μV)] | Amp Gain [dB] | ATT [dB] | AF / CL [dB(1/m)] | Actual [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| **Quasi-peak data, emissions below 1000 MHz** | | | | | | | | | | |
| 171.86 | 120 | H | 4.0 | 48.9 | 27.4 | - | 12.8/1.4 | 35.7 | 43.5 | 7.8 |
| 180.33 | 120 | H | 4.0 | 49.8 | 27.5 | - | 11.0/1.2 | 34.5 | 43.5 | 9.0 |
| 195.95 | 120 | H | 4.0 | 51.9 | 27.4 | - | 11.0/1.3 | 36.8 | 43.5 | 6.7 |
| 251.30 | 120 | H | 4.0 | 50.3 | 27.0 | - | 11.3/1.3 | 35.9 | 46.0 | 10.1 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **AVERAGE data, emissions above 1000 MHz** | | | | | | | | | | |
| 2412.28 | 1000 | V | 1.01 | 87.55 | 44.0 | 10.2 | 28.6/5.2 | 87.55 | - | - |
| 2387.79 | 1000 | V | 1.01 | 37.47 | 44.0 | 10.2 | 28.6/5.2 | 37.47 | 54.00 | 16.53 |
| 2390.00 | 1000 | V | 1.01 | 37.31 | 44.0 | 10.2 | 28.6/5.2 | 37.31 | 54.00 | 16.69 |
| | | | | | | | | | | |
| 2437.25 | 1000 | V | 1.01 | 87.13 | 44.0 | 10.2 | 28.6/5.2 | 87.13 | - | - |
| | | | | | | | | | | |
| 2462.24 | 1000 | V | 1.01 | 87.36 | 44.0 | 10.2 | 28.6/5.2 | 87.36 | - | - |
| 2483.50 | 1000 | V | 1.01 | 37.36 | 44.0 | 10.2 | 28.6/5.2 | 37.36 | 54.00 | 16.64 |
| | | | | | | | | | | |
| **PEAK data, emissions above 1000 MHz** | | | | | | | | | | |
| 2413.38 | 1000 | V | 1.01 | 96.54 | 44.0 | 10.2 | 28.6/5.2 | 96.54 | - | - |
| 2387.79 | 1000 | V | 1.01 | 50.25 | 44.0 | 10.2 | 28.6/5.2 | 50.25 | 74.00 | 23.75 |
| 2390.00 | 1000 | V | 1.01 | 49.58 | 44.0 | 10.2 | 28.6/5.2 | 49.58 | 74.00 | 24.42 |
| | | | | | | | | | | |
| 2435.94 | 1000 | V | 1.01 | 96.42 | 44.0 | 10.2 | 28.6/5.2 | 96.42 | - | - |
| | | | | | | | | | | |
| 2463.24 | 1000 | V | 1.01 | 96.48 | 44.0 | 10.2 | 28.6/5.2 | 96.48 | - | - |
| 2483.50 | 1000 | V | 1.01 | 49.85 | 44.0 | 10.2 | 28.6/5.2 | 49.85 | 74.00 | 24.15 |
| | | | | | | | | | | |

**Margin (dB) = Limit – Actual**

**[Actual = Reading – Amp Gain + Attenuator + AF + CL]**

1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuator (10dB pad), AF/CL = Antenna Factor and Cable Loss

Remark "---" means the emission level was too low to be measured or in the noise floor.

NOTE: The spectrum was scanned from 30 MHz to 18 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

| Measured values of the Field strength of spurious emission (Radiated): 802.11g | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency [MHz] | Receiver Bandwidth [kHz] | Pol. [V/H] | Antenna Height [m] | Reading [dB(μV)] | Amp Gain [dB] | ATT [dB] | AF / CL [dB(1/m)] | Actual [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
| **Quasi-peak data, emissions below 1000 MHz** | | | | | | | | | | |
| 171.86 | 120 | H | 4.0 | 48.9 | 27.4 | - | 12.8/1.4 | 35.7 | 43.5 | 7.8 |
| 180.33 | 120 | H | 4.0 | 49.8 | 27.5 | - | 11.0/1.2 | 34.5 | 43.5 | 9.0 |
| 195.95 | 120 | H | 4.0 | 51.9 | 27.4 | - | 11.0/1.3 | 36.8 | 43.5 | 6.7 |
| 251.30 | 120 | H | 4.0 | 50.3 | 27.0 | - | 11.3/1.3 | 35.9 | 46.0 | 10.1 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **AVERAGE data, emissions above 1000 MHz** | | | | | | | | | | |
| 2414.48 | 1000 | H | 1.01 | 80.80 | 44.0 | 10.2 | 28.6/5.2 | 80.80 | - | - |
| 2390.00 | 1000 | H | 1.01 | 39.09 | 44.0 | 10.2 | 28.6/5.2 | 39.09 | 54.00 | 14.91 |
| | | | | | | | | | | |
| 2434.94 | 1000 | H | 1.01 | 80.73 | 44.0 | 10.2 | 28.6/5.2 | 80.73 | - | - |
| | | | | | | | | | | |
| 2468.85 | 1000 | H | 1.01 | 80.81 | 44.0 | 10.2 | 28.6/5.2 | 80.81 | - | - |
| 2483.50 | 1000 | H | 1.01 | 42.17 | 44.0 | 10.2 | 28.6/5.2 | 42.17 | 54.00 | 11.83 |
| | | | | | | | | | | |
| **PEAK data, emissions above 1000 MHz** | | | | | | | | | | |
| 2410.30 | 1000 | H | 1.01 | 91.74 | 44.0 | 10.2 | 28.6/5.2 | 91.74 | - | - |
| 2390.00 | 1000 | H | 1.01 | 56.69 | 44.0 | 10.2 | 28.6/5.2 | 56.69 | 74.00 | 17.31 |
| | | | | | | | | | | |
| 2435.14 | 1000 | H | 1.01 | 91.90 | 44.0 | 10.2 | 28.6/5.2 | 91.90 | - | - |
| | | | | | | | | | | |
| 2465.85 | 1000 | H | 1.01 | 91.63 | 44.0 | 10.2 | 28.6/5.2 | 91.63 | - | - |
| 2483.50 | 1000 | H | 1.01 | 61.34 | 44.0 | 10.2 | 28.6/5.2 | 61.34 | 74.00 | 12.66 |
| | | | | | | | | | | |

**Margin (dB) = Limit – Actual**

**[Actual = Reading – Amp Gain + Attenuator + AF + CL]**

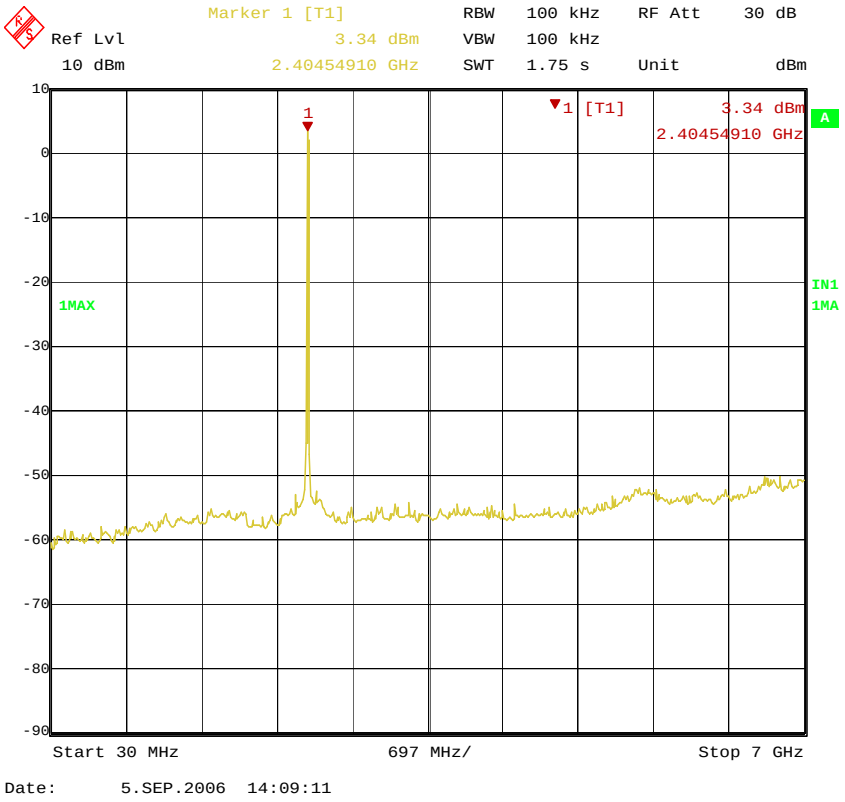
1. H = Horizontal, V = Vertical Polarization
2. ATT = Attenuator (10dB pad), AF/CL = Antenna Factor and Cable Loss

Remark "---" means the emission level was too low to be measured or in the noise floor.

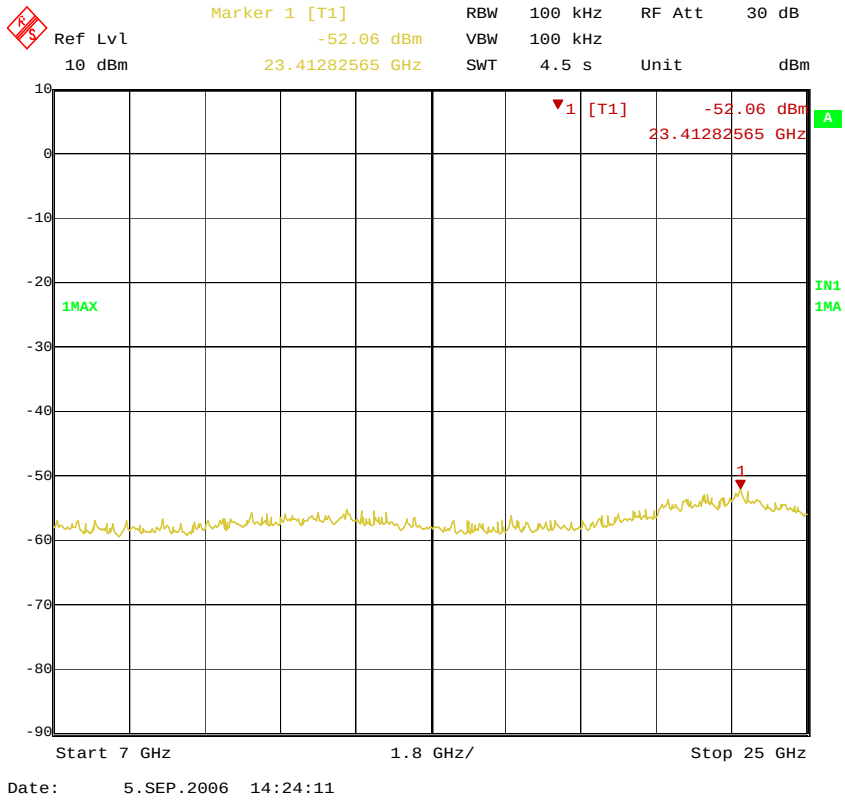
NOTE: The spectrum was scanned from 30 MHz to 18 GHz. All emissions not reported were more than 20 dB below the specified limit or in the noise floor.

## Figure 2. Plot of the RF antenna port emissions (Conducted)

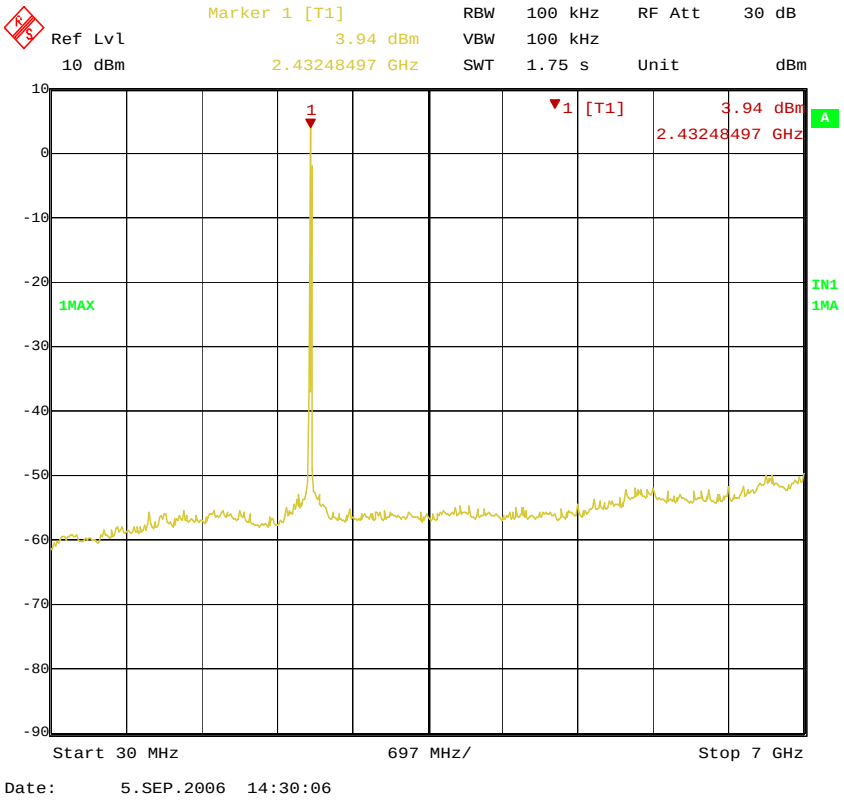
### Lowest Channel (operating at 2412 MHz): 30 MHz ~ 7 GHz (802.11b, 11Mbps)



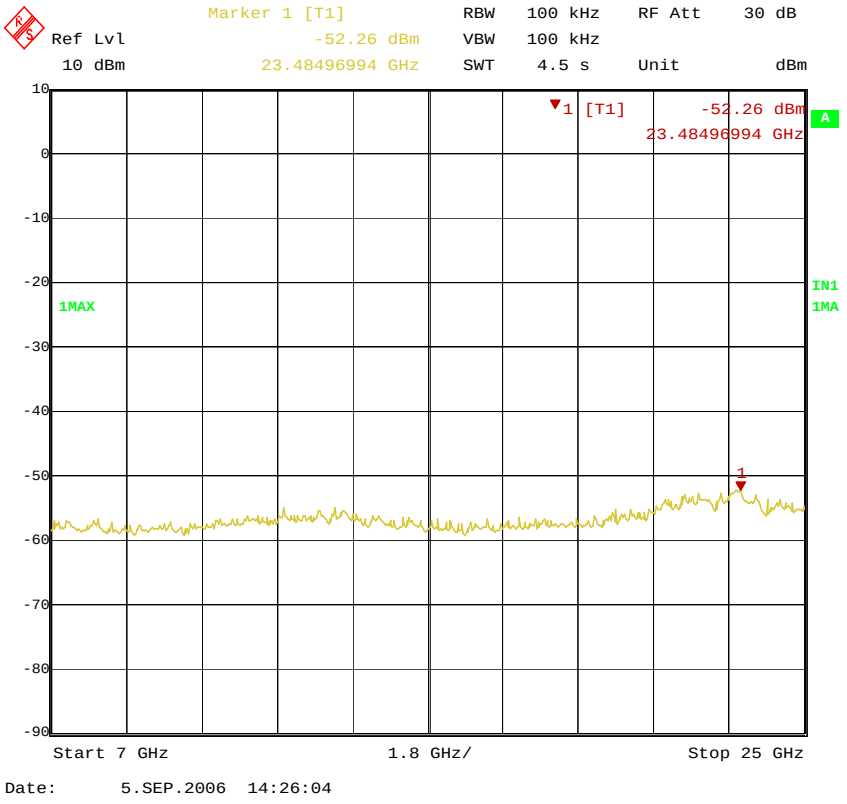

### Lowest Channel (operating at 2412 MHz): 7 GHz ~ 25 GHz (802.11b, 11Mbps)



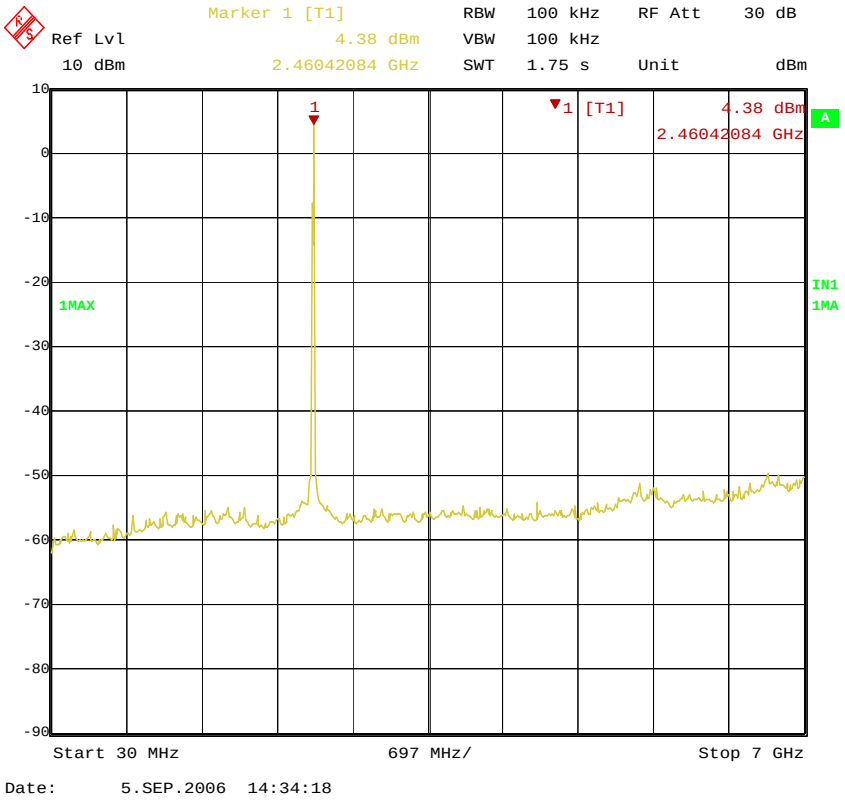
## Middle Channel (operating at 2437 MHz): 30 MHz ~ 7 GHz (802.11b, 11Mbps)



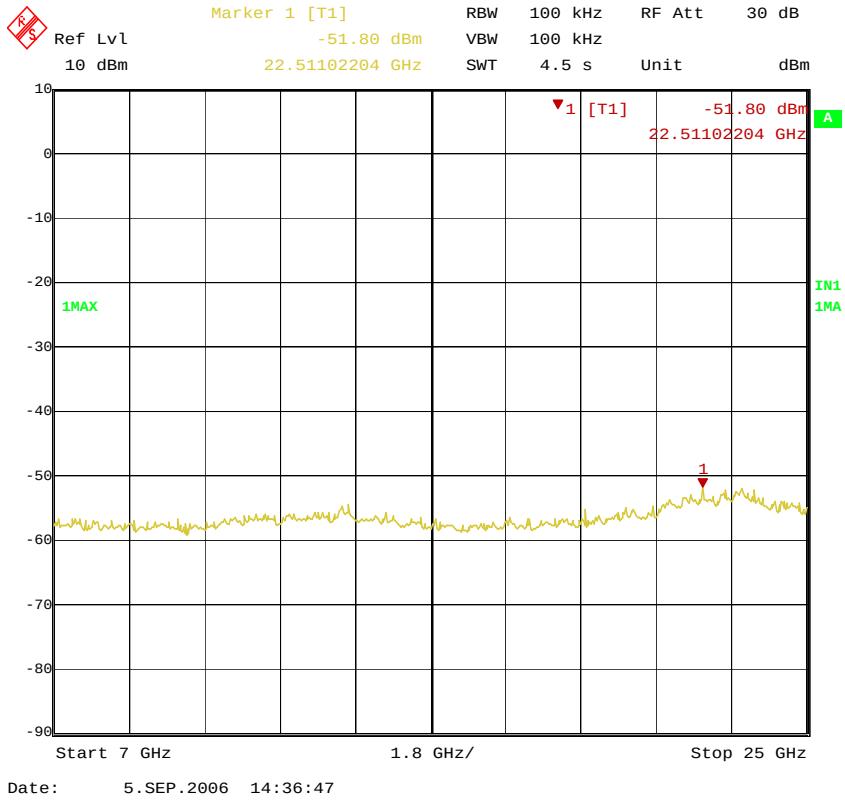

## Middle Channel (operating at 2437 MHz): 7 GHz ~ 25 GHz (802.11b, 11Mbps)



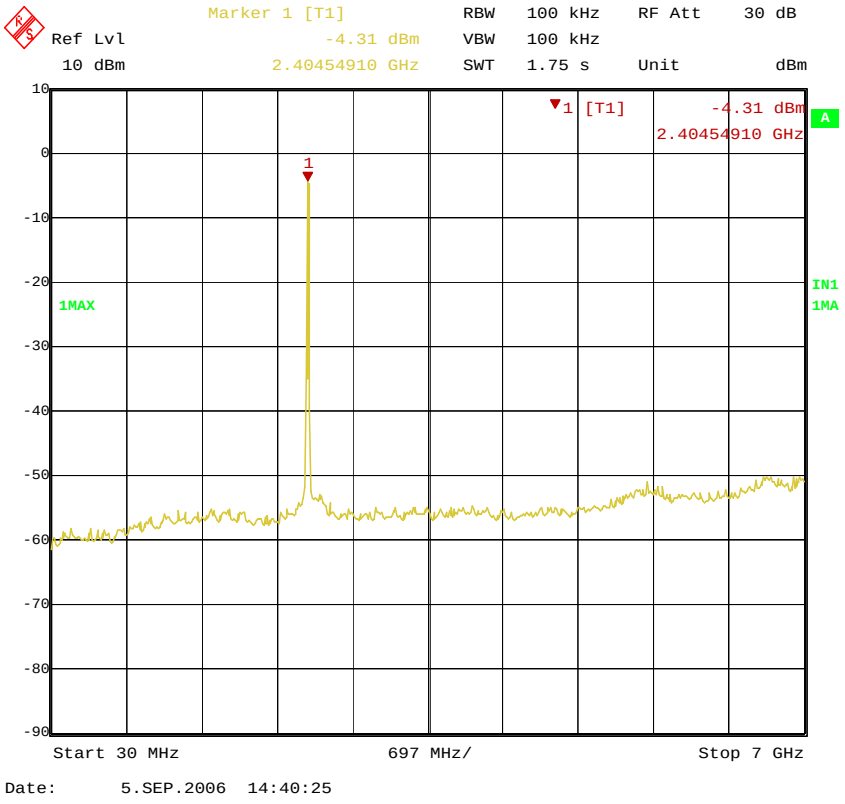
## Highest Channel (operating at 2462 MHz): 30 MHz ~ 7 GHz (802.11b, 11Mbps)



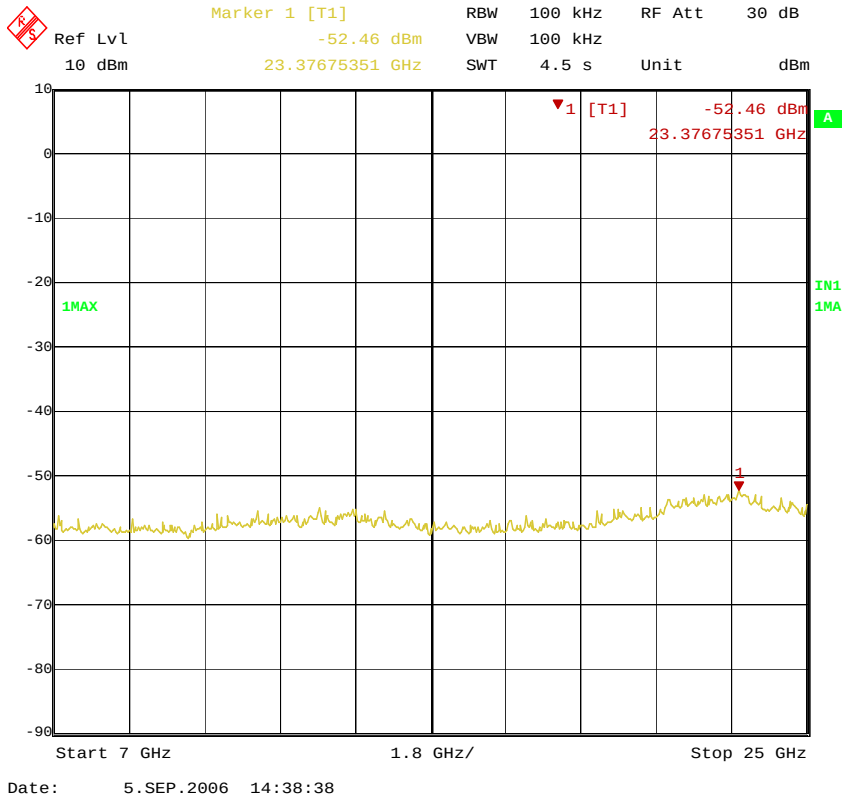

## Highest Channel (operating at 2462 MHz): 7 GHz ~ 25 GHz (802.11b, 11Mbps)



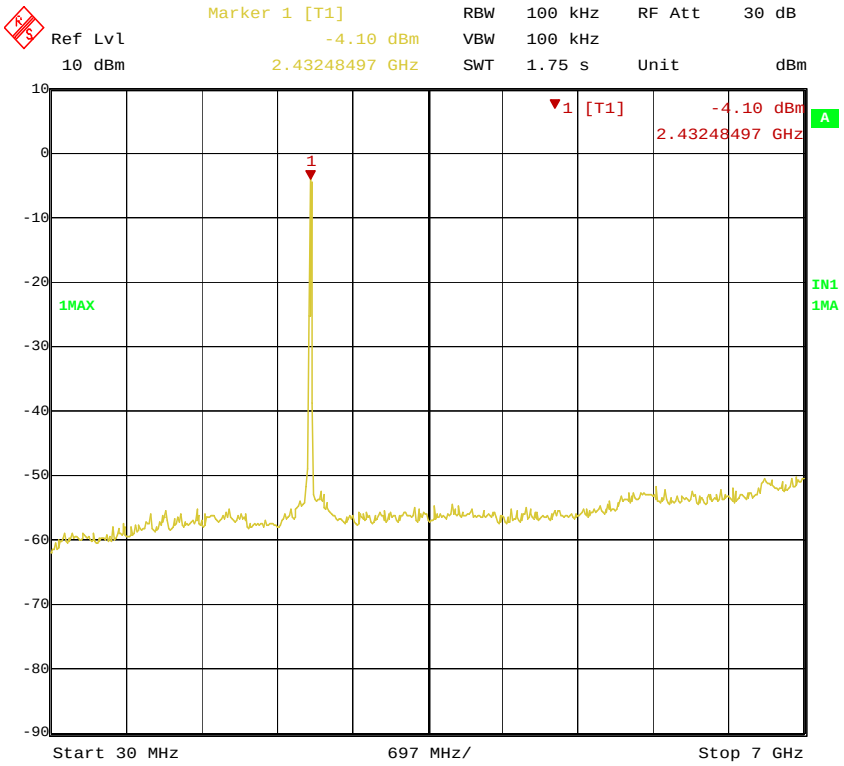
## Lowest Channel (operating at 2412 MHz): 30 MHz ~ 7 GHz (802.11g, 9Mbps)




## Lowest Channel (operating at 2412 MHz): 7 GHz ~ 25 GHz (802.11g, 9Mbps)

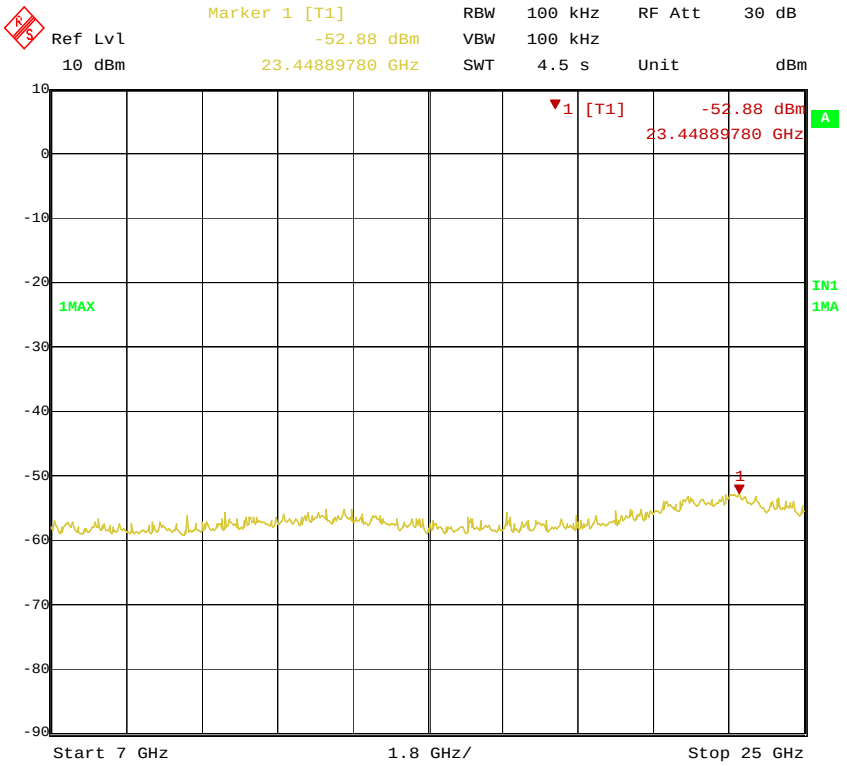


## Middle Channel (operating at 2437 MHz): 30 MHz ~ 7 GHz (802.11g, 9Mbps)



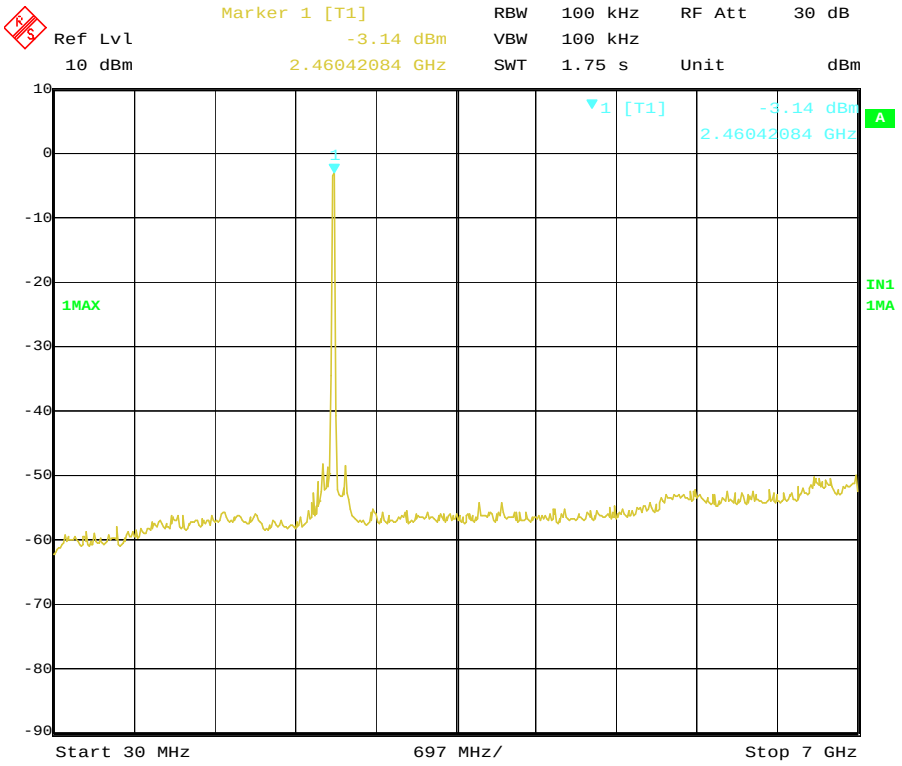

Date: 5.SEP.2006 14:44:16

## Middle Channel (operating at 2437 MHz): 7 GHz ~ 25 GHz (802.11g, 9Mbps)



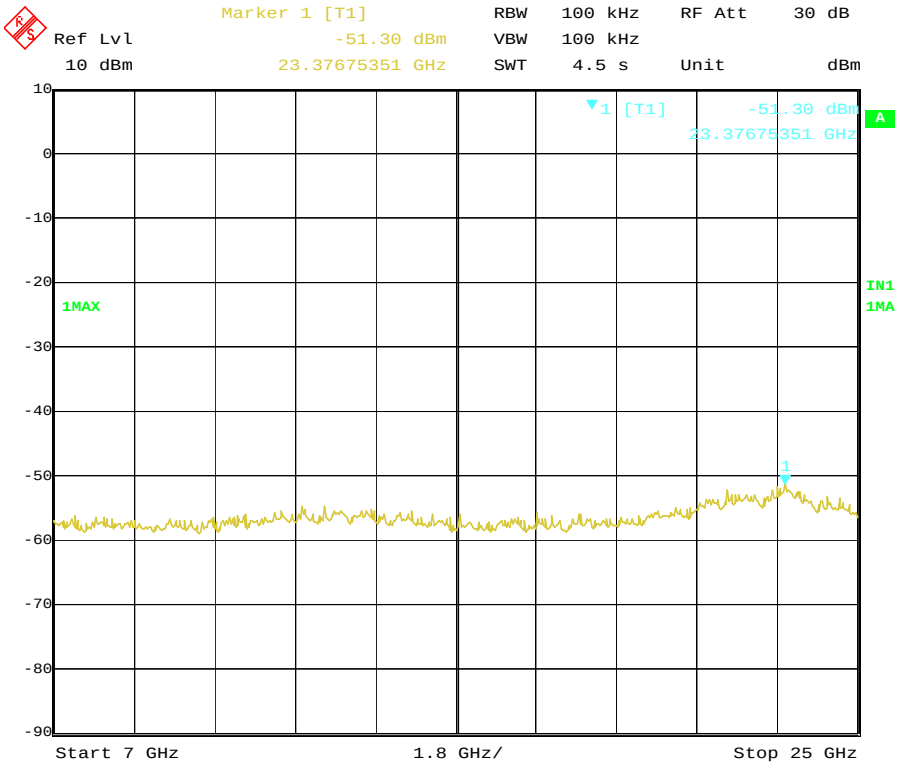

Date: 5.SEP.2006 14:45:23

## Highest Channel (operating at 2462 MHz): 30 MHz ~ 7 GHz (802.11g, 9Mbps)




Date: 24.JAN.2006 13:16:18

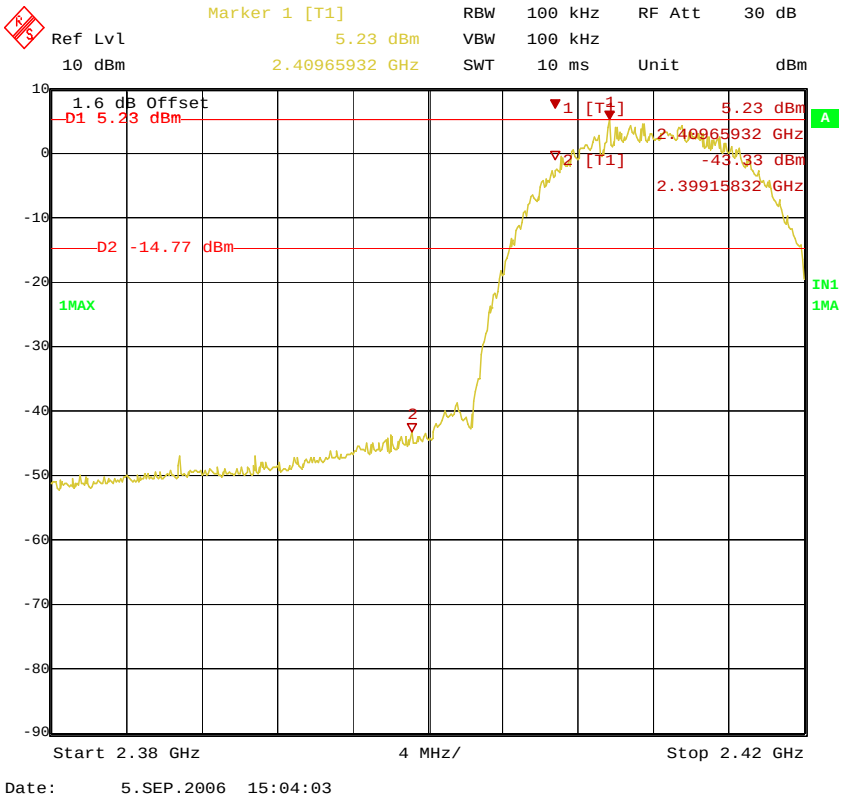
## Highest Channel (operating at 2462 MHz): 7 GHz ~ 25 GHz (802.11g, 9Mbps)



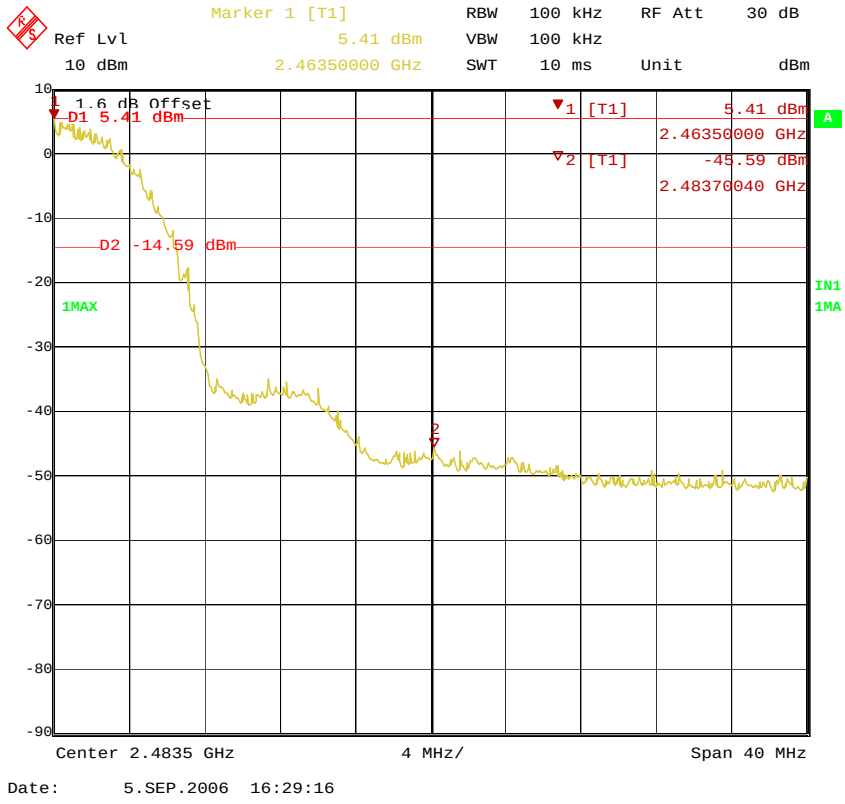

Date: 24.JAN.2006 13:17:11

## Figure 3. Plot of the Band Edge (Conducted)

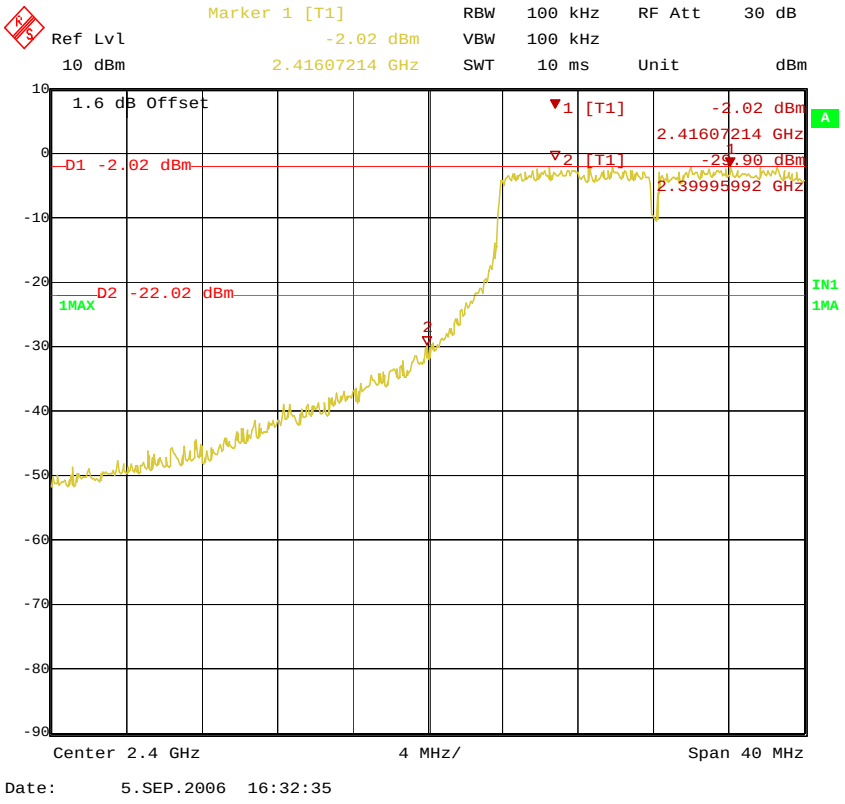
### Lowest Channel (operating at 2412 MHz): 802.11b, 11Mbps



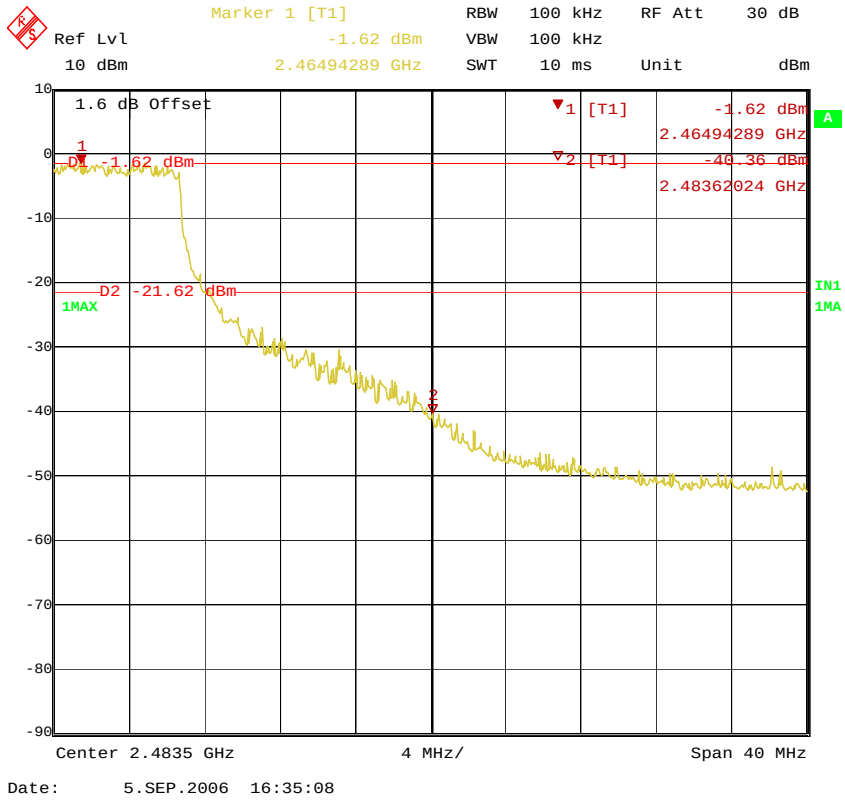

### Highest Channel (operating at 2462 MHz): 802.11b, 11Mbps



## Lowest Channel (operating at 2412 MHz): 802.11g, 9Mbps

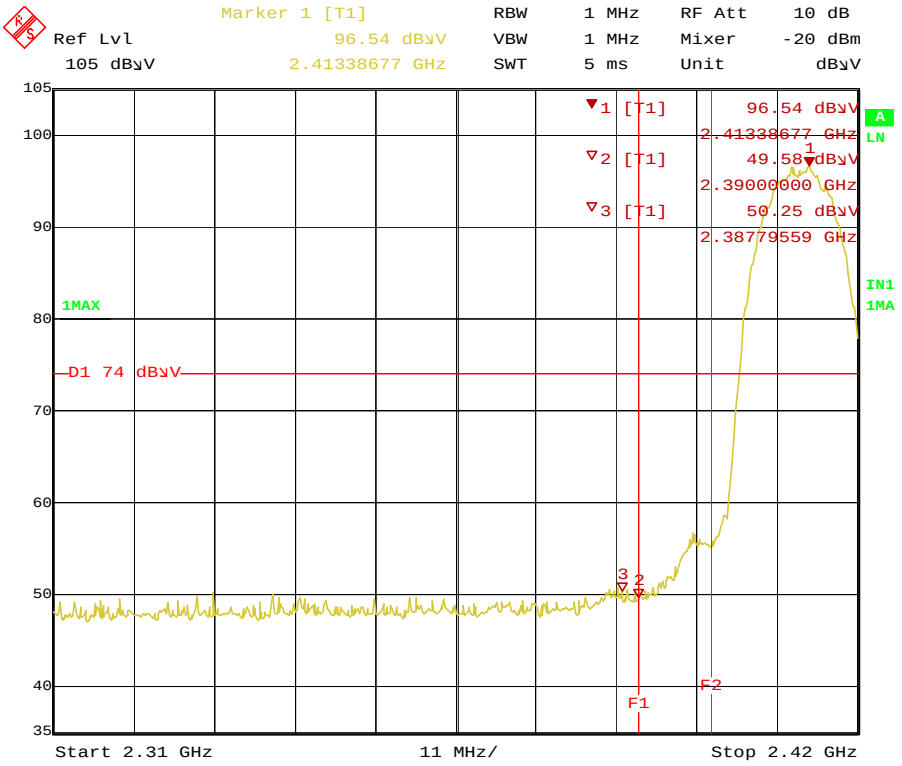



## Highest Channel (operating at 2462 MHz): 802.11g, 9Mbps

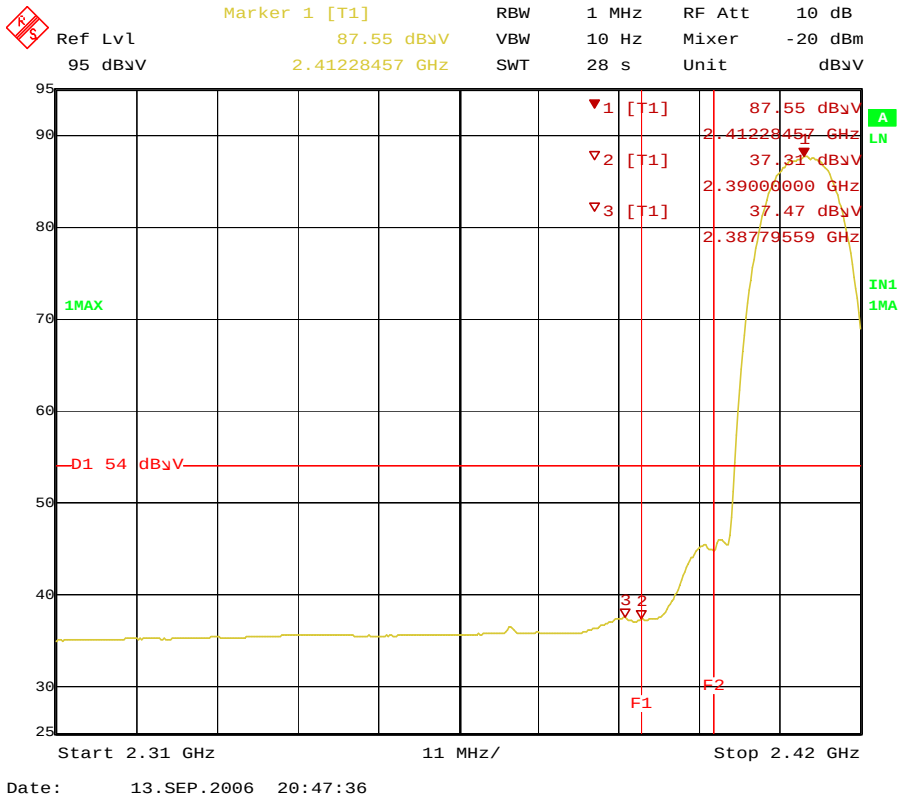


## Figure 4. Plot of the Band Edge (Radiated)

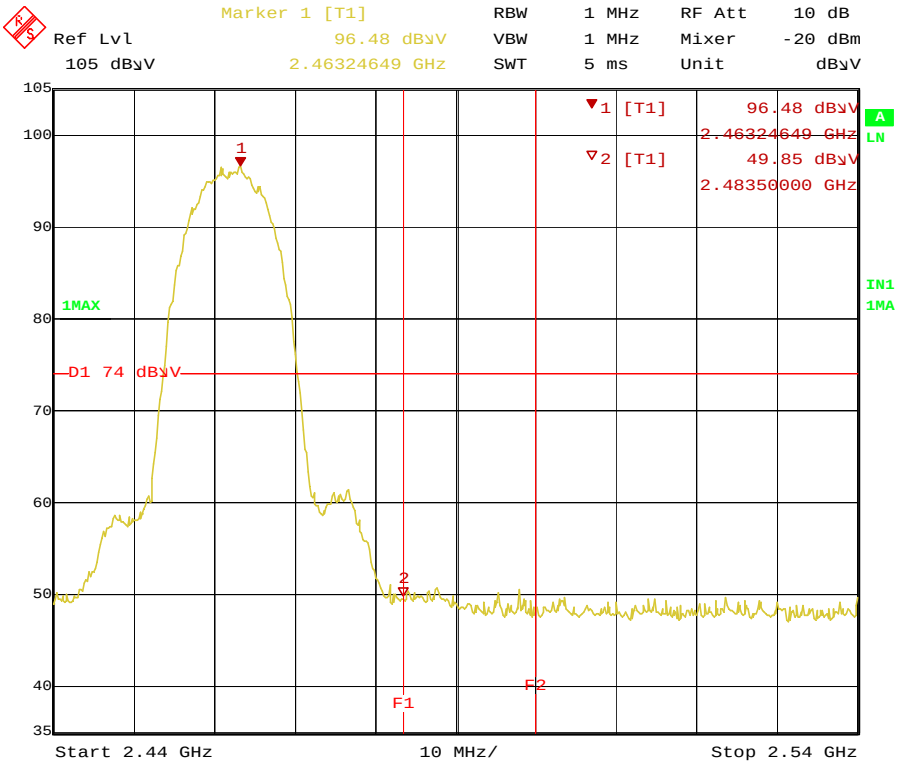
### Lowest Channel (operating at 2412 MHz): PEAK (802.11b, 11Mbps)



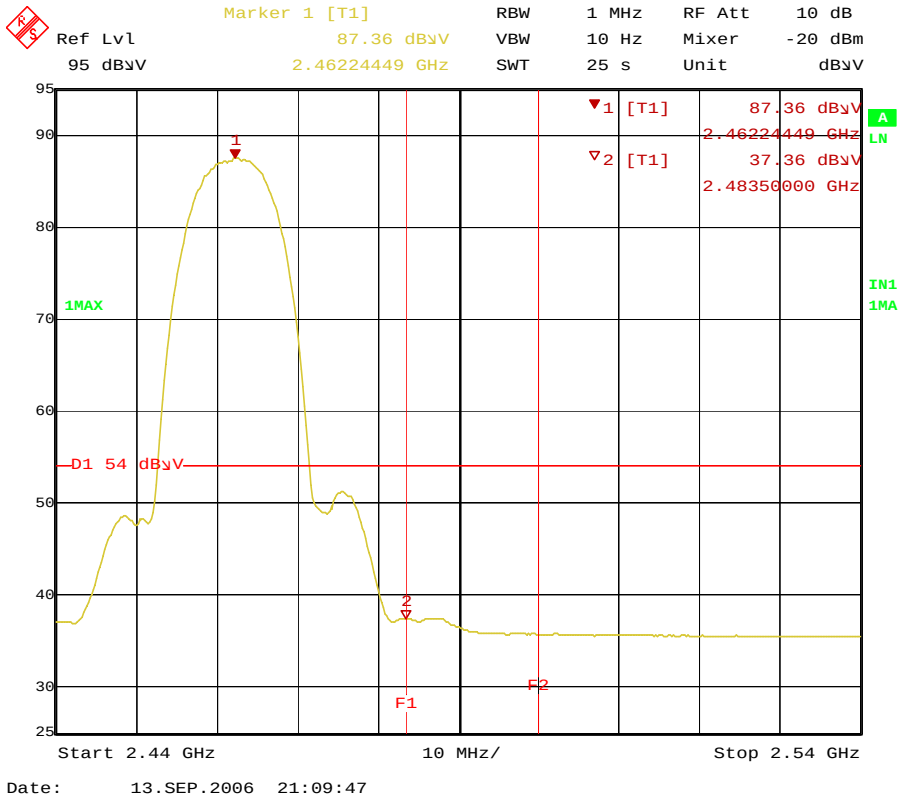

### Lowest Channel (operating at 2412 MHz): AVERAGE (802.11b, 11Mbps)



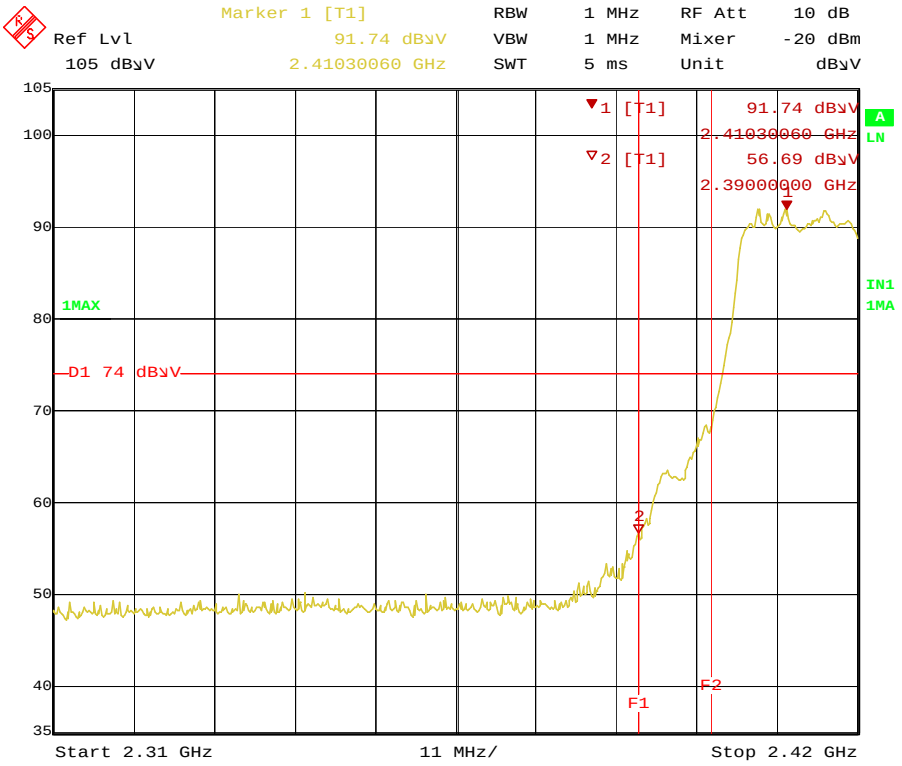
## Highest Channel (operating at 2462 MHz): PEAK (802.11b, 11Mbps)



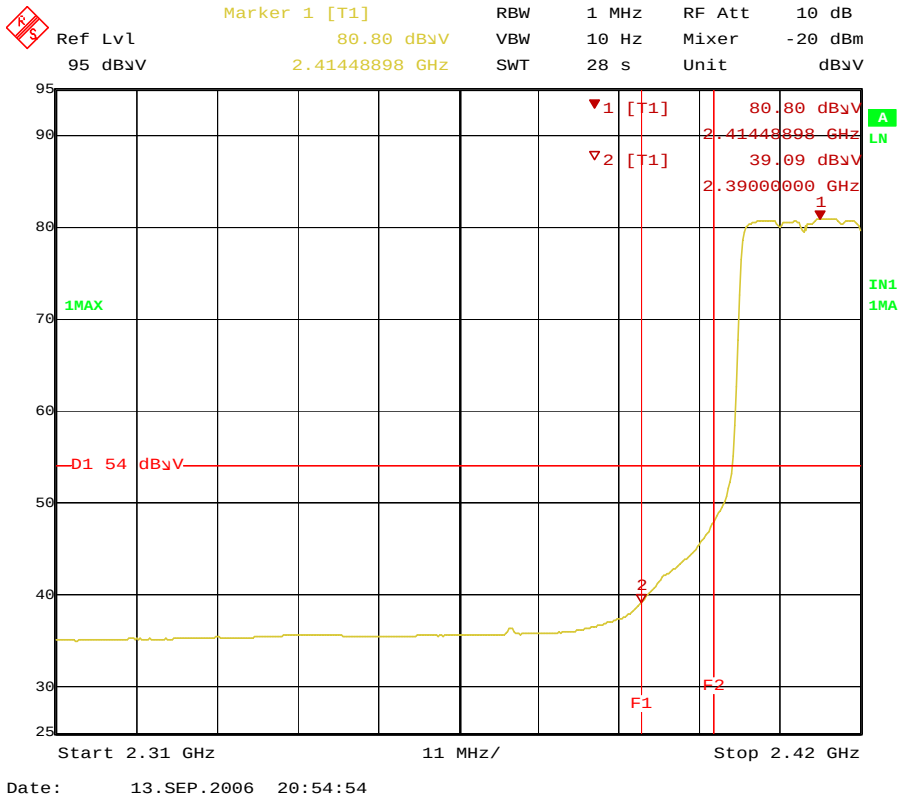

## Highest Channel (operating at 2462 MHz): AVERAGE (802.11b, 11Mbps)



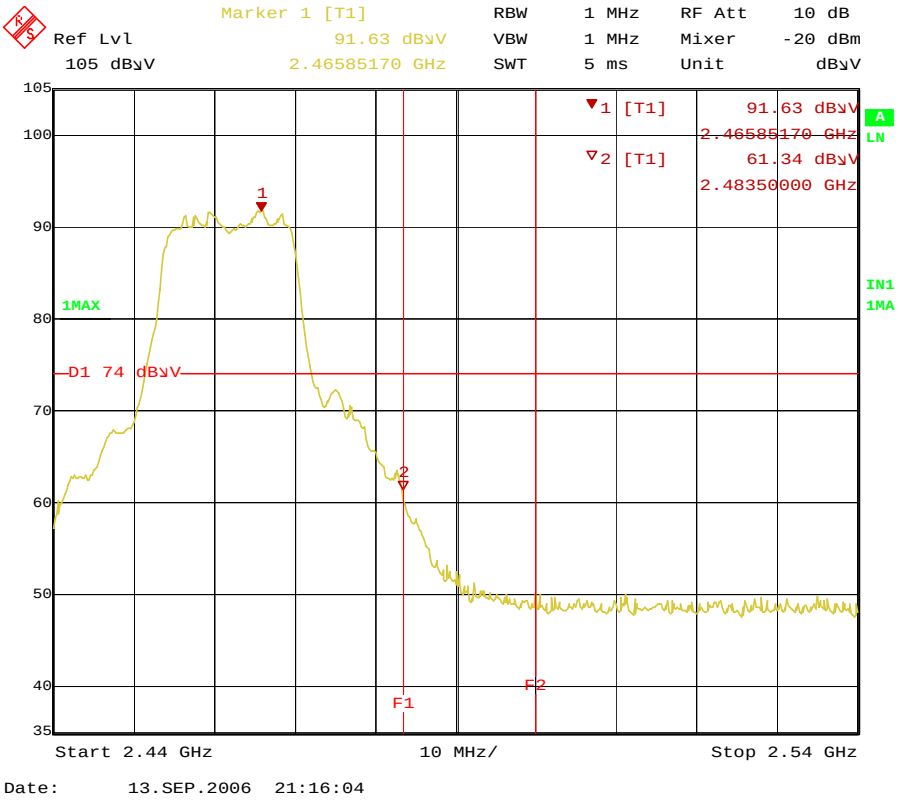
## Lowest Channel (operating at 2412 MHz): PEAK (802.11g, 9Mbps)



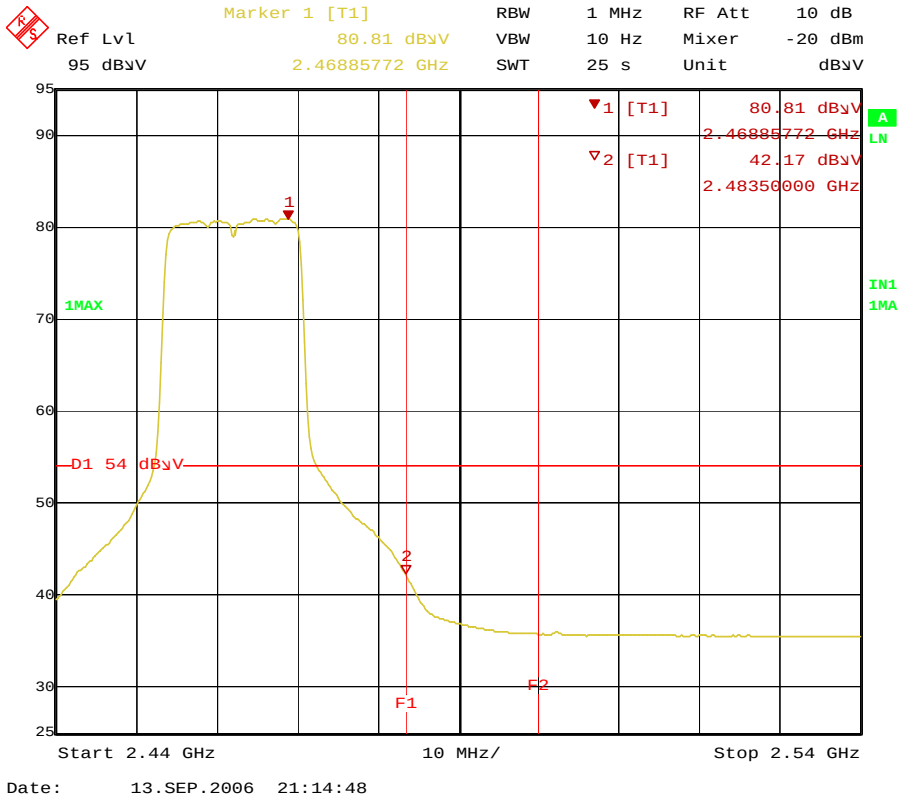

## Lowest Channel (operating at 2412 MHz): AVERAGE (802.11g, 9Mbps)



## Highest Channel (operating at 2462 MHz): PEAK (802.11g, 9Mbps)




## Highest Channel (operating at 2462 MHz): AVERAGE (802.11g, 9Mbps)



## 5.5 PEAK POWER SPECTRAL DENSITY

### 5.5.1 Regulation

According to §15.247(e) 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 5.5.2 Test Procedure

1. Connect the antenna port of the EUT to RF input on the spectrum analyzer via a low loss cable.
2. Locate and zoom in on emission peak(s) within the passband.
3. Set RBW = 3 kHz, VBW = 10 kHz, Span = 1.5 MHz, and Sweep = 500 seconds.
4. Measure the highest amplitude appearing on spectral display and record the level to calculate results.
5. Repeat above procedures until all frequencies measured were complete.

### 5.5.3 Test Results: PASS

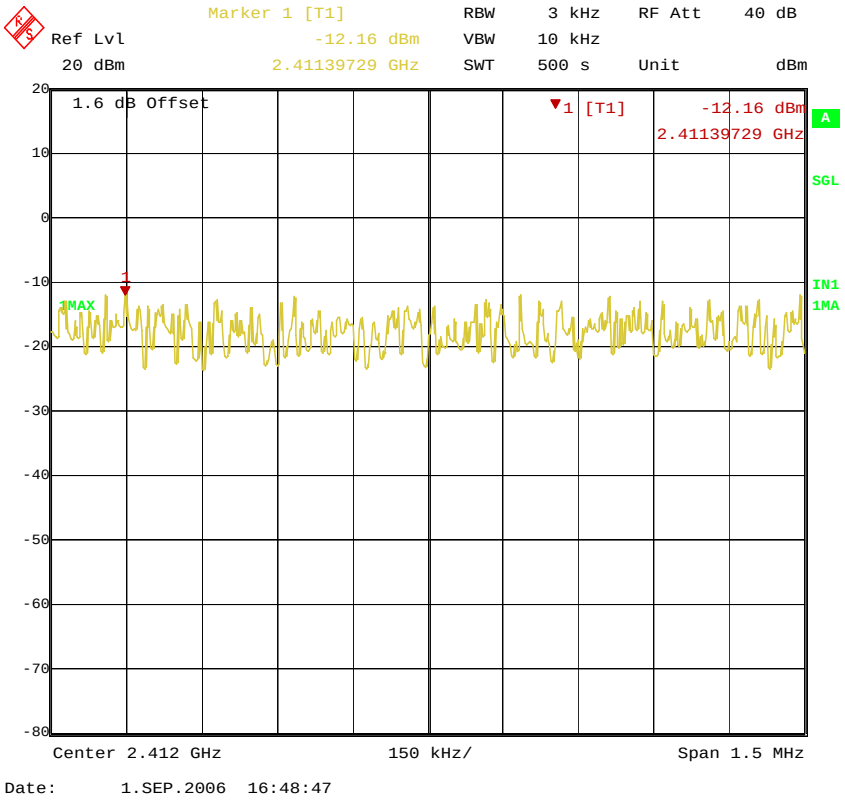
**Table 5: Measured values of the Peak Power Spectral Density (Conducted)**

| Modulation | Operating frequency | Transfer Rate | Cable Loss | Reading (PPSD) | Limit |
|---|---|---|---|---|---|
| 802.11b | 2412 MHz | 11Mbps | 1.6 | -12.16 dBm | 8.0 dBm |
| | 2437 MHz | 11Mbps | 1.6 | -11.85 dBm | 8.0 dBm |
| | 2462 MHz | 11Mbps | 1.6 | -11.34 dBm | 8.0 dBm |
| 802.11g | 2412 MHz | 9Mbps | 1.6 | -16.45 dBm | 8.0 dBm |
| | 2437 MHz | 9Mbps | 1.6 | -15.83 dBm | 8.0 dBm |
| | 2462 MHz | 9Mbps | 1.6 | -15.40 dBm | 8.0 dBm |

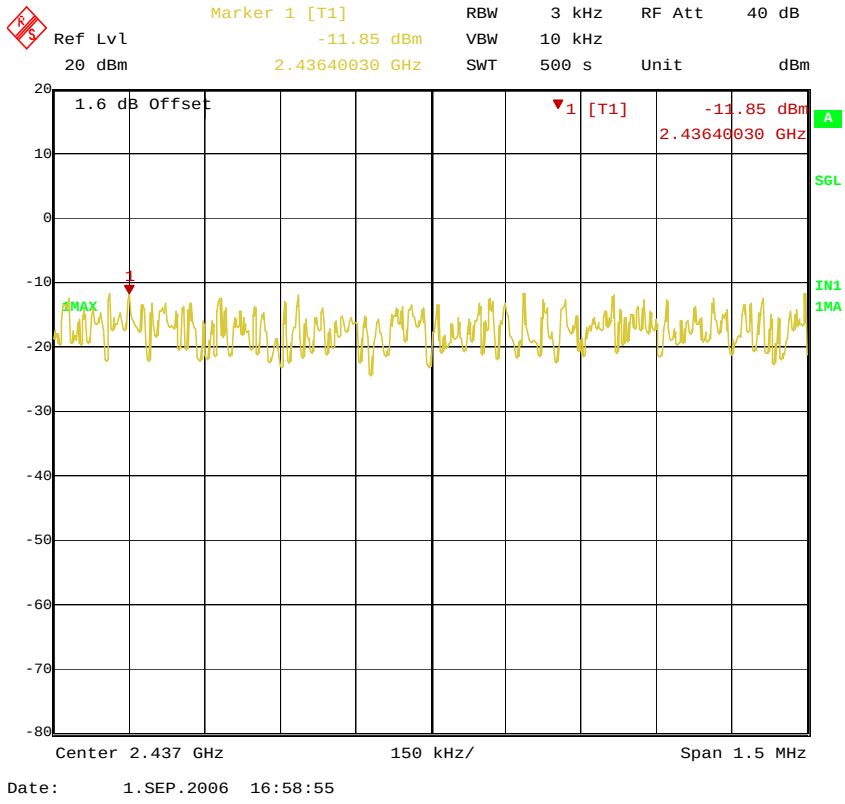
**Cable Loss was included in Reading as Offset**

## Figure 5. Plot of the Peak Power Spectral Density (Conducted)

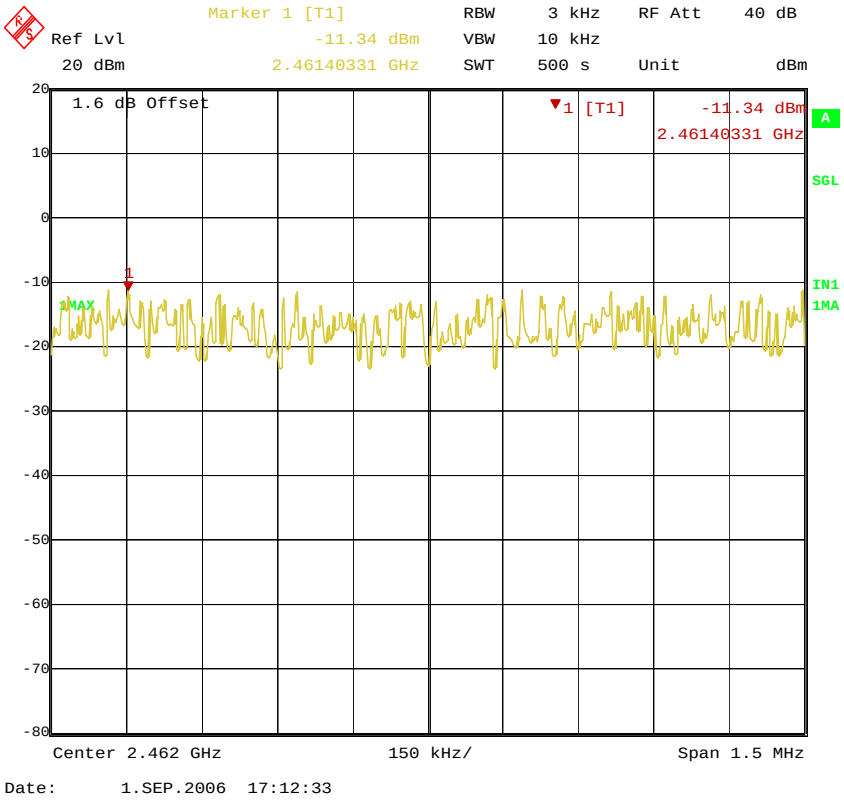
### Lowest Channel (operating at 2412 MHz): 802.11b, 11Mbps



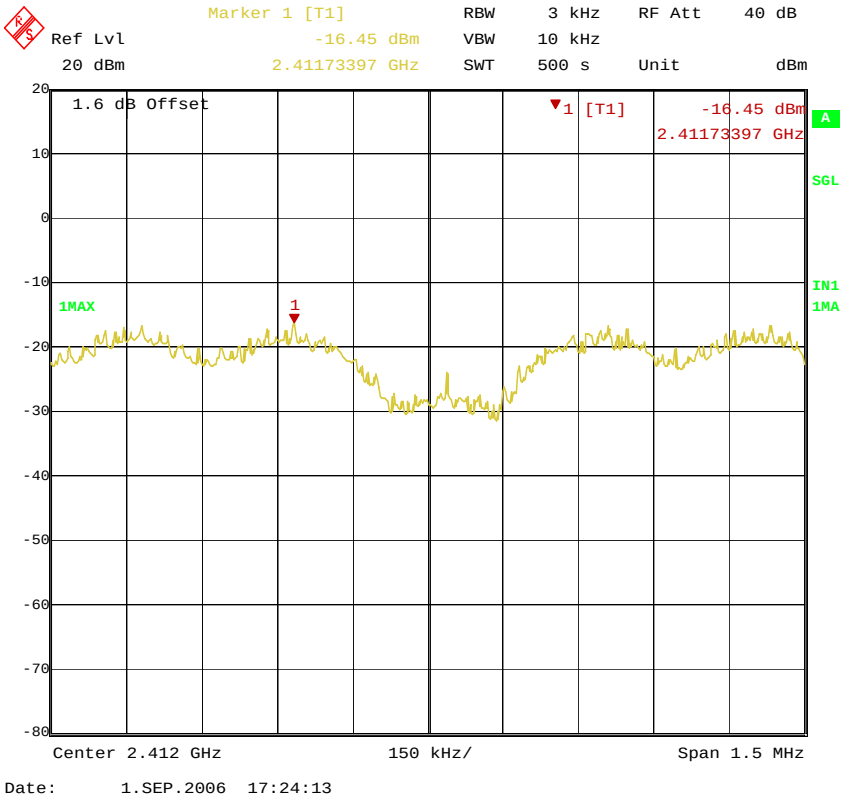

### Middle Channel (operating at 2437 MHz): 802.11b, 11Mbps



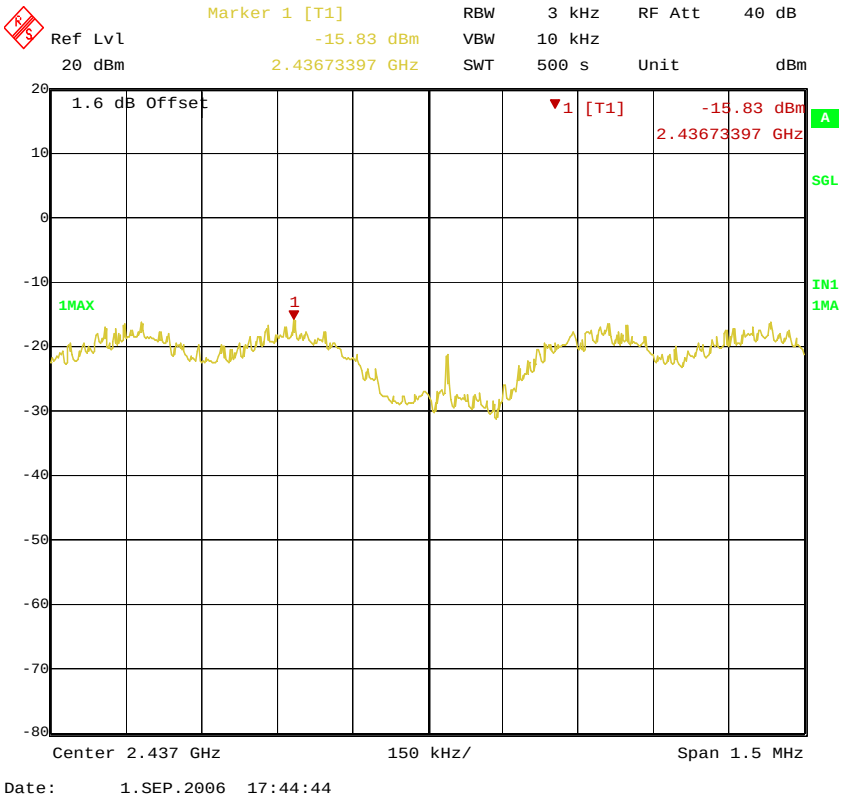
## Highest Channel (operating at 2462 MHz): 802.11b, 11Mbps



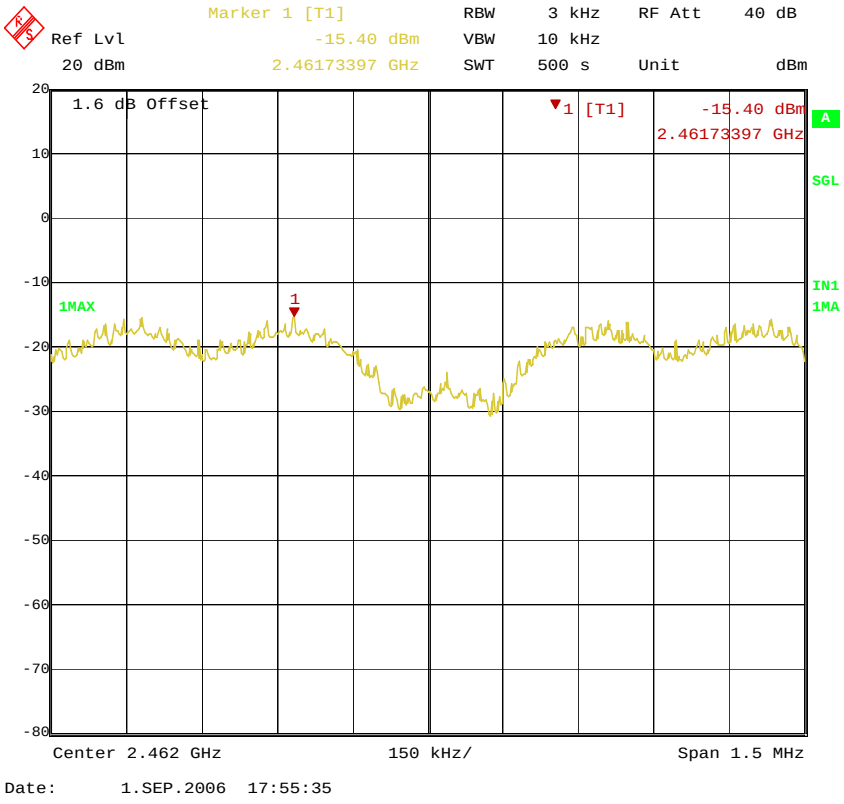

## Lowest Channel (operating at 2412 MHz): 802.11g, 9Mbps



## Middle Channel (operating at 2437 MHz): 802.11g, 9Mbps




## Highest Channel (operating at 2462 MHz): 802.11g, 9Mbps



# 5.6 CONDUCTED EMISSIONS

## 5.6.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of emission (MHz) | Conducted limit (dBμV) | |
|---|---|---|
| | Qausi-peak | Average |
| 0.15 – 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

## 5.6.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

**5.6.3 Test Results:** **PASS**

**Table 6: Measured values of the Conducted Emissions**
- Adaptor Only: **Transmitting at 2437 MHz**

| Frequency [MHz] | Reading [dBμV] | L / N | CF [dB] | CL [dB] | Actual [dBμV] | Limit [dBμV] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| **QUASI-PEAK DATA** | | | | | | | |
| 0.200 | 41.64 | N | 0.12 | 0.02 | 41.78 | 63.61 | 21.83 |
| 0.265 | 34.69 | N | 0.12 | 0.02 | 34.83 | 61.27 | 26.44 |
| 0.460 | 30.46 | N | 0.12 | 0.04 | 30.62 | 56.69 | 26.07 |
| 0.465 | 33.89 | L | 0.13 | 0.04 | 34.06 | 56.60 | 22.54 |
| 0.530 | 31.76 | N | 0.12 | 0.04 | 31.92 | 56.00 | 24.08 |
| 0.595 | 35.90 | L | 0.14 | 0.05 | 36.09 | 56.00 | 19.91 |
| 2.590 | 29.22 | N | 0.15 | 0.11 | 29.48 | 56.00 | 26.52 |
| 5.975 | 25.34 | L | 0.24 | 0.16 | 25.74 | 60.00 | 34.26 |
| 6.250 | 25.83 | N | 0.29 | 0.19 | 26.31 | 60.00 | 33.69 |
| 22.955 | 32.13 | N | 0.86 | 0.40 | 33.39 | 60.00 | 26.61 |
| 24.565 | 27.41 | L | 1.18 | 0.41 | 29.00 | 60.00 | 31.00 |
| 29.020 | 28.68 | L | 1.15 | 0.44 | 30.27 | 60.00 | 29.73 |
| | | | | | | | |
| **AVERAGE DATA** | | | | | | | |
| 0.200 | 36.05 | L | 0.13 | 0.02 | 36.20 | 53.61 | 17.41 |
| 0.265 | 27.27 | L | 0.13 | 0.02 | 27.42 | 51.27 | 23.85 |
| 0.460 | 28.10 | N | 0.12 | 0.04 | 28.26 | 46.69 | 18.43 |
| 0.465 | 31.09 | L | 0.13 | 0.04 | 31.26 | 46.60 | 15.34 |
| 0.530 | 29.36 | N | 0.12 | 0.04 | 29.52 | 46.00 | 16.48 |
| 0.595 | 33.47 | L | 0.14 | 0.05 | 33.66 | 46.00 | 12.34 |
| 2.590 | 24.30 | N | 0.15 | 0.11 | 24.56 | 46.00 | 21.44 |
| 6.250 | 13.94 | N | 0.29 | 0.19 | 14.42 | 50.00 | 35.58 |
| 22.955 | 26.68 | N | 0.86 | 0.40 | 27.94 | 50.00 | 22.06 |
| 24.565 | 21.76 | L | 1.18 | 0.41 | 23.35 | 50.00 | 26.65 |
| 29.020 | 23.31 | L | 1.15 | 0.44 | 24.90 | 50.00 | 25.10 |
| | | | | | | | |

**Margin (dB) = Limit – Actual**
**[Actual = Reading + CF + CL]**
1. Remark "---" means the level is undetectable or the Qausi-peak value is lower than the limit of Average.
2. CF/CL = Correction Factor and Cable Loss
3. Qp = Quasi-peak, Avg = Average value

NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

**Measured values of the Conducted Emissions**
- Adaptor with Cradle: **Transmitting at 2437 MHz**

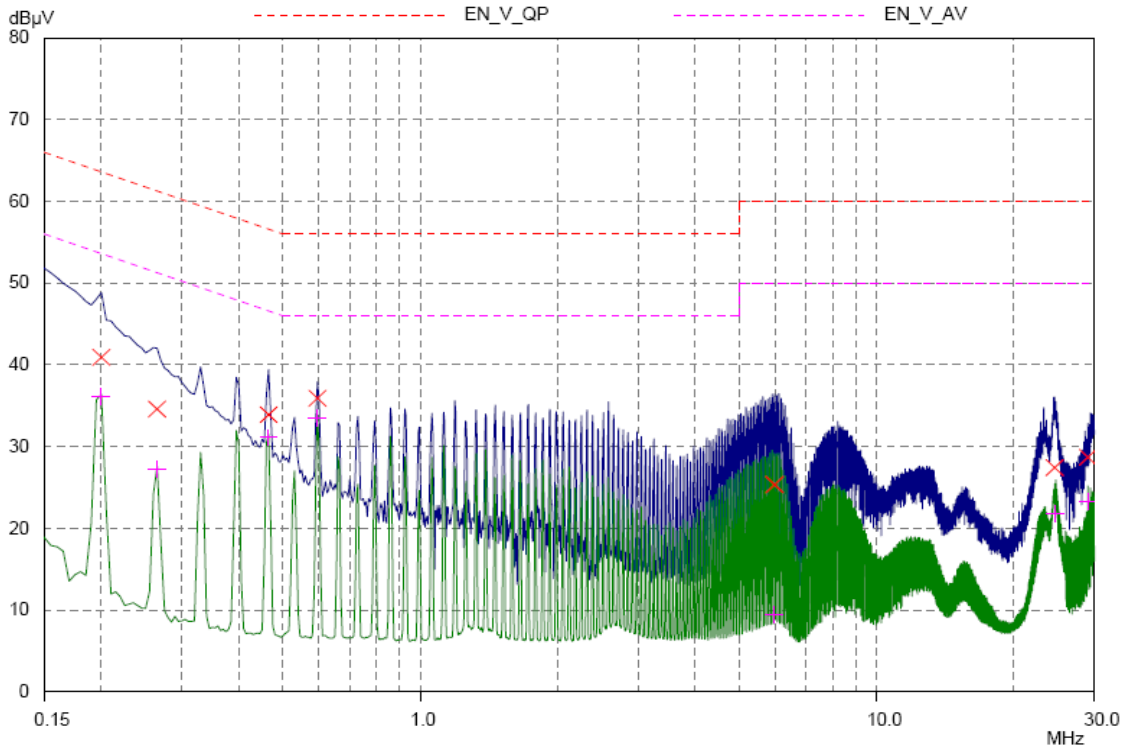
| Frequency [MHz] | Reading [dBμV] | L / N | CF [dB] | CL [dB] | Actual [dBμV] | Limit [dBμV] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| **QUASI-PEAK DATA** | | | | | | | |
| 0.200 | 41.26 | N | 0.12 | 0.02 | 41.40 | 63.61 | 22.21 |
| 0.265 | 35.03 | N | 0.12 | 0.02 | 35.17 | 61.27 | 26.10 |
| 0.395 | 35.07 | L | 0.13 | 0.04 | 35.24 | 57.96 | 22.72 |
| 0.460 | 34.03 | L | 0.13 | 0.04 | 34.20 | 56.69 | 22.49 |
| 0.465 | 33.13 | N | 0.12 | 0.04 | 33.29 | 56.60 | 23.31 |
| 0.595 | 36.92 | L | 0.14 | 0.05 | 37.11 | 56.00 | 18.89 |
| 2.585 | 33.53 | N | 0.15 | 0.11 | 33.79 | 56.00 | 22.21 |
| 6.040 | 33.46 | L | 0.34 | 0.19 | 33.99 | 60.00 | 26.01 |
| 6.110 | 21.58 | N | 0.29 | 0.19 | 22.06 | 60.00 | 37.94 |
| 24.565 | 28.55 | N | 0.89 | 0.41 | 29.85 | 60.00 | 30.15 |
| 24.635 | 27.81 | L | 1.18 | 0.41 | 29.40 | 60.00 | 30.60 |
| 29.000 | 28.49 | L | 1.15 | 0.44 | 30.08 | 60.00 | 29.92 |
| | | | | | | | |
| **AVERAGE DATA** | | | | | | | |
| 0.200 | 36.28 | L | 0.13 | 0.02 | 36.43 | 53.61 | 17.18 |
| 0.265 | 25.38 | N | 0.12 | 0.02 | 25.52 | 51.27 | 25.75 |
| 0.395 | 31.92 | L | 0.13 | 0.04 | 32.09 | 47.96 | 15.87 |
| 0.460 | 31.14 | L | 0.13 | 0.04 | 31.31 | 46.69 | 15.38 |
| 0.465 | 30.72 | N | 0.12 | 0.04 | 30.88 | 46.60 | 15.72 |
| 0.595 | 34.79 | L | 0.14 | 0.05 | 34.98 | 46.00 | 11.02 |
| 2.585 | 28.60 | N | 0.15 | 0.11 | 28.86 | 46.00 | 17.14 |
| 6.040 | 23.09 | L | 0.34 | 0.19 | 23.62 | 50.00 | 26.38 |
| 24.565 | 22.45 | N | 0.89 | 0.41 | 23.75 | 50.00 | 26.25 |
| 24.635 | 21.62 | L | 1.18 | 0.41 | 23.21 | 50.00 | 26.79 |
| 29.000 | 15.20 | L | 1.15 | 0.44 | 16.79 | 50.00 | 33.21 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Margin (dB) = Limit – Actual**
**[Actual = Reading + CF + CL]**
1. Remark "---" means the level is undetectable or the Qausi-peak value is lower than the limit of Average.
2. CF/CL = Correction Factor and Cable Loss
3. Qp = Quasi-peak, Avg = Average value

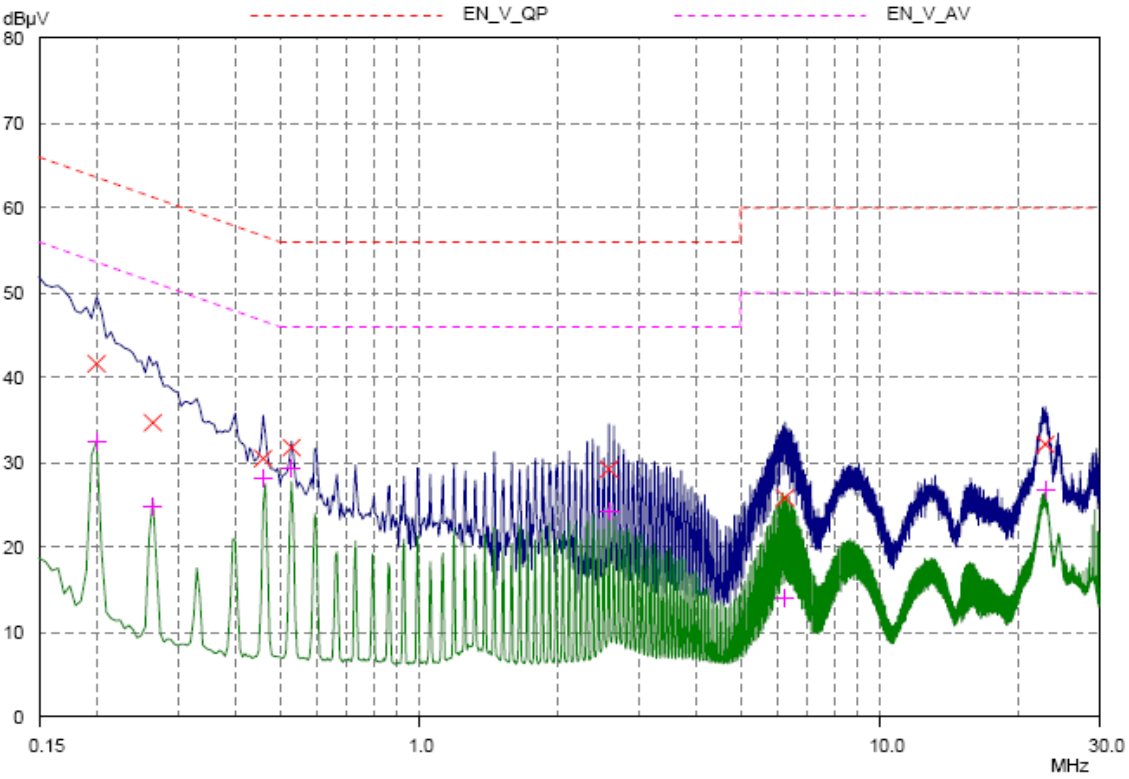
NOTE: The frequency range was scanned from 150 kHz to 30 MHz. All emissions not reported were more than 20 dB below the specified limit.

## Figure 6. Plot of the Conducted Emissions

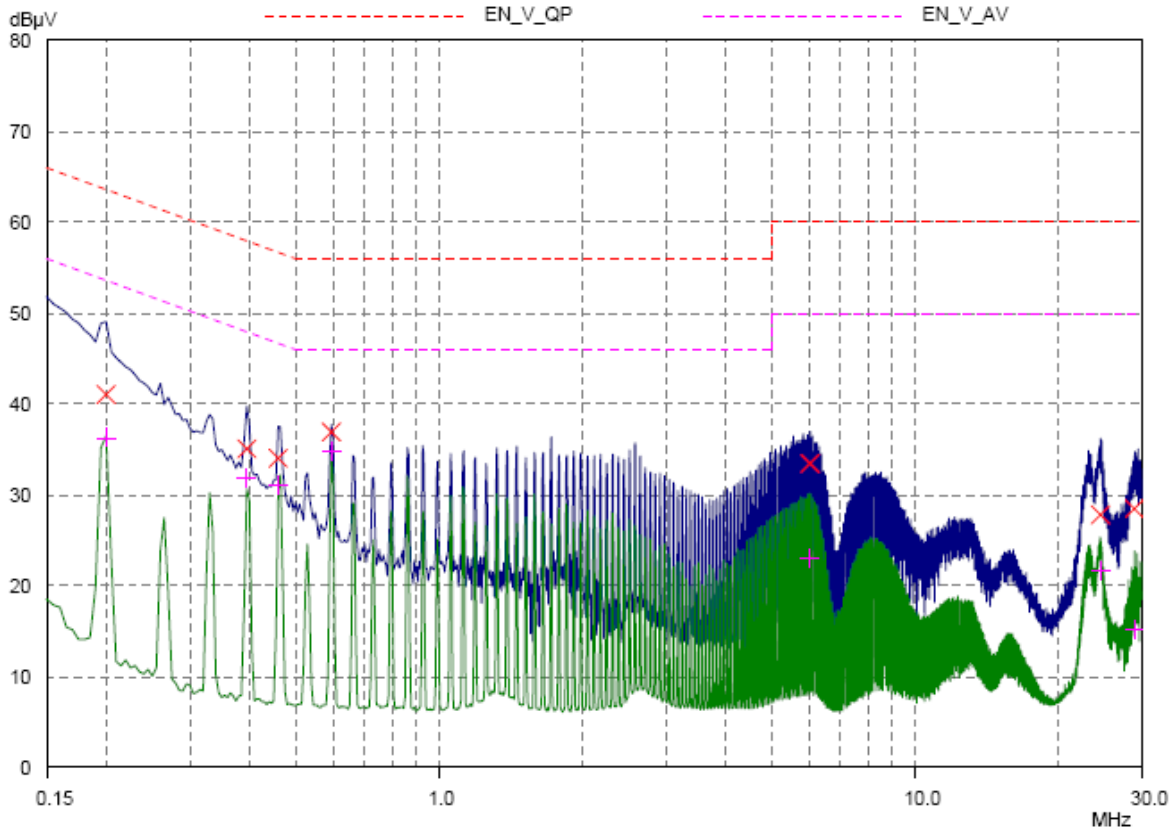
**Adaptor only, Transmitting at 2437 MHz: LINE – PE**



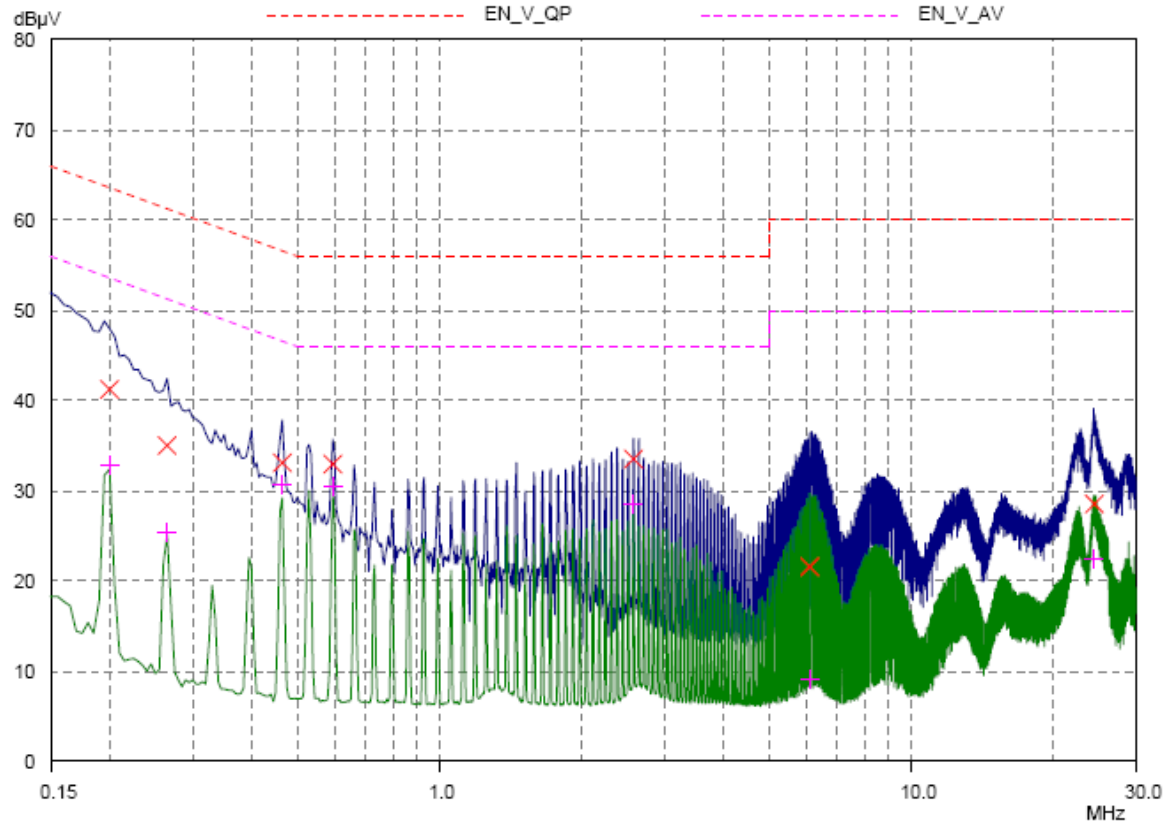

**Adaptor only, Transmitting at 2437 MHz: NEUTRAL – PE**



**Adaptor with Cradle, Transmitting at 2437 MHz: LINE – PE**




**Adaptor with Cradle, Transmitting at 2437 MHz: NEUTRAL – PE**



# 5.7 RF Exposure

## 5.7.1 Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissive Exposure: According to §1.1310 and §2.1093, RF exposure is calculated.

| Frequency Range | Electric Field Strength [V/m] | Magnetic Field Strength [A/m] | Power Density [mW/cm$^2$] | Averaging Time [minute] |
|---|---|---|---|---|
| Limits for General Population/Uncontrolled Exposure | | | | |
| 0.3 ~ 1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34 ~ 30 | 824/f | 2.19/f | *(180/f$^2$) | 30 |
| 30 ~ 300 | 27.5 | 0.073 | 0.2 | 30 |
| 300 ~ 1500 | / | / | f/1500 | 30 |
| 1500 ~ 15000 | / | / | 1.0 | 30 |

f = frequency in MHz, * = Plane-wave equivalent power density

**MPE (Maximum Permissive Exposure) Prediction**

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$ $\left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$

S = power density [mW/cm$^2$]
P = power input to antenna [mW]
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna [cm]

| EUT: Maximum peak output power = 19.41[dBm] (= 87.29 [mW]) & Antenna gain = -14.03[dBi] | |
|---|---|
| 100mW, at 20cm from an antenna 6 [dBi] | S = PG/4πR² = 100 × 3.98 / (4 × π × 400) = 0.0792 [mW/cm$^2$] < 1.0 [mW/cm$^2$] |
| 87.29mW, at 20cm from the antenna -14.03 [dBi] | S = PG/4πR² = 0.0006[mW/cm$^2$] < 1.0 [mW/cm$^2$] |
| 87.29mW, at 2.5cm from the antenna -14.03 [dBi] | S = PG/4πR² = 0.0439 [mW/cm$^2$] < 1.0 [mW/cm$^2$] |

## 5.7.2 RF Exposure Compliance Issue

This device is a handheld and hand-operated device only with respect to RF exposure compliance.

This device must operate with a separation distance of at least 20cm from a person's body and must not be co-located or operating in conjunction with any other antenna or transmitter.