# FCC 47 CFR PART 15 SUBPART C

# TEST REPORT

**For**

**Cradle**

**Model: QS6500BS**

**Trade Name: N/A**

*Issued to*

**PSC Scanning Inc.**
**959 TERRY ST EUGENE, OR 97402 USA**

*Issued by*

**Compliance Certification Services Inc.**
**No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang,**
**Taoyuan Hsien, (338) Taiwan, R.O.C.**
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ACCREDITED

Testing Laboratory
0363

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# 1. TEST RESULT CERTIFICATION

**Applicant:** PSC Scanning Inc.
959 TERRY ST EUGENE, OR 97402 USA

**Equipment Under Test:** Cradle

**Trade Name:** N/A

**Model:** QS6500BS

**Date of Test:** October 5, 2005 ~ February 8, 2006

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULT** |
| FCC 47 CFR Part 15 Subpart C | No non-compliance noted |

## We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

*Approved by:*

Gavin Lim
Section Manager
Compliance Certification Services Inc.

*Reviewed by:*

Amanda Wu
Section Manager
Compliance Certification Services Inc.

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product** | Cradle |
| **Trade Name** | N/A |
| **Model Number** | QS6500BS |
| **Model Discrepancy** | N/A |
| **Power Supply** | Model Number: PSC 4004-0705<br>I/P: AC 120V, 60Hz, 19W<br>O/P: DC 10V, 800mA |
| **Frequency Range** | 2402 ~ 2480 MHz |
| **Transmit Power** | 1.31 dBm |
| **Modulation Technique** | FHSS |
| **Transmit Data Rate** | 1Mbps |
| **Number of Channels** | 79 Channels |
| **Antenna Specification** | Whip Antenna / -3dBi |

***Remark:***

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: O9NQS6500BS filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

# 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

## 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

## 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

## 3.3 GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

**Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

## 3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.52525 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 156.7 - 156.9 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 162.0125 - 167.17 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 167.72 - 173.2 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 240 - 285 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | 322 - 335.4 | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 3.5 DESCRIPTION OF TEST MODES

The EUT (model: QS6500BS) had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

Channel Low (2402MHz)、Mid (2441MHz) and High (2480MHz) were chosen for full testing.

# 4. INSTRUMENT CALIBRATION

## 4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

## 4.2 MEASUREMENT EQUIPMENT USED

**Equipment Used for Emissions Measurement**

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

| Conducted Emissions Test Site | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Spectrum Analyzer | Agilent | E4446A | MY43360131 | 01/10/2007 |
| Power Meter | Agilent | E4416A | GB41291611 | 06/02/2006 |
| Power Sensor | Agilent | E9327A | US40441097 | 06/02/2006 |
| Spectrum Analyzer | R&S | FSEK30 | 835253/002 | 09/24/2006 |

| 3M Semi Anechoic Chamber | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Spectrum Analyzer | Agilent | E4446A | US42510252 | 07/25/2006 |
| Test Receiver | Rohde&Schwarz | ESCI | 100064 | 06/28/2006 |
| Switch Controller | TRC | Switch Controller | SC94050010 | 05/05/2006 |
| 4 Port Switch | TRC | 4 Port Switch | SC94050020 | 05/05/2006 |
| Horn-Antenna | TRC | HA-0502 | 06 | 06/02/2006 |
| Horn-Antenna | TRC | HA-0801 | 04 | 05/05/2006 |
| Bilog- Antenna | Sunol Sciences | JB3 | A030205 | 03/09/2006 |
| Turn Table | Max-Full | MFT-120S | T120S940302 | N.C.R. |
| Antenna Tower | Max-Full | MFA-430 | A440940302 | N.C.R. |
| Controller | Max-Full | MF-CM886 | CC-C-1F-13 | N.C.R. |
| Site NSA | CCS | N/A | FCC: 965860<br>IC: IC 6106 | 09/26/2008 |
| Test S/W | LABVIEW (V 6.1) | | | |

***Remark:*** *The measurement uncertainty is less than +/-2.0065dB (30MHz ~ 1GHz), +/-3.0958dB (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

| Powerline Conducted Emissions Test Site | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| EMI TEST RECEIVER 9kHz-30MHz | ROHDE & SCHWARZ | ESHS30 | 828144/003 | 09/24/2006 |
| TWO-LINE V-NETWORK 9kHz-30MHz | SCHAFFNER | NNB41 | 03/10013 | 06/11/2006 |
| LISN 10kHz-100MHz | EMCO | 3825/2 | 9106-1809 | 02/17/2007 |
| Test S/W | LABVIEW (V 6.1) | | | |

***Remark:*** *The measurement uncertainty is less than +/- 2.81dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

## 5.3 TABLE OF ACCREDITATIONS AND LISTINGS

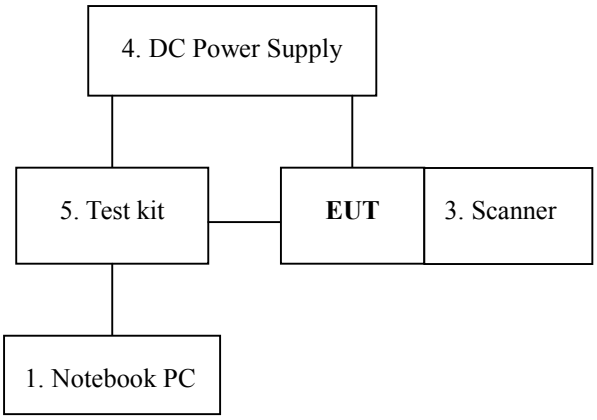
| Country | Agency | Scope of Accreditation | Logo |
|---|---|---|---|
| USA | A2LA | EN 55011, EN 55014-1/2, CISPR 11, CISPR 14-1/2,<br>EN 55022, EN 55015, CISPR 22, CISPR 15,<br>AS/NZS 3548, VCCI V3 (2001), CFR 47, FCC Part 15/18,<br>CNS 13783-1, CNS 13439, CNS 13438, CNS 13803,<br>CNS 14115, EN 55024, IEC 801-2, IEC 801-3, IEC 801-4,<br>IEC/EN 61000-3-2, EIC/EN 61000-3-3,<br>IEC/EN 61000-4-2/3/4/5/6/8/11, EN 50081-1/<br>EN 61000-6-3, EN 50081-2/EN 61000-6-4,<br>EN 50081-2/EN 61000-6-1: 2001 | ACCREDITED<br>0824-01 |
| USA | FCC | 3/10 meter Open Area Test Sites (93105, 90471) /<br>3M Semi Anechoic Chamber (965860) to perform<br>FCC Part 15/18 measurements | 93105, 90471<br>965860 |
| Japan | VCCI | 3/10 meter Open Area Test Sites to perform conducted/radiated measurements | VCCI<br>R-393/1066/725/879<br>C-402/747/912 |
| Norway | NEMKO | EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2,<br>EN 50130-4, EN 55011, EN 55013, EN 55014-1/2,<br>EN 55015, EN 55022, EN 55024, EN 61000-3-2/3,<br>EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2,<br>EN 300 328-2, EN 300 422-2, EN 301 419-1,<br>EN 301 489-01/03/07/08/09/17, EN 301 419-2/3,<br>EN 300 454-2, EN 301 357-2 | ELA 124a<br>ELA 124b<br>ELA 124c |
| Taiwan | TAF | EN 300 328-1, EN 300 328-2, EN 300 220-1,<br>EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C,<br>EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1,<br>CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1,<br>IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3 | TAF<br>Testing Laboratory<br>0363 |
| Taiwan | BSMI | CNS 13438, CNS 13783-1,<br>CNS 13439, CNS 14115 | 商<br>檢<br>SL2-IS-E-0014<br>SL2-IN-E-0014<br>SL2-A1-E-0014<br>SL2-R1-E-0014<br>SL2-R2-E-0014<br>SL2-L1-E-0014 |
| Canada | Industry Canada | 3/10 meter Open Area Test Sites (IC 3991-3, IC 3991-4) /<br>3M Semi Anechoic Chamber (IC 6106) to perform<br>RSS 212 Issue 1 | Canada<br>IC 3991-3<br>IC 3991-4<br>IC 6106 |

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

# 6. SETUP OF EQUIPMENT UNDER TEST

## 6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.




## 6.2 SUPPORT EQUIPMENT

| No. | Device Type | Brand | Model | Series No. | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|---|
| 1. | Notebook PC | DELL | PP10L | 50XP51J | E2K5HCKT | N/A | AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core |
| 2. | Notebook PC | IBM | 2672(X31) | 99PBTKB | WLAN: ANO20030400LEG Bluetooth: ANO20020100MTN | N/A | AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core |
| 3. | Scanner | N/A | QS6500BT | N/A | O9NQS6500BT | N/A | N/A |
| 4. | DC Power Supply | MOTECH | PPS-1203 | 12033120005 | N/A | N/A | Unshielded, 1.8m |
| 5. | Test kit | N/A | N/A | N/A | N/A | N/A | N/A |

***Remark:***

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

# 7. FCC PART 15.247 REQUIREMENTS

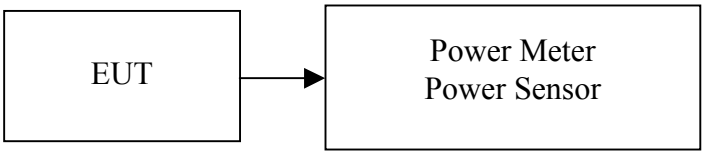
## 7.1 PEAK POWER

### LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
2. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
3. 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.

**Test Configuration**




### TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

### TEST RESULTS

*No non-compliance noted*

**Test Data**

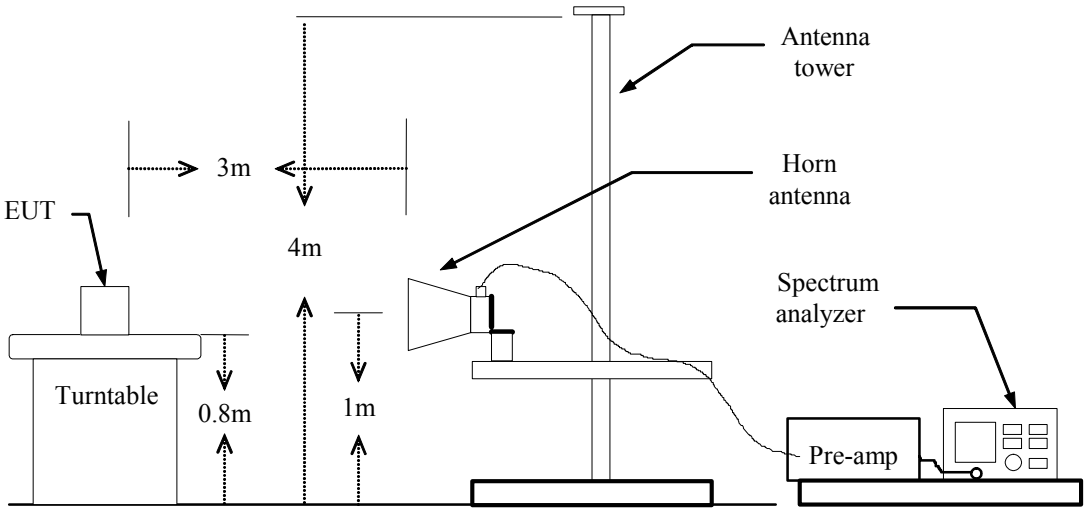
| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (W) | Limit (W) | Result |
|---|---|---|---|---|---|
| Low | 2402 | 1.31 | 0.00135 | 1 | PASS |
| Mid | 2441 | 1.12 | 0.00129 | | PASS |
| High | 2480 | 0.67 | 0.00117 | | PASS |

## 7.2 BAND EDGES MEASUREMENT

## LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

**Test Configuration**




## TEST PROCEDURE

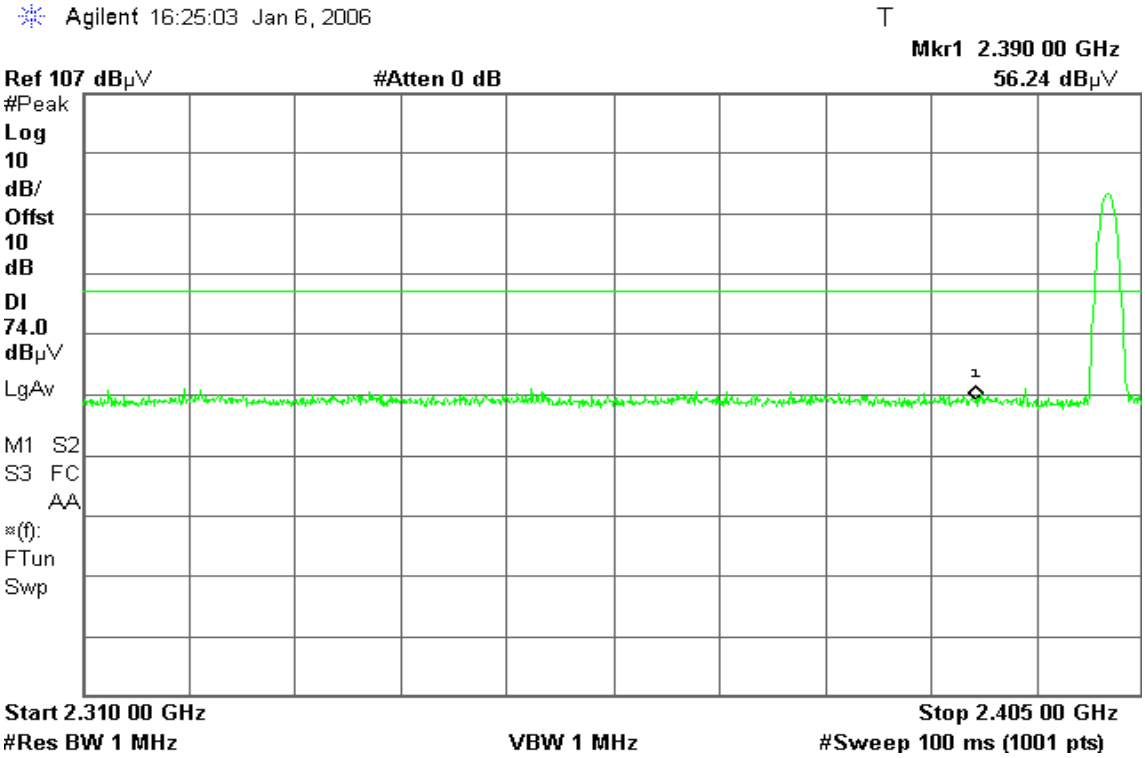
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

## TEST RESULTS

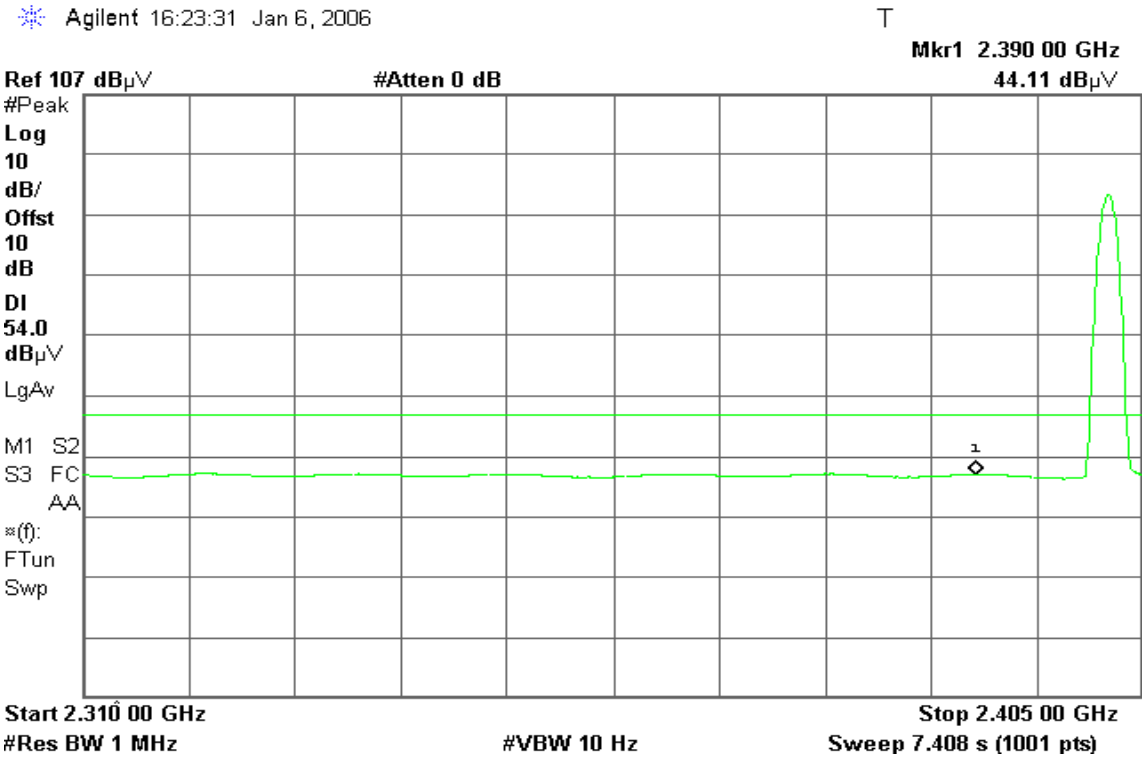
Refer to attach spectrum analyzer data chart.

## Band Edges (CH Low)

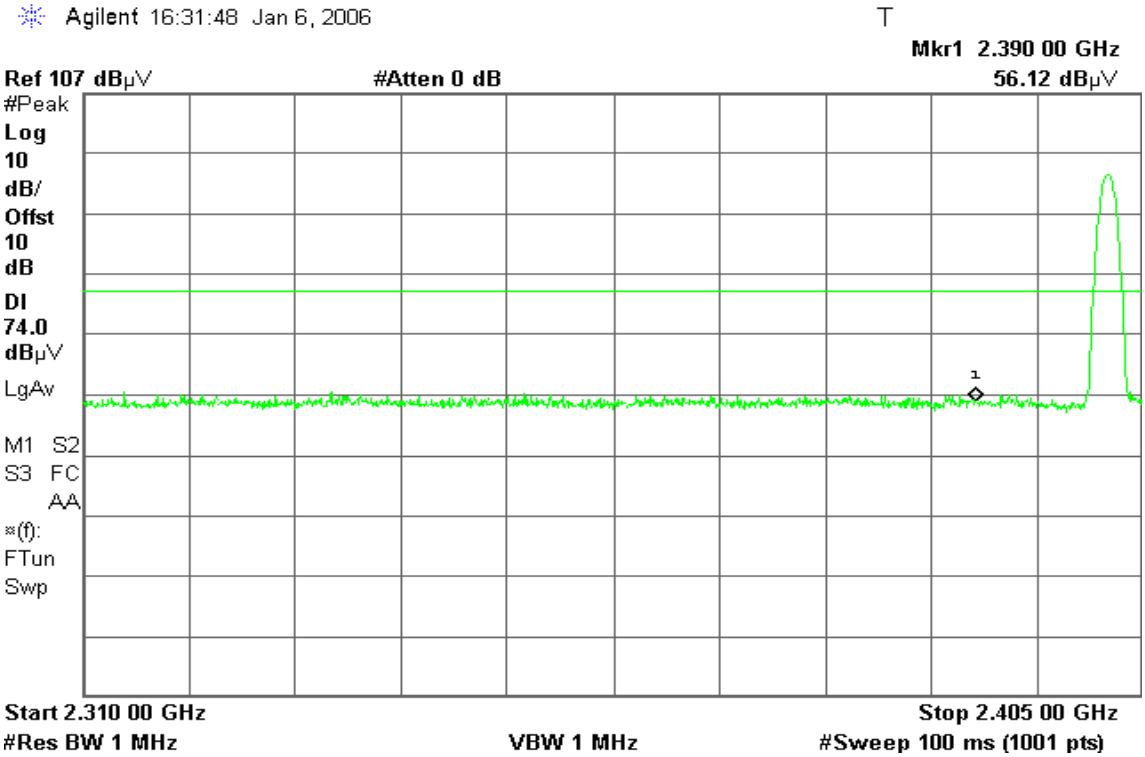
**Detector mode: Peak** **Polarity: Vertical**



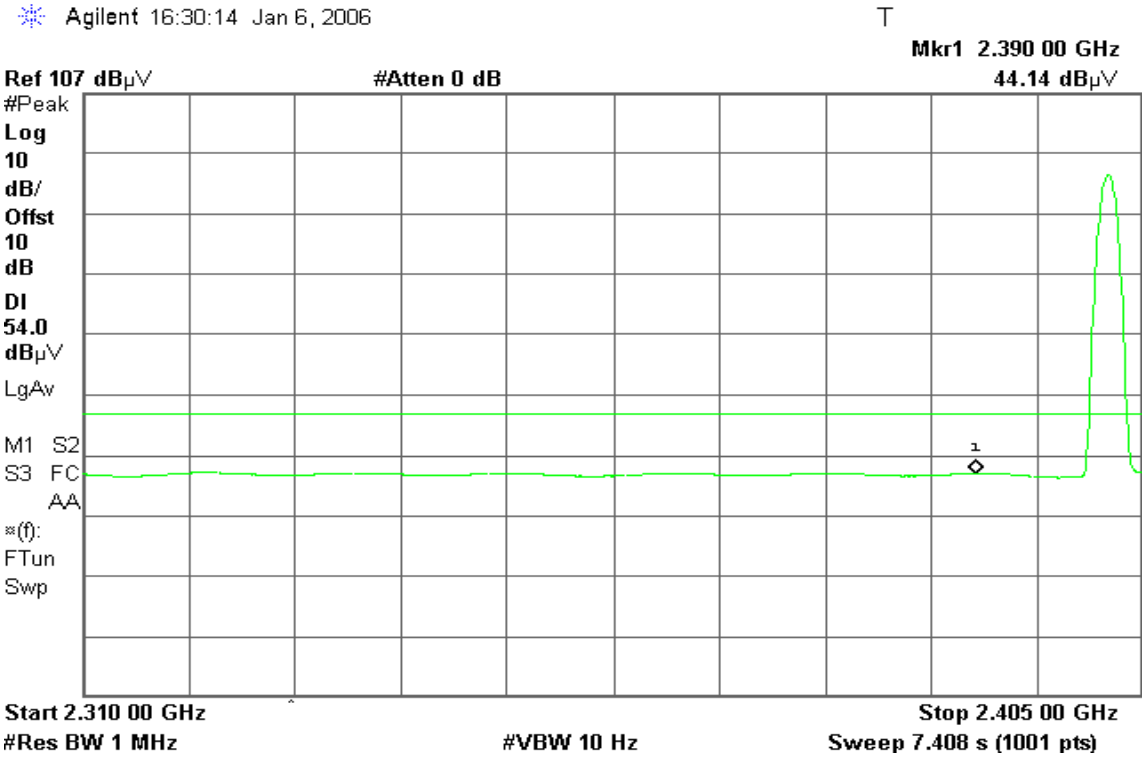

**Detector mode: Average** **Polarity: Vertical**



**Detector mode: Peak** **Polarity: Horizontal**

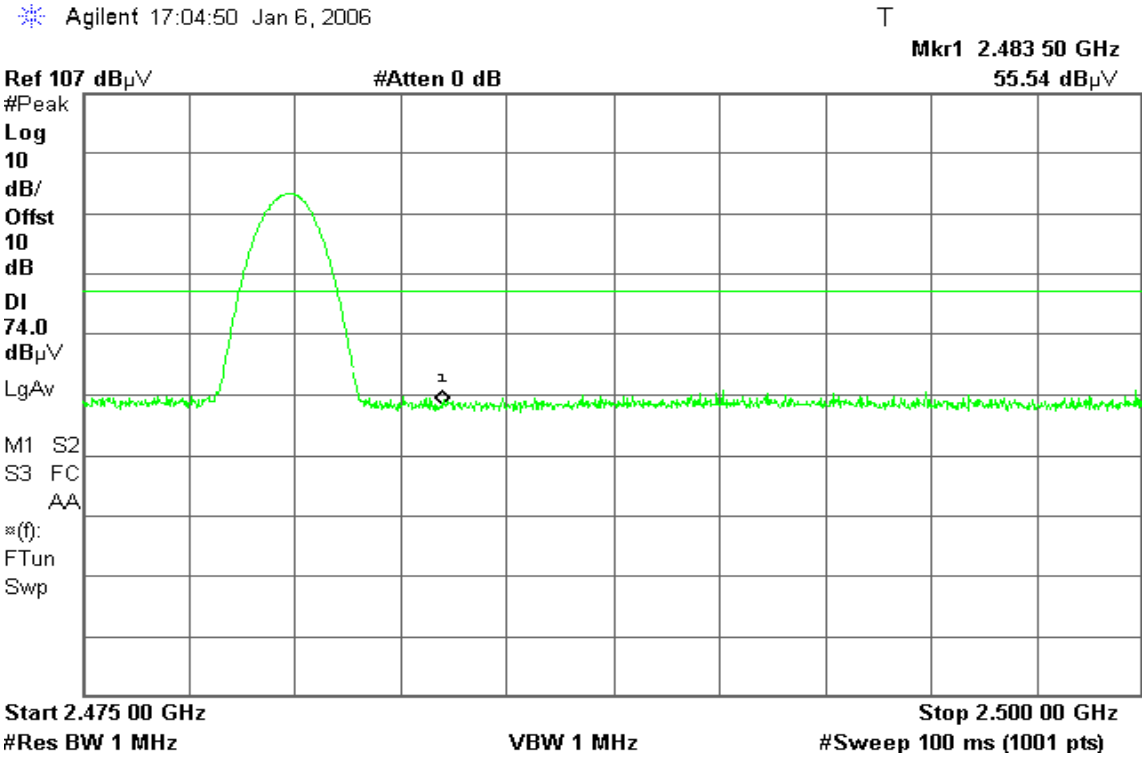



**Detector mode: Average** **Polarity: Horizontal**

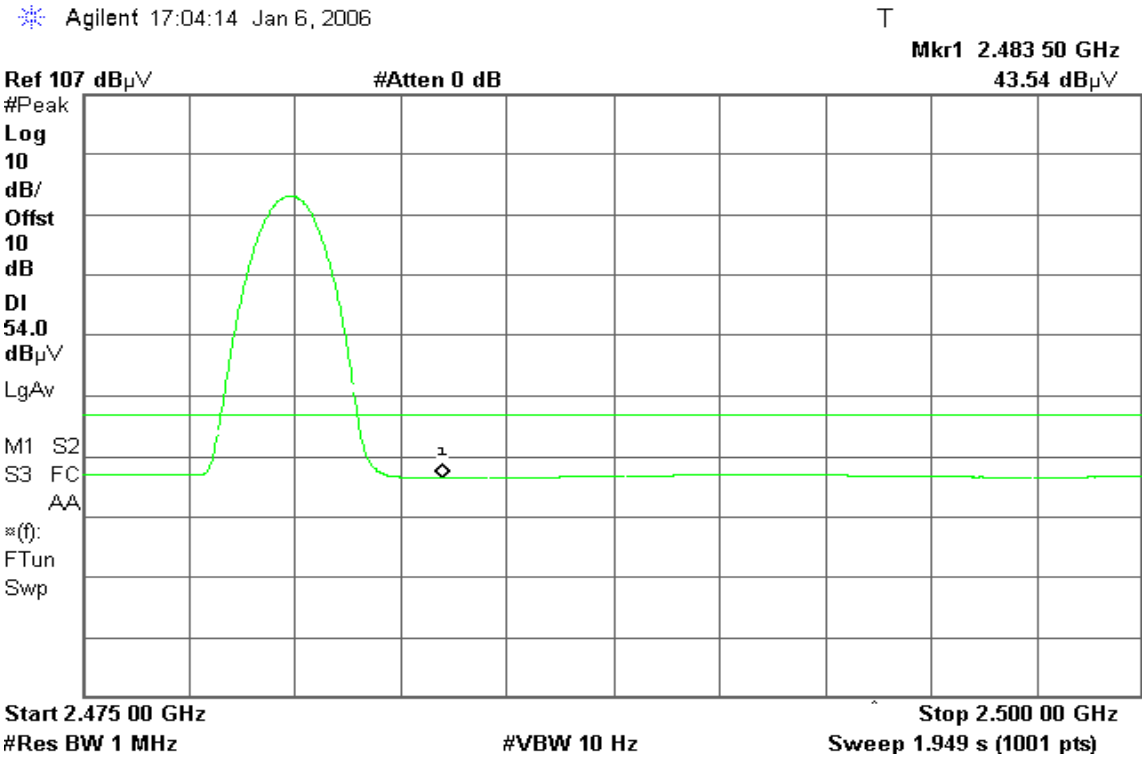


## Band Edges (CH High)

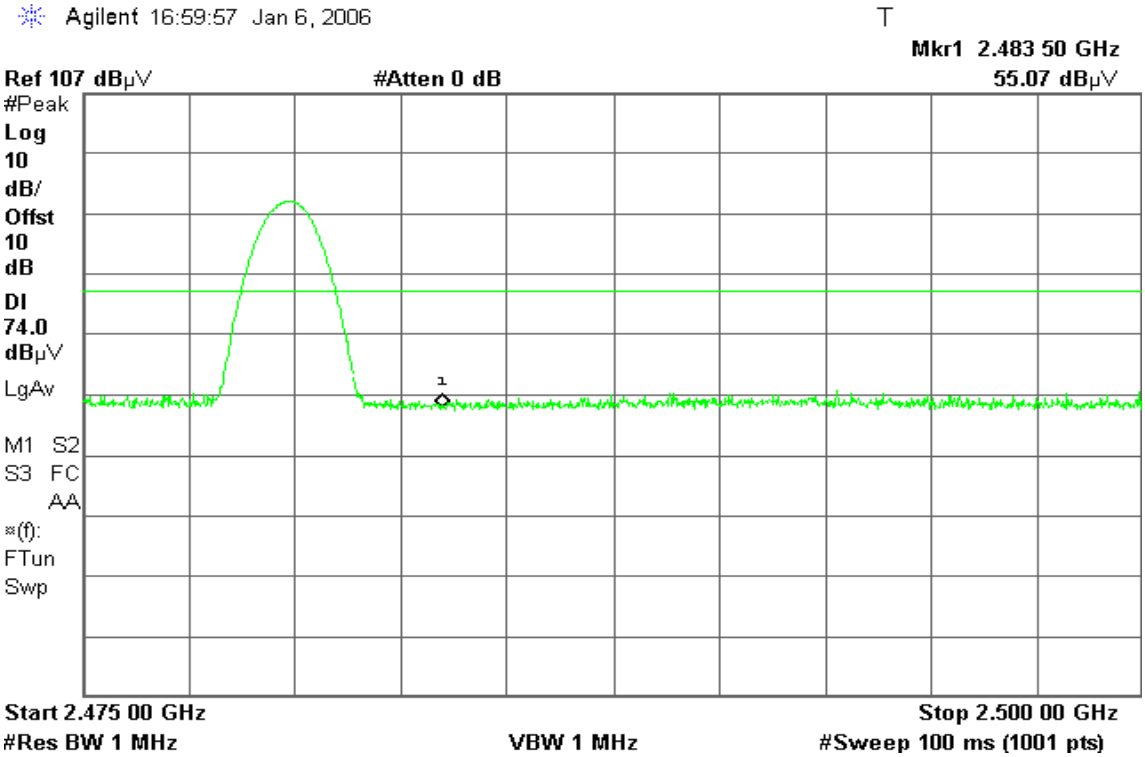
**Detector mode: Peak** **Polarity: Vertical**



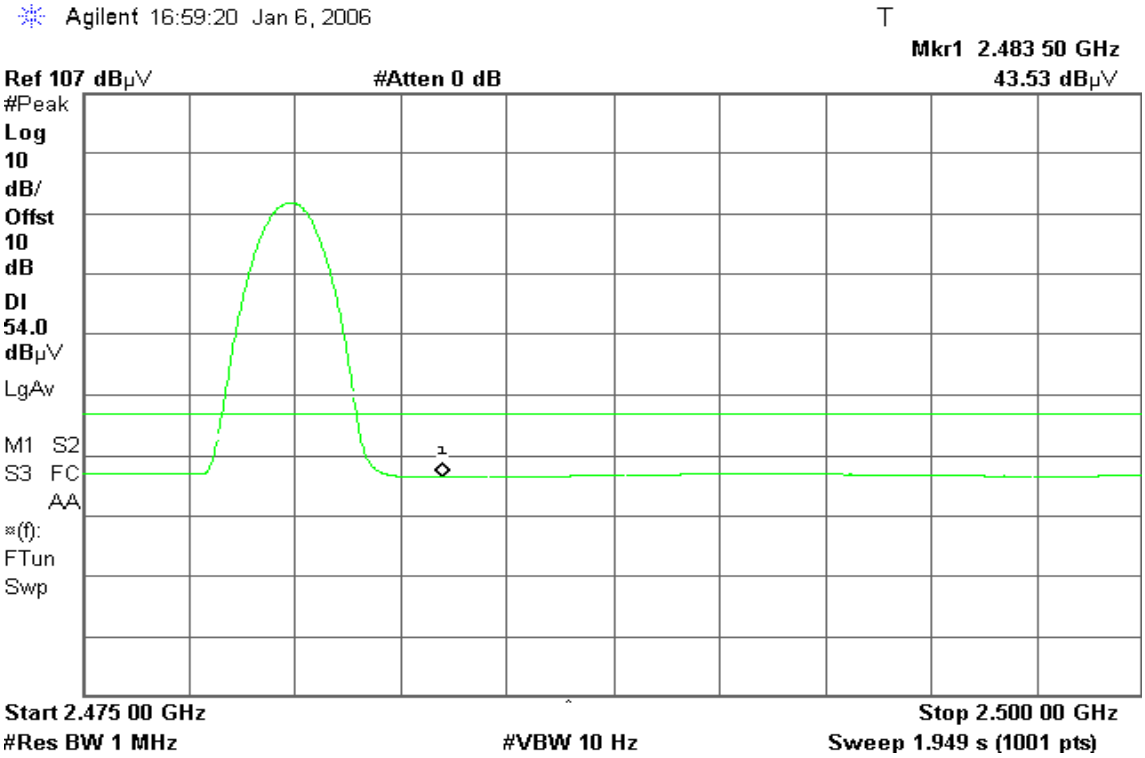

**Detector mode: Average** **Polarity: Vertical**



**Detector mode: Peak** **Polarity: Horizontal**




**Detector mode: Average** **Polarity: Horizontal**

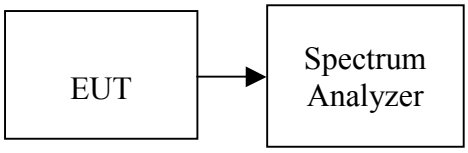


## 7.3 PEAK POWER SPECTRAL DENSITY

### LIMIT

1. 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.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

**Test Configuration**




### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

### TEST RESULTS

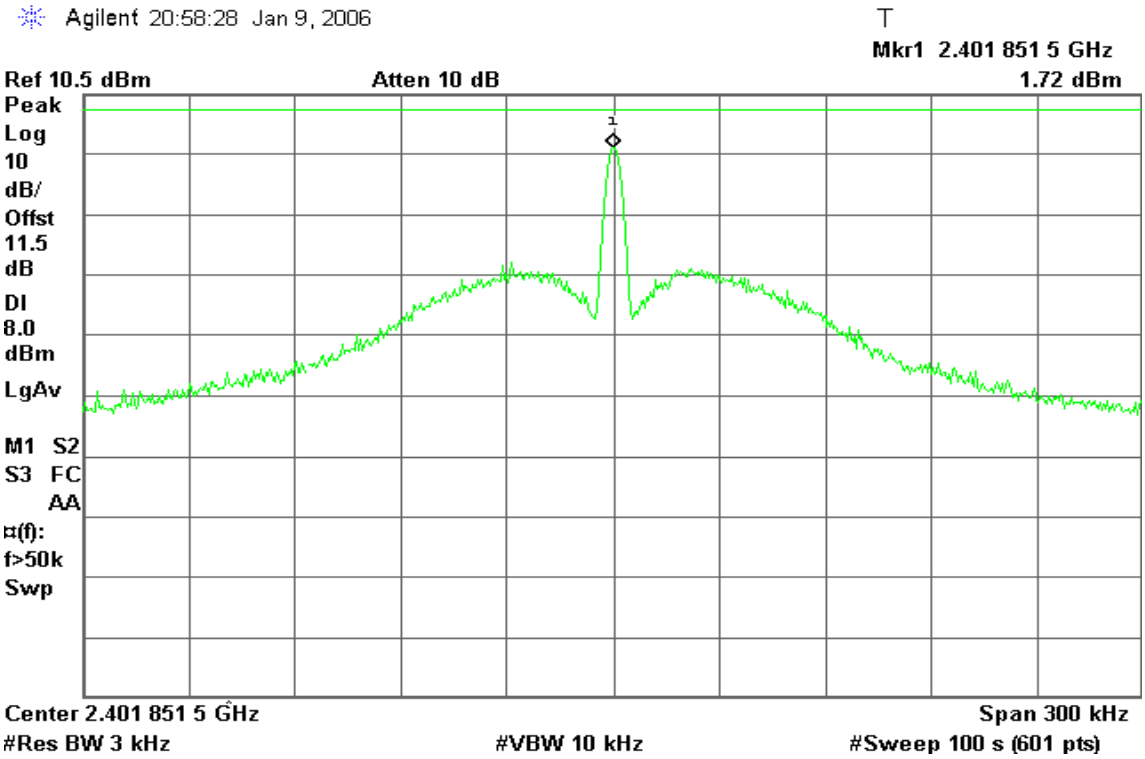
*No non-compliance noted*

**Test Data**

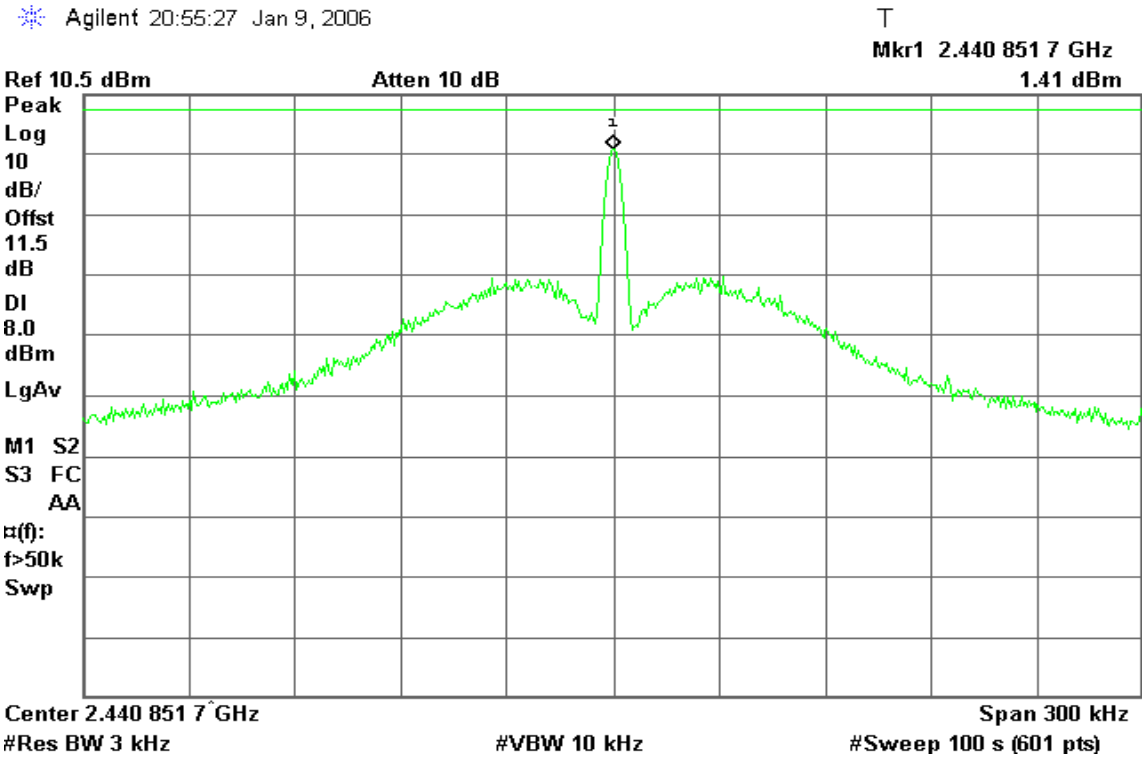
| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|
| Low | 2402 | 1.72 | 8.00 | PASS |
| Mid | 2441 | 1.41 | | PASS |
| High | 2480 | 1.02 | | PASS |

## Test Plot

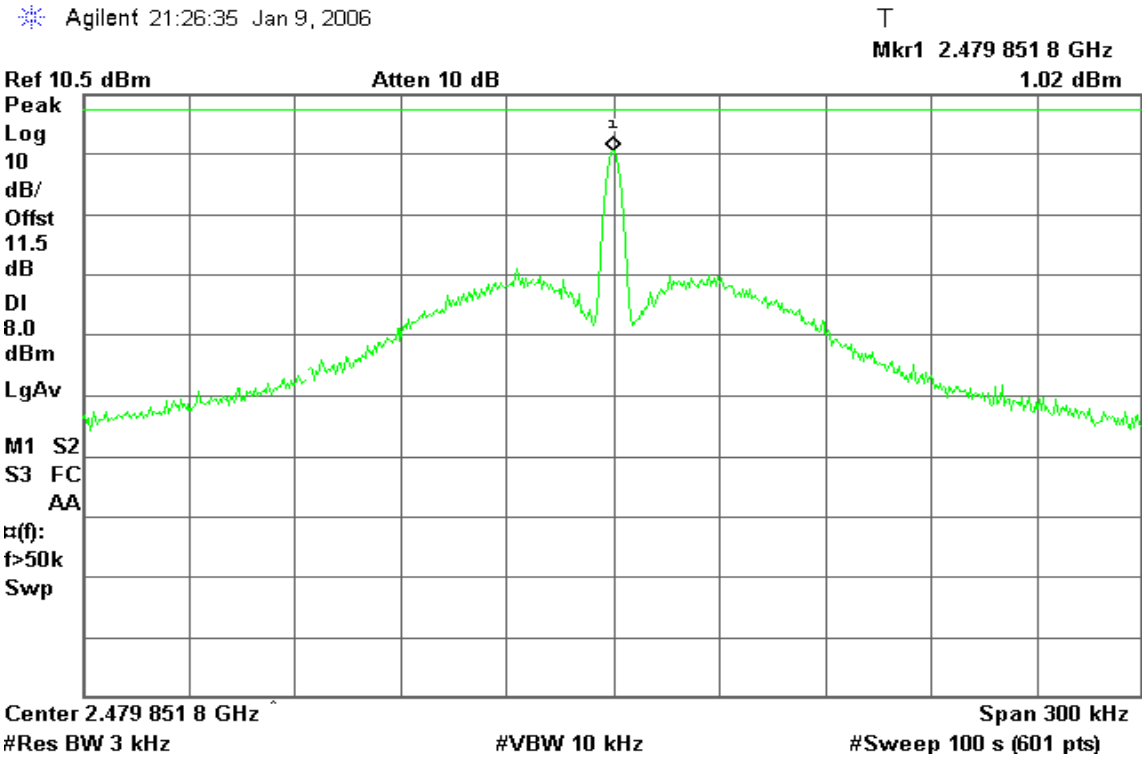
### PPSD (CH Low)




### PPSD (CH Mid)



## PPSD (CH High)

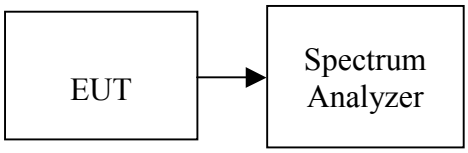

Agilent 21:26:35 Jan 9, 2006
Mkr1 2.479 851 8 GHz
Ref 10.5 dBm
Atten 10 dB
1.02 dBm
Peak
Log
10
dB/
Offst
11.5
dB
DI
8.0
dBm
LgAv
M1 S2
S3 FC
AA
¤(f):
f>50k
Swp
Center 2.479 851 8 GHz
Span 300 kHz
#Res BW 3 kHz
#VBW 10 kHz
#Sweep 100 s (601 pts)

## 7.4 FREQUENCY SEPARATION

### LIMIT

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

**Test Configuration**




### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

### TEST RESULTS

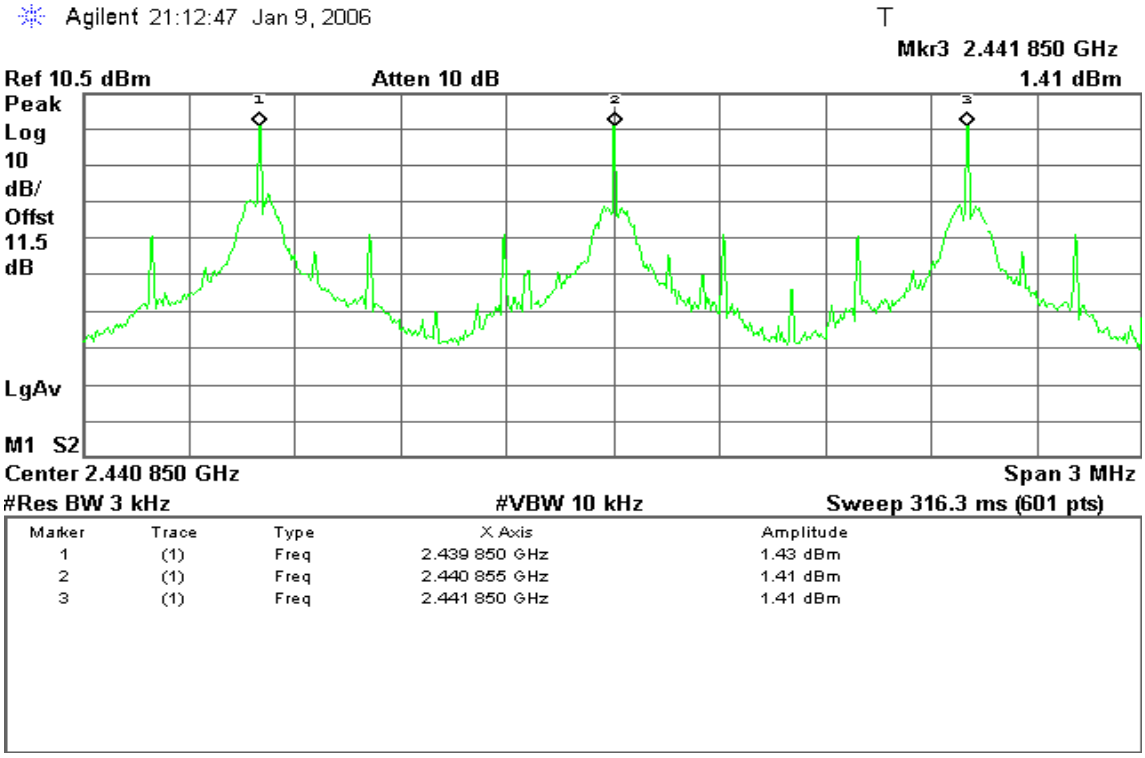
*No non-compliance noted*

**Test Data**

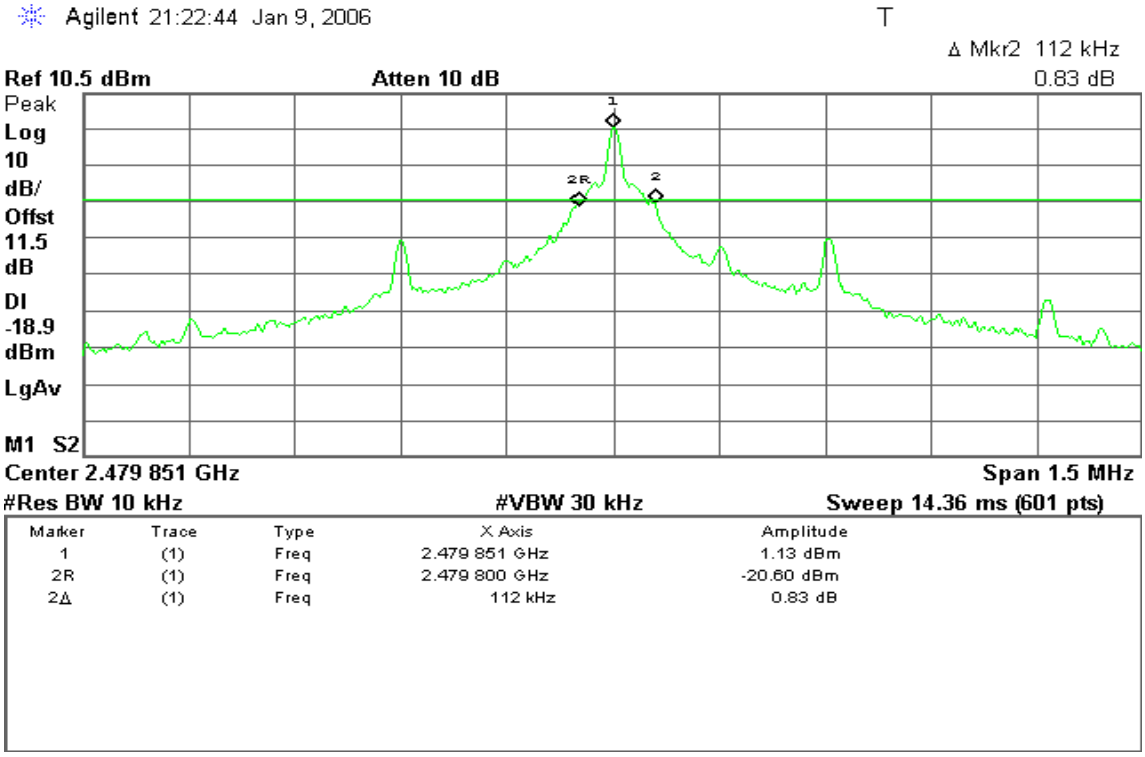
| Channel Separation (MHz) | 20dB Bandwith (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| 1.00 | 112 | >25 | Pass |

## Test Plot

## Measurement of Channel Separation




## Measurement of 20dB Bandwidth

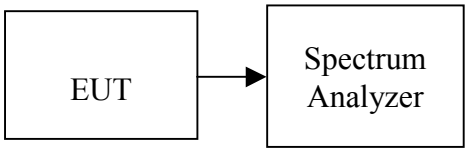


## 7.5 NUMBER OF HOPPING FREQUENCY

### LIMIT

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

**Test Configuration**




### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = auto and Start=2441.5MHz, Stop = 2483.0MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=510kHz.
5. Max hold, view and count how many channel in the band.

### TEST RESULTS

*No non-compliance noted*

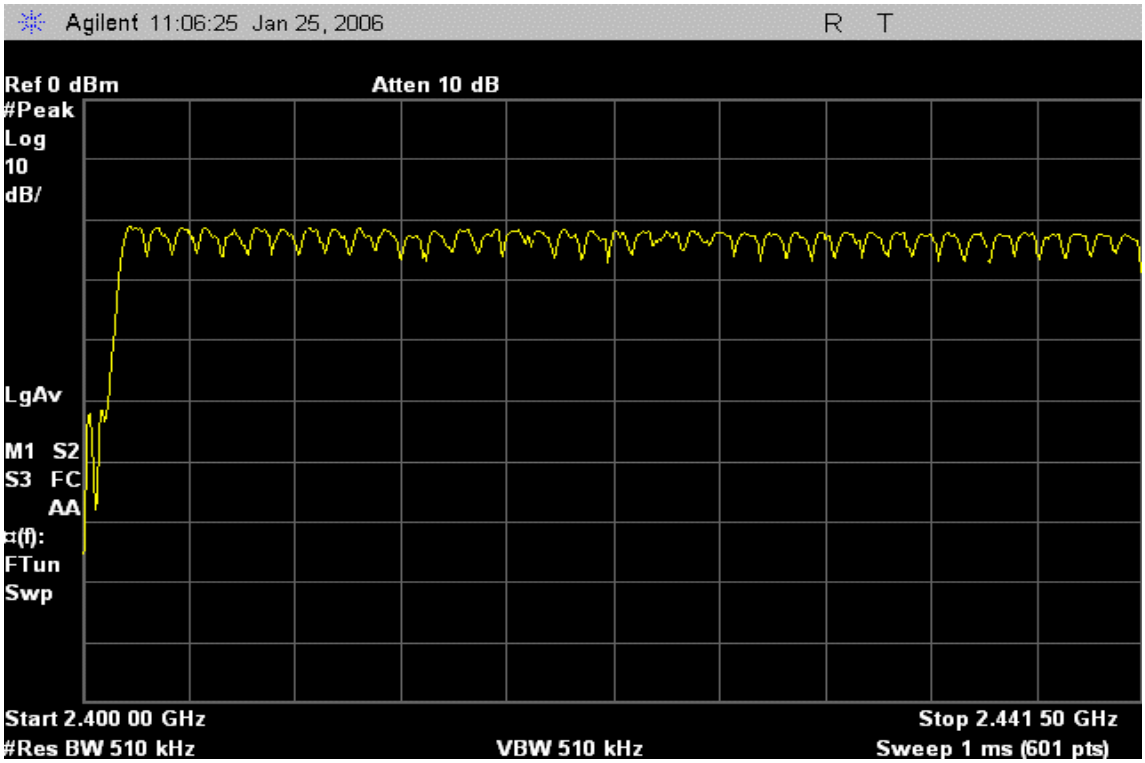
**Test Data**

| Result (No. of CH) | Limit (No. of CH) | Result |
|---|---|---|
| 79 | >75 | PASS |

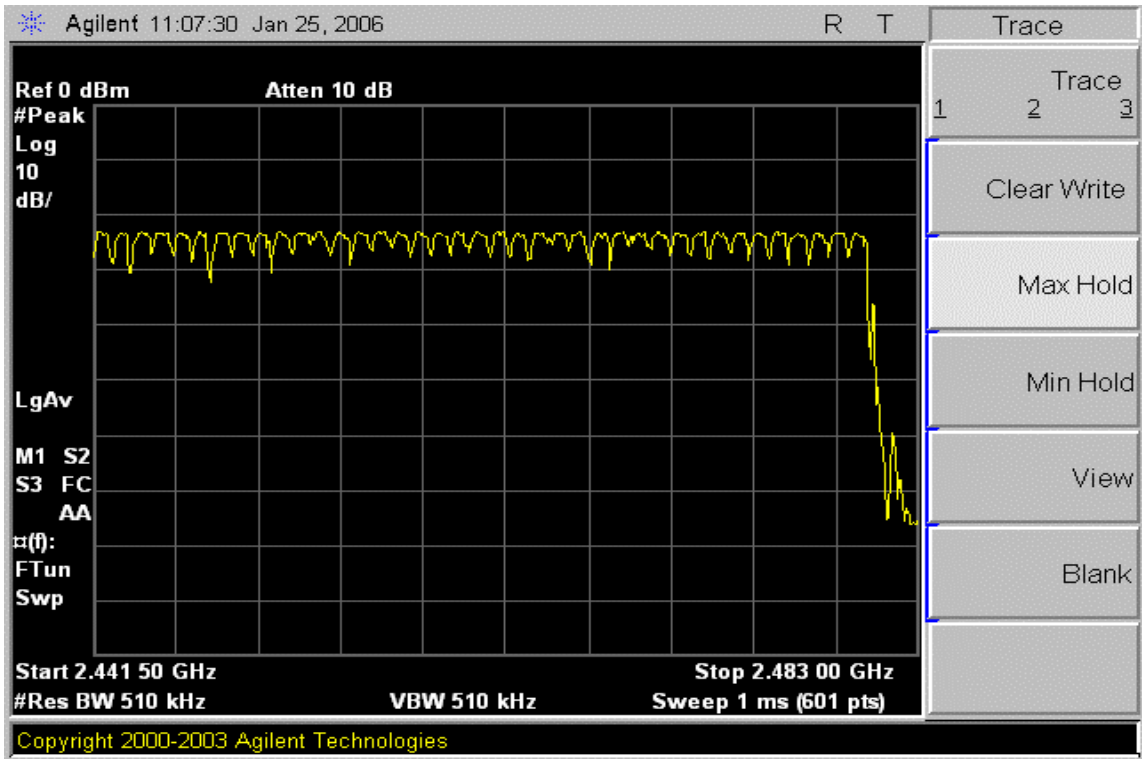
## Test Plot

## Channel Number

## 2.4 GHz – 2.4415 GHz




## 2.4415 GHz – 2.4830 GHz

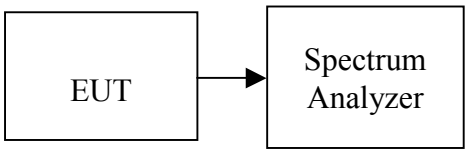


## 7.6 TIME OF OCCUPANCY (DWELL TIME)

## LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

**Test Configuration**




## TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.

# TEST RESULTS

*No non-compliance noted*

## Test Data

DH1: (Mark 2 - Mark 1) * (1600/2)/79 * 31.6

= (5.41 – 5.00) * (1600/2)/79 * 31.6
= 131.20

DH3: (Mark 2 - Mark 1)* (1600/4)/79 * 31.6

= (6.65 – 5.00) * (1600/4)/79 * 31.6
= 264.00

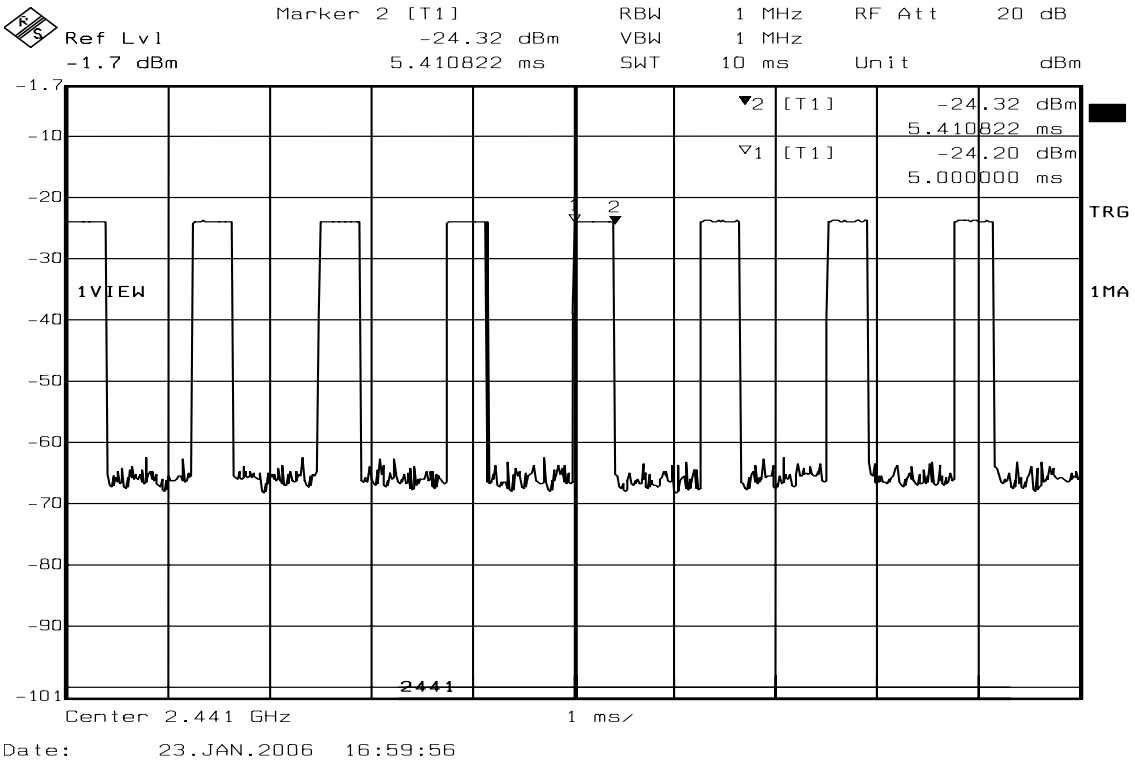
DH5: (Mark 2 - Mark 1) * (1600/6)/79 * 31.6

= (6.65 – 3.75) * (1600/4)/79 * 31.6
= 309.33

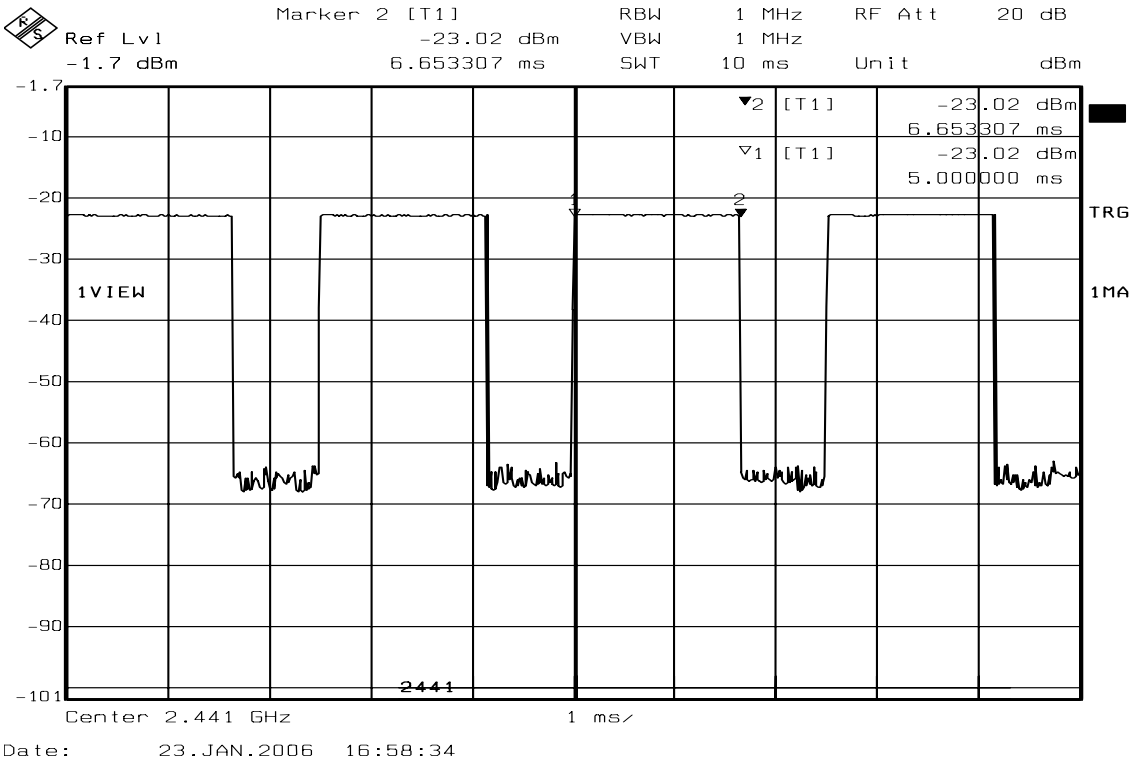
| CH | Pulse Time (ms) | Total of Dwell (ms) | Period Time (s) | Limit (ms) | Result |
|---|---|---|---|---|---|
| DH1 | 0.41 | 131.20 | 31.60 | 400.00 | PASS |
| DH3 | 1.65 | 264.00 | 31.60 | | PASS |
| DH5 | 2.90 | 309.33 | 31.60 | | PASS |

## Test Plot

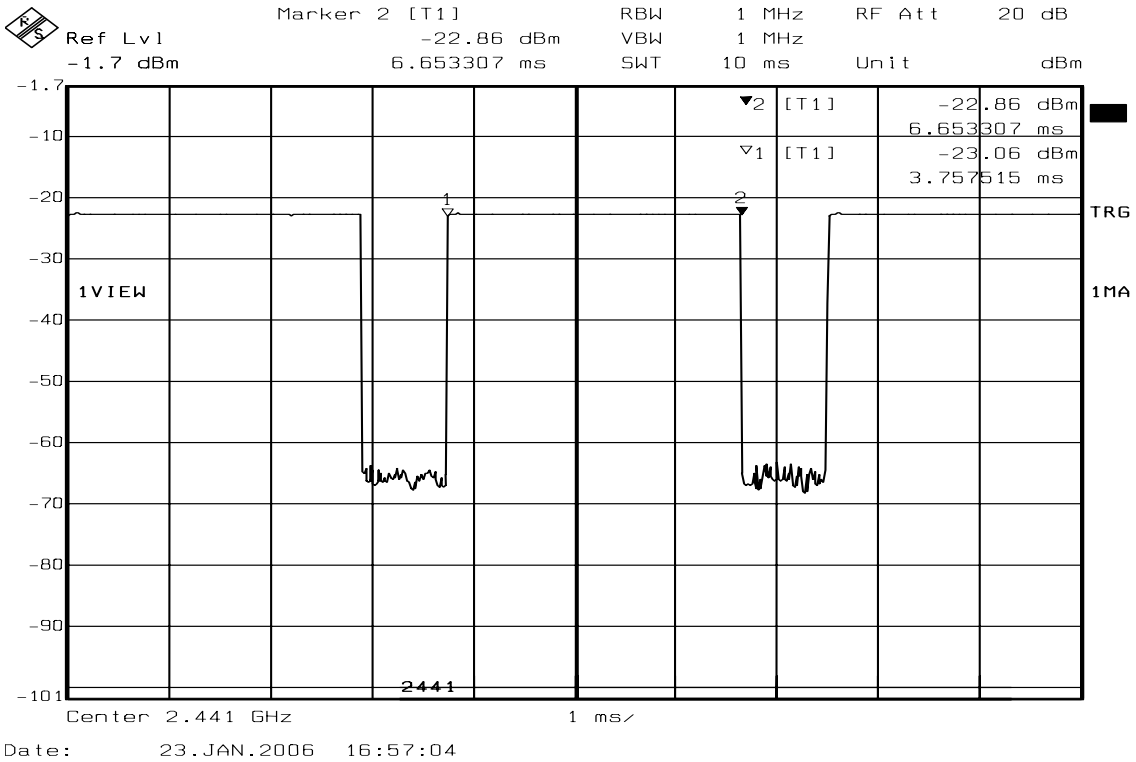
### CH Mid / DH 1




### DH 3



**DH 5**


Marker 2 [T1]
Ref Lvl
-1.7 dBm
-22.86 dBm
6.653307 ms
RBW 1 MHz
VBW 1 MHz
SWT 10 ms
RF Att 20 dB
Unit dBm
▼2 [T1] -22.86 dBm 6.653307 ms
▽1 [T1] -23.06 dBm 3.757515 ms
TRG
1MA
1VIEW
2441
Center 2.441 GHz
1 ms/
Date: 23.JAN.2006 16:57:04

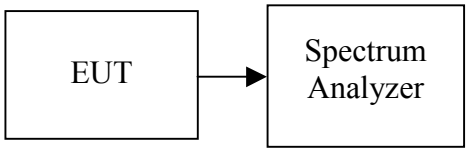
## 7.7 SPURIOUS EMISSIONS

### 7.7.1 Conducted Measurement

**LIMIT**

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

**Test Configuration**




**TEST PROCEDURE**

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

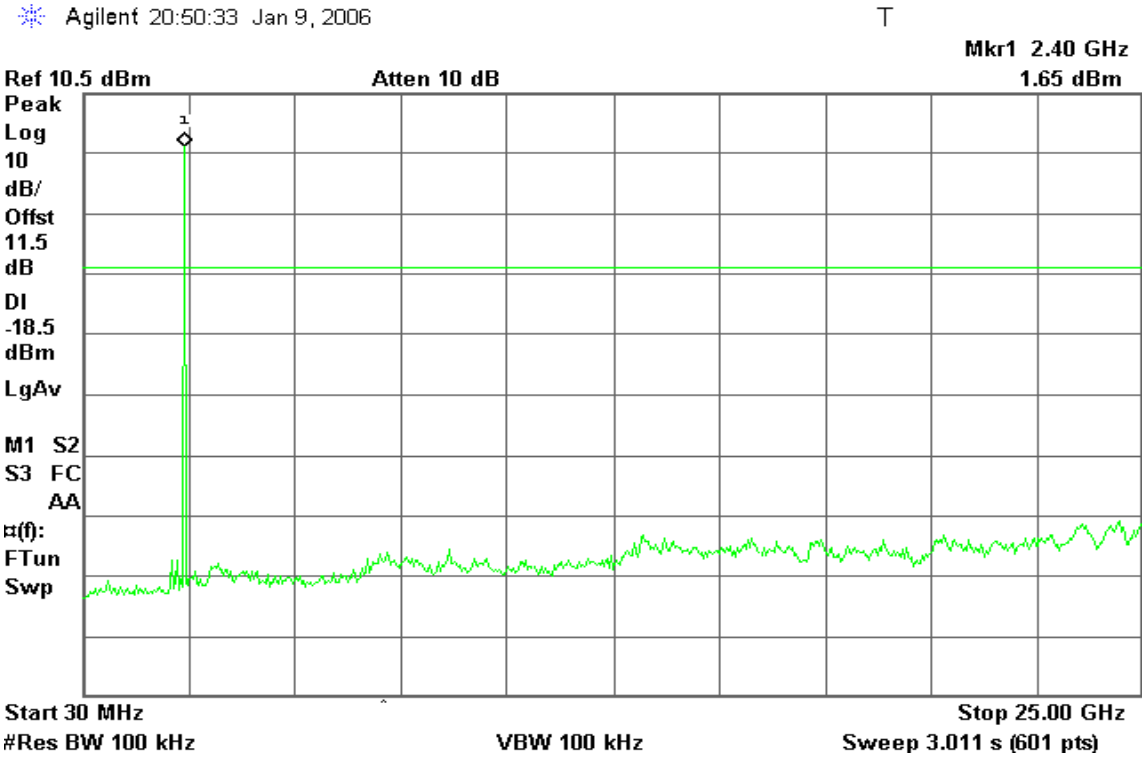
Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

**TEST RESULTS**

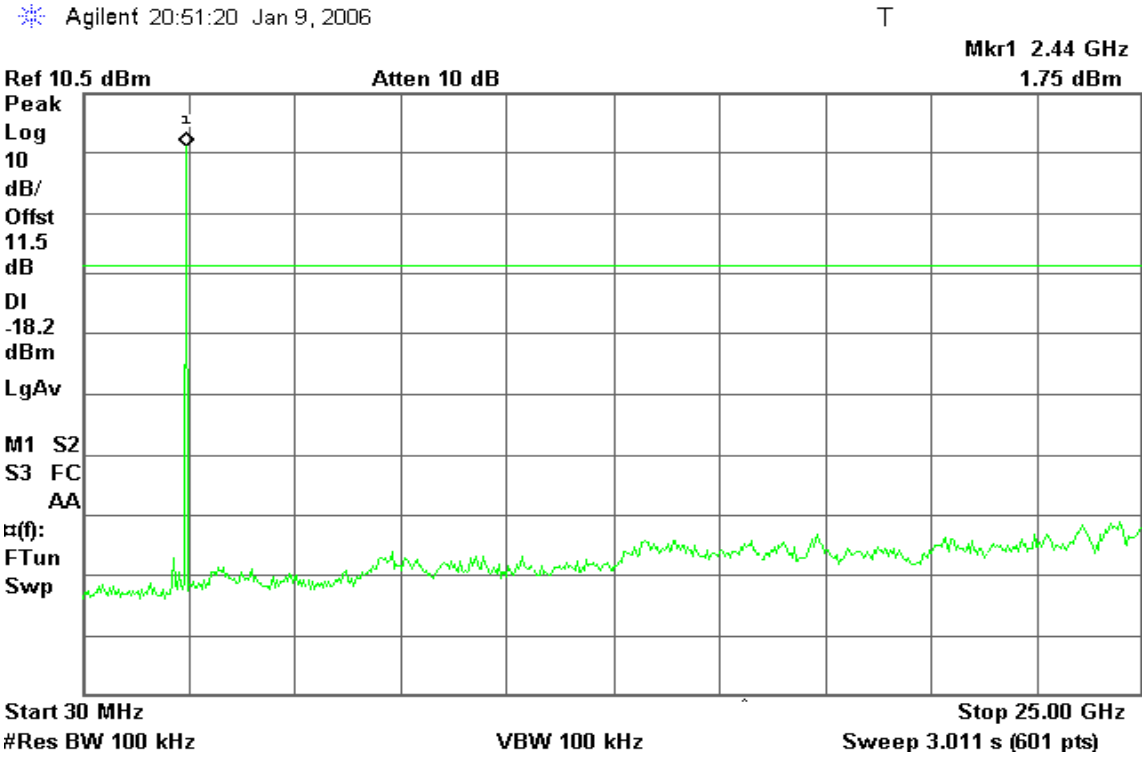
*No non-compliance noted*

## Test Plot

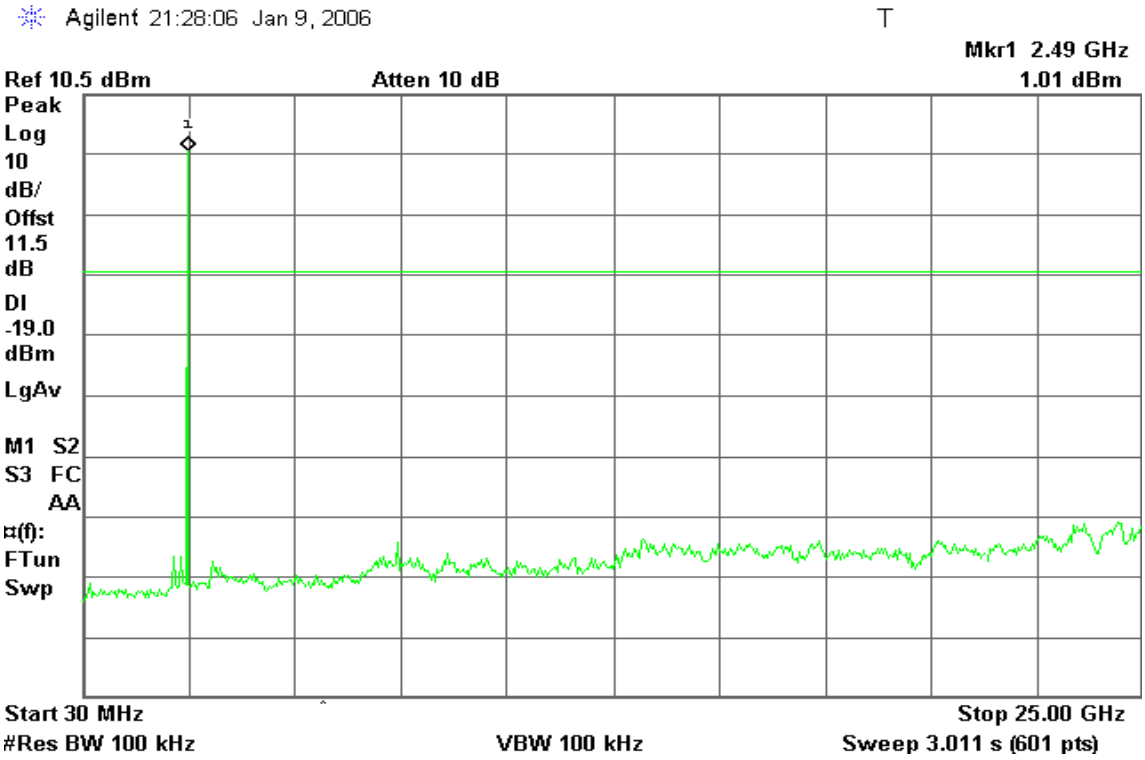
## CH Low




## CH Mid



**CH High**


Agilent 21:28:06 Jan 9, 2006
Mkr1 2.49 GHz
Ref 10.5 dBm
Atten 10 dB
1.01 dBm
Peak
Log
10
dB/
Offst
11.5
dB
DI
-19.0
dBm
LgAv
M1 S2
S3 FC
AA
¤(f):
FTun
Swp
Start 30 MHz
Stop 25.00 GHz
#Res BW 100 kHz
VBW 100 kHz
Sweep 3.011 s (601 pts)

### 7.7.2 Radiated Emissions

**LIMIT**

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (µV/m) | Measurement Distance (m) |
|---|---|---|
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

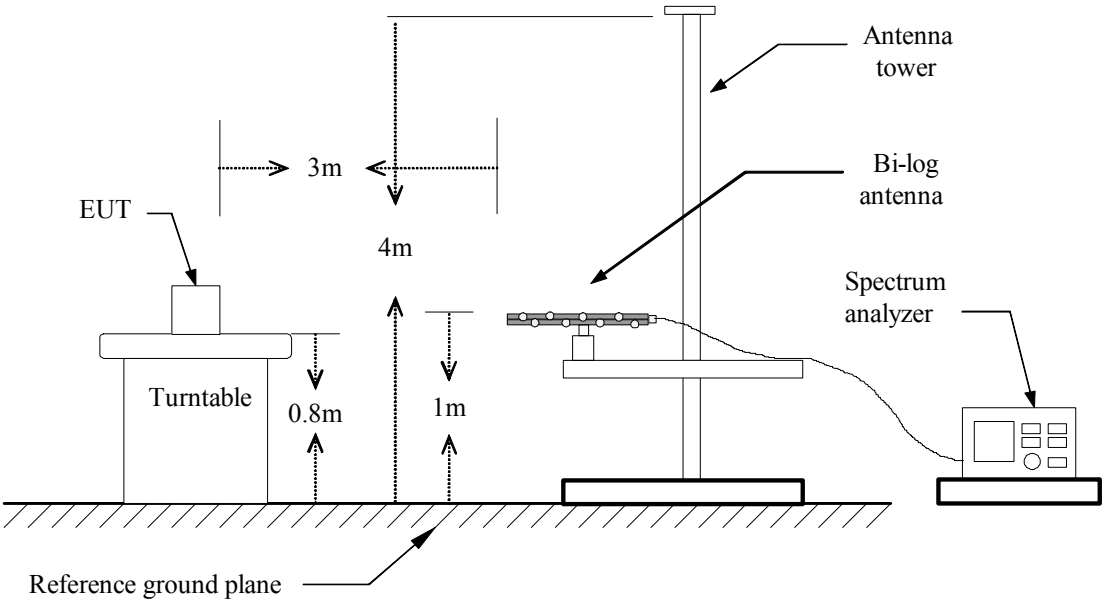
***Remark:*** *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the emission table above, the tighter limit applies at the band edges.

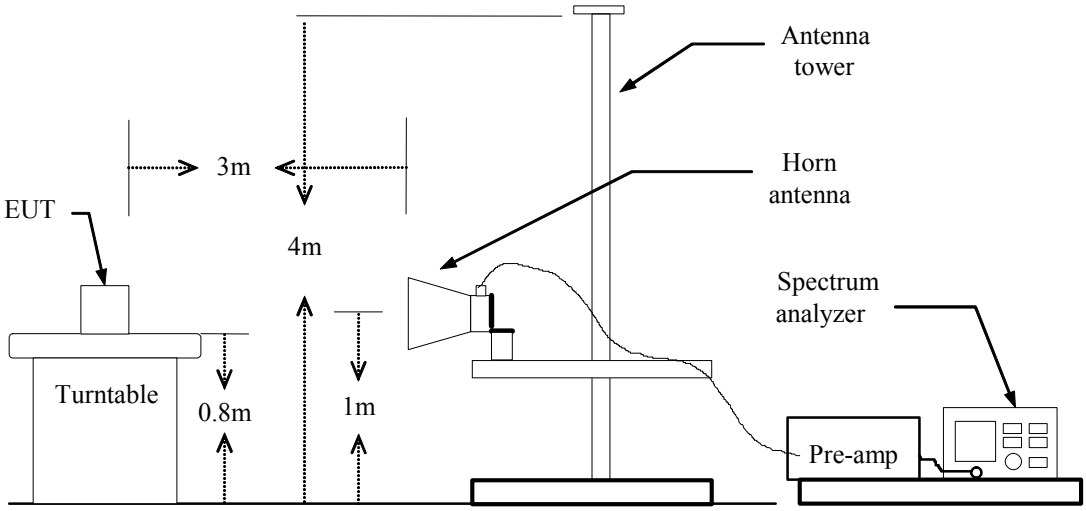
| Frequency (MHz) | Field Strength (µV/m at 3-meter) | Field Strength (dBµV/m at 3-meter) |
|---|---|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

## Test Configuration

### Below 1 GHz




### Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

# TEST RESULTS

## Below 1 GHz

**Operation Mode:** Normal Link **Test Date:** February 8, 2006

**Temperature:** 18.7°C **Tested by:** Eric Cheng

**Humidity:** 52 % RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (QP) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (QP) (dBuV/m) | Limit (QP) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 125.38 | V | 52.78 | --- | -19.36 | 33.42 | --- | 43.50 | -10.08 | Peak |
| 191.67 | V | 52.51 | --- | -21.22 | 31.28 | --- | 43.50 | -12.22 | Peak |
| 288.67 | V | 51.66 | --- | -18.81 | 32.85 | --- | 46.00 | -13.15 | Peak |
| 335.55 | V | 52.93 | --- | -17.60 | 35.33 | --- | 46.00 | -10.67 | Peak |
| 432.55 | V | 55.72 | --- | -15.14 | 40.57 | --- | 46.00 | -5.43 | Peak |
| 720.32 | V | 43.35 | --- | -10.42 | 32.93 | --- | 46.00 | -13.07 | Peak |
| | | | | | | | | | |
| 191.67 | H | 54.29 | --- | -21.22 | 33.07 | --- | 43.50 | -10.43 | Peak |
| 288.67 | H | 56.09 | --- | -18.81 | 37.29 | --- | 46.00 | -8.71 | Peak |
| 335.55 | H | 60.04 | --- | -17.60 | 42.43 | --- | 46.00 | -3.57 | Peak |
| 432.55 | H | 54.59 | --- | -15.14 | 39.45 | --- | 46.00 | -6.55 | Peak |
| 623.32 | H | 47.90 | --- | -11.52 | 36.38 | --- | 46.00 | -9.62 | Peak |
| 912.70 | H | 44.49 | --- | -8.04 | 36.45 | --- | 46.00 | -9.55 | Peak |

***Remark:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

**Above 1 GHz**

**Operation Mode:** TX / CH Low **Test Date:** January 9, 2006

**Temperature:** 23°C **Tested by:** Rex Lai

**Humidity:** 55 % RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 6315.00 | V | 48.12 | --- | -6.87 | 41.24 | --- | 74.00 | 54.00 | -12.76 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 3905.00 | H | 48.48 | --- | -8.61 | 39.86 | --- | 74.00 | 54.00 | -14.14 | Peak |
| 4285.00 | H | 47.80 | --- | -8.12 | 39.68 | --- | 74.00 | 54.00 | -14.32 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

**Operation Mode:** TX / CH Mid **Test Date:** January 9, 2006

**Temperature:** 23°C **Tested by:** Rex Lai

**Humidity:** 55 % RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 5785.00 | V | 49.28 | --- | -7.26 | 42.02 | --- | 74.00 | 54.00 | -11.98 | Peak |
| 6790.00 | V | 48.20 | --- | -6.21 | 41.99 | --- | 74.00 | 54.00 | -12.01 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1198.00 | H | 58.60 | --- | -14.52 | 44.08 | --- | 74.00 | 54.00 | -9.92 | Peak |
| 2222.00 | H | 58.70 | --- | -10.63 | 48.07 | --- | 74.00 | 54.00 | -5.93 | Peak |
| 7720.00 | H | 47.12 | --- | -5.42 | 41.70 | --- | 74.00 | 54.00 | -12.30 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

**Operation Mode:** TX / CH High **Test Date:** January 9, 2006

**Temperature:** 23°C **Tested by:** Rex Lai

**Humidity:** 55 % RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1266.00 | V | 58.17 | --- | -14.38 | 43.79 | --- | 74.00 | 54.00 | -10.21 | Peak |
| 5415.00 | V | 49.17 | --- | -7.42 | 41.75 | --- | 74.00 | 54.00 | -12.25 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1584.00 | H | 59.36 | --- | -13.41 | 45.95 | --- | 74.00 | 54.00 | -8.05 | Peak |
| 2058.00 | H | 57.27 | --- | -10.84 | 46.43 | --- | 74.00 | 54.00 | -7.57 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

## 7.8 POWERLINE CONDUCTED EMISSIONS

## LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, 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 50 µH/50 ohms 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 Range (MHz) | Limits (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56* | 56 to 46* |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

** Decreases with the logarithm of the frequency.*

**Test Configuration**

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

## TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

# TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

**Test Data**

| | | | |
|---|---|---|---|
| **Operation Mode:** | Normal Link | **Test Date:** | October 5, 2005 |
| **Temperature:** | 25°C | **Tested by:** | Bruce Chen |
| **Humidity:** | 55% RH | | |

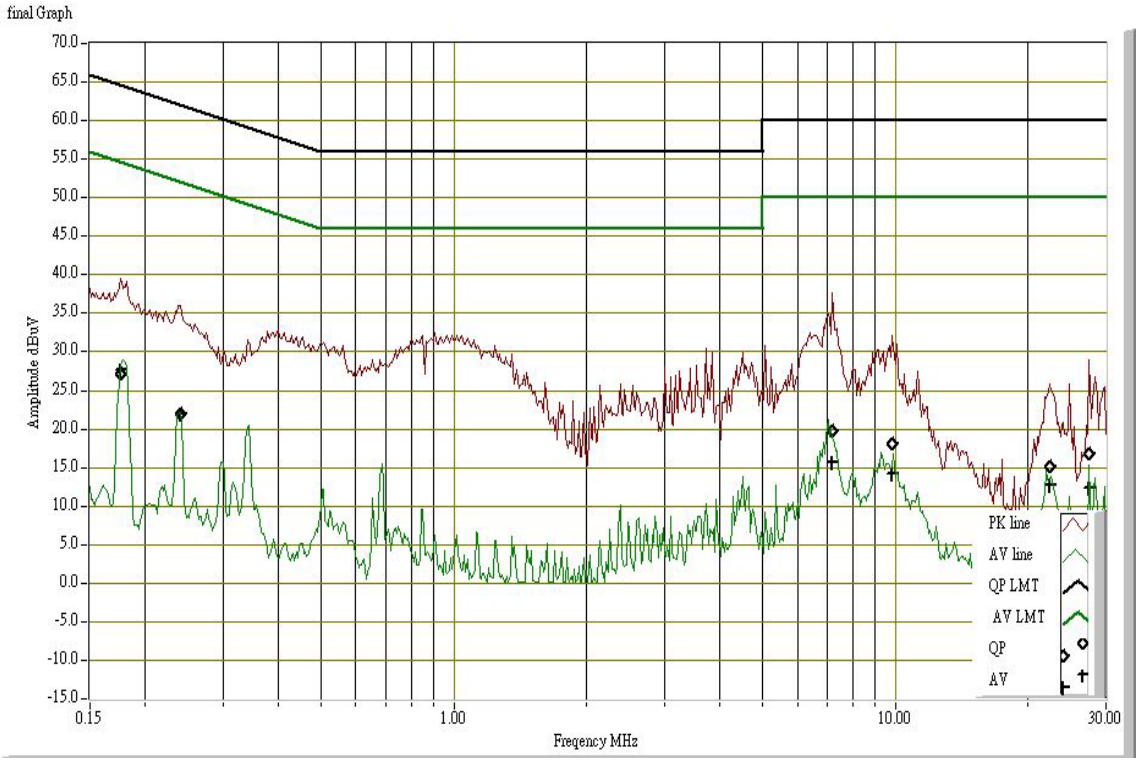
| Freq. (MHz) | QP Reading (dBuV) | AV Reading (dBuV) | Corr. factor (dB) | QP Result (dBuV) | AV Result (dBuV) | QP Limit (dBuV) | AV Limit (dBuV) | QP Margin (dB) | AV Margin (dB) | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.176 | 27.190 | 27.730 | 0.148 | 27.338 | 27.878 | 64.672 | 54.672 | -37.334 | -26.794 | L1 |
| 0.240 | 21.960 | 21.870 | 0.100 | 22.060 | 21.970 | 62.096 | 52.096 | -40.036 | -30.126 | L1 |
| 7.210 | 19.810 | 15.620 | 0.421 | 20.231 | 16.041 | 60.000 | 50.000 | -39.769 | -33.959 | L1 |
| 9.837 | 18.150 | 14.240 | 0.684 | 18.834 | 14.924 | 60.000 | 50.000 | -41.166 | -35.076 | L1 |
| 22.351 | 15.100 | 12.640 | 1.200 | 16.300 | 13.840 | 60.000 | 50.000 | -43.700 | -36.160 | L1 |
| 27.497 | 16.730 | 12.260 | 1.300 | 18.030 | 13.560 | 60.000 | 50.000 | -41.970 | -36.440 | L1 |
| | | | | | | | | | | |
| 0.177 | 20.940 | 21.370 | 0.146 | 21.086 | 21.516 | 64.625 | 54.625 | -43.539 | -33.109 | L2 |
| 4.295 | 15.000 | 10.830 | 0.130 | 15.130 | 10.960 | 56.000 | 46.000 | -40.870 | -35.040 | L2 |
| 7.152 | 24.960 | 21.130 | 0.415 | 25.375 | 21.545 | 60.000 | 50.000 | -34.625 | -28.455 | L2 |
| 9.916 | 24.990 | 20.620 | 0.692 | 25.682 | 21.312 | 60.000 | 50.000 | -34.318 | -28.688 | L2 |
| 24.791 | 17.730 | 14.260 | 1.200 | 18.930 | 15.460 | 60.000 | 50.000 | -41.070 | -34.540 | L2 |
| 28.162 | 18.250 | 13.060 | 1.326 | 19.576 | 14.386 | 60.000 | 50.000 | -40.424 | -35.614 | L2 |

***Remark:***

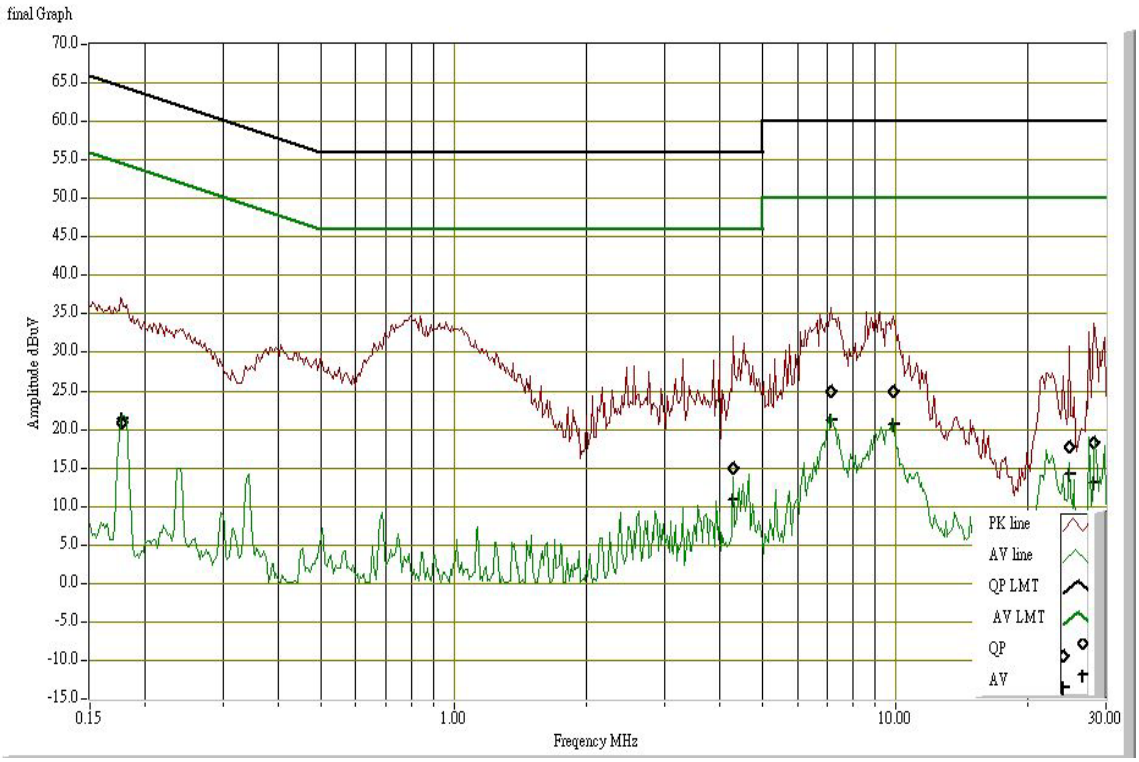
1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

## Test Plots

### *Conducted emissions (Line 1)*




### *Conducted emissions (Line 2)*



# APPENDIX I
# RADIO FREQUENCY EXPOSURE

## LIMIT

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.

**EUT Specification**

| | |
|---|---|
| **EUT** | Cradle |
| **Frequency band (Operating)** | ☐ WLAN: 2.412GHz ~ 2.462GHz<br>☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz<br>☐ WLAN: 5.745GHz ~ 5.825GHz<br>☒ Others: Bluetooth: 2.402GHz ~ 2.480GHz |
| **Device category** | ☒ Portable (<20cm separation)<br>☐ Mobile (>20cm separation)<br>☐ Others _____ |
| **Exposure classification** | ☐ Occupational/Controlled exposure *(S = 5mW/cm$^2$)*<br>☒ General Population/Uncontrolled exposure *(S=1mW/cm$^2$)* |
| **Antenna diversity** | ☒ Single antenna<br>☐ Multiple antennas<br>☐ Tx diversity<br>☐ Rx diversity<br>☐ Tx/Rx diversity |
| **Max. output power** | 1.31dBm (1.35mW) |
| **Antenna gain (Max)** | -3 dBi (Numeric gain: 0.501) |
| **Evaluation applied** | ☐ MPE Evaluation<br>☐ SAR Evaluation<br>☒ N/A |

***Remark:***
1. *The maximum output power is 1.31dBm (1.35mW) at 2402MHz (with 0.501 numeric antenna gain.)*
2. *DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.*
3. *For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm$^2$ even if the calculation indicates that the power density would be larger.*

## TEST RESULTS

*No non-compliance noted.*

*(SAR evaluation is not required for the PORTABLE device while its maximum output power is lower than the general population low threshold: $60/f_{(GHz)}$=60/2.441=24.58mW)*

**MPE evaluation**

*Not applicable.*