

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

### INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

**Product Name:** PDA Scanner  
**Brand Name:** unitech  
**Model Name:** HT680  
**Model Difference:** N/A  
**FCC ID:** HLEHT680BTGGR  
**Report No.:** EH/2009/70043  
**Issue Date:** Sep. 04, 2009  
**FCC Rule Part:** §15.247, Cat: DSS  
**Prepared for:** Unitech electronics CO., LTD.  
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**VERIFICATION OF COMPLIANCE**

**Applicant:** Unitech electronics CO., LTD.  
5F, No.136, Lan235, Pao-Chiao Rd., Hsin-Tien City, Taipei Hsien,  
Taiwan

**Equipment Under Test:** PDA Scanner

**Brand Name:** unitech

**Model No.:** HT680

**Model Difference:** N/A

**FCC ID:** HLEHT680BTGGR

**File Number:** EH/2009/70043

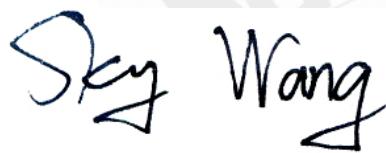
**Date of test:** Jul. 28, 2009 ~ Sep. 04, 2009

**Date of EUT Received:** Jul. 28, 2009

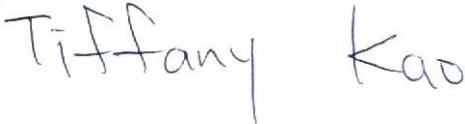
**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. 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 conducted and radiated emission limits of FCC Rules Part 15.247.

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

**Test By:****Date:**

Sep. 04, 2009

*Sky Wang / Engineer***Prepared By:****Date:**

Sep. 04, 2009

*Tiffany Kao / Clerk***Approved By:****Date:**

Sep. 04, 2009

*Vincent Su / Manager*

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**Version**

| <b>Version No.</b> | <b>Date</b>   | <b>Description</b>           |
|--------------------|---------------|------------------------------|
| 00                 | Sep. 04, 2009 | Initial creation of document |
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## 1. GENERAL INFORMATION

General:

|                   |  |                        |
|-------------------|--|------------------------|
| Product Name:     | PDA Scanner  |                        |
| Brand Name:       | unitech  |                        |
| Model Name:       | unitech  |                        |
| Model Difference: | N/A  |                        |
| Data Cable:       | Model No.: 1550-900021G                                      |                        |
| Power Supply      | 3.7 Vdc re-chargeable battery or 5 dc by AC/DC power adapter |                        |
|                   | Adapter:   | Model No.: 3A-181WP05A |
|                   | Battery:   | Model No.: HUT-2001G   |

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**GSM:**

|                   | Operating Frequency   | Rated Power           |
|-------------------|---|-----------------------|
| Hardware Version: | GSM/GPRS/EDGE 850, Class 12   | 824.2 MHz – 848.8MHz  |
|                   | GSM/GPRS/EDGE 900, Class 12   | 880.0MHz – 914.8MHz   |
|                   | GSM/GPRS/EDGE 1800, Class 12  | 1710.2MHz-1784.8MHz   |
|                   | GSM/GPRS/EDGE 1900, Class 12  | 1850.2MHz – 1909.8MHz |
| Type of Emission  | GSM/GPRS 850: 247KGXW, GSM/GPRS 1900: 245GXW<br>EDGE 850: 244KG7W<br>EDGE 1900: 244KG7W |                       |
| Hardware Version: | N/A   |                       |
| Software Version: | N/A   |                       |
| IMEI:             | 353227020112390   |                       |

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**WLAN:**

|                                   |  |
|-----------------------------------|--|
| Frequency Range & Channel number: | 802.11 b/g: 2412 – 2462 MHz  |
| Rated Power:                      | 802.11 b: 18.24 dBm<br>802.11 g: 15.90 dBm                         |
| Modulation type:                  | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM    |
| Transmission Rate:                | 802.11 b: 1/2/5.5/11 Mbps;<br>802.11 g: 6/9/12/18/24/36/48/54 Mbps |
| Antenna Designation:              | PCB Antenna / Gain: 2.9 dBi  |

The EUT is compliance with IEEE 802.11 b/g Standard.

**Bluetooth:**

|                      |   |
|----------------------|---|
| Bluetooth Version:   | <input type="checkbox"/> V1.1 (GFSK)<br><input type="checkbox"/> V1.2 (GFSK)<br><input type="checkbox"/> V2.0 (GFSK)<br><input checked="" type="checkbox"/> V2.0 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK)<br><input type="checkbox"/> V2.1 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK) |
| Channel number:      | 79 channels   |
| Modulation type:     | GFSK + $\pi/4$ DQPSK + 8DPSK  |
| Transmit Power:      | 1.68 dBm  |
| Frequency Range:     | 2.402GHz – 2.480GHz   |
| Dwell Time:          | <= 0.4s   |
| Operating Mode:      | Point-to-Point  |
| Antenna Designation: | Dielectric PIFA Antenna, 1.71 dBi.  |

The EUT is compliance with Bluetooth 2.0 + EDR Standard.

This report applies for Bluetooth

### **1.1. Related Submittal(s) / Grant (s)**

This submittal(s) (test report) is intended for FCC ID: **HLEHT680BTGGR** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a Doc procedure.

### **1.2. Test Methodology**

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance 3 meters.

### **1.3. Test Facility**

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. FCC Registration Number are: 990257 and 236194, Canada Registration Number: 4620A-1

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 & 10 meters) and FCC Registration Number: 94644.

### **1.4. Special Accessories**

Not available for this EUT intended for grant.

### **1.5. Equipment Modifications**

Not available for this EUT intended for grant.

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## **2. SYSTEM TEST CONFIGURATION**

### **2.1. EUT Configuration**

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

### **2.2. EUT Exercise**

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

### **2.3. Test Procedure**

#### **2.3.1 Conducted Emissions**

The EUT is placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7 and 13 of ANSI C63.4: 2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

#### **2.3.2 Radiated Emissions**

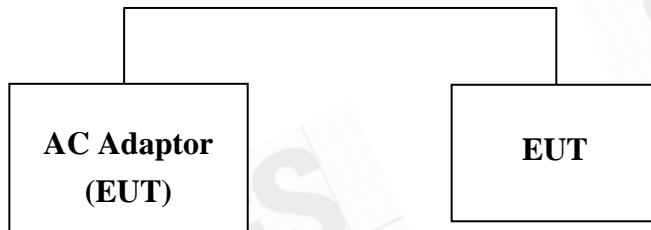
The EUT is placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level.

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 max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 and Subclause 8.3.1.2 of ANSI C63.4: 2003.

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## 2.4. Configuration of Tested System

**Fig. 2-1 AC Power line and Radiated Emission Configuration**



**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/<br>Type No. | Series No. | Data Cable | Power Cord |
|------|-----------|-----------|--------------------|------------|------------|------------|
| 1    | N/A       |           |                    |            |            |            |

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### 3. SUMMARY OF TEST RESULTS

| <b>FCC Rules</b>             | <b>Description Of Test</b>                | <b>Result</b> |
|------------------------------|---|---------------|
| §15.207(a)                   | Conducted Emission                        | Compliant     |
| §15.247(b)(1)                | Peak Output Power                         | Compliant     |
| §15.247(a)                   | 20dB Bandwidth                            | No Limit      |
| §15.247I                     | 100 KHz Bandwidth Of Frequency Band Edges | Compliant     |
| §15.209(a) (f)               | Spurious Emission                         | Compliant     |
| §15.247(a)(1)                | Frequency Separation                      | Compliant     |
| §15.247(a)(1)(iii)           | Number of hopping frequency               | Compliant     |
| §15.247(a)(1)(iii)           | Time of Occupancy                         | Compliant     |
| §15.203,<br>§15.247(b)(4)(i) | Antenna Requirement                       | Compliant     |

### 4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel Low, Mid and High with highest rated data rate were chosen for full testing.

The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High the worst case H position was reported.

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## 5. CONDUCTED EMISSION TEST

### 5.1. Standard Applicable

According to §15.207. frequency within 150KHz to 30MHz shall not exceed the limit table as below.

| Frequency range<br>MHz | Limits<br>dB(uV) |          |
|------------------------|------------------|----------|
|                        | 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       |

**Note**

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 5.2. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4: 2003.
2. The EUT was plug-in the AC/DC Power adapter. The host system was placed on the center of the back edge on the test table. The peripherals was placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host system was connected with 120Vac/60Hz power source.

### 5.3. Measurement 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.

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#### 5.4. Measurement Equipment Used:

| Conducted Emission Test Site |            |                         |               |            |            |
|------------------------------|------------|-------------------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR        | MODEL NUMBER            | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EMI Test Receiver            | R&S        | ESCS30                  | 828985/004    | 09/15/2009 | 09/14/2010 |
| LISN                         | Rolf-Heine | NNB-2/16Z               | 99012         | 02/02/2009 | 02/01/2010 |
| LISN                         | FCC        | FCC-LISN-50/250-25-2-01 | 04034         | 02/02/2009 | 02/01/2010 |
| Coaxial Cables               | N/A        | WK CE Cable             | N/A           | 11/28/2009 | 11/27/2010 |

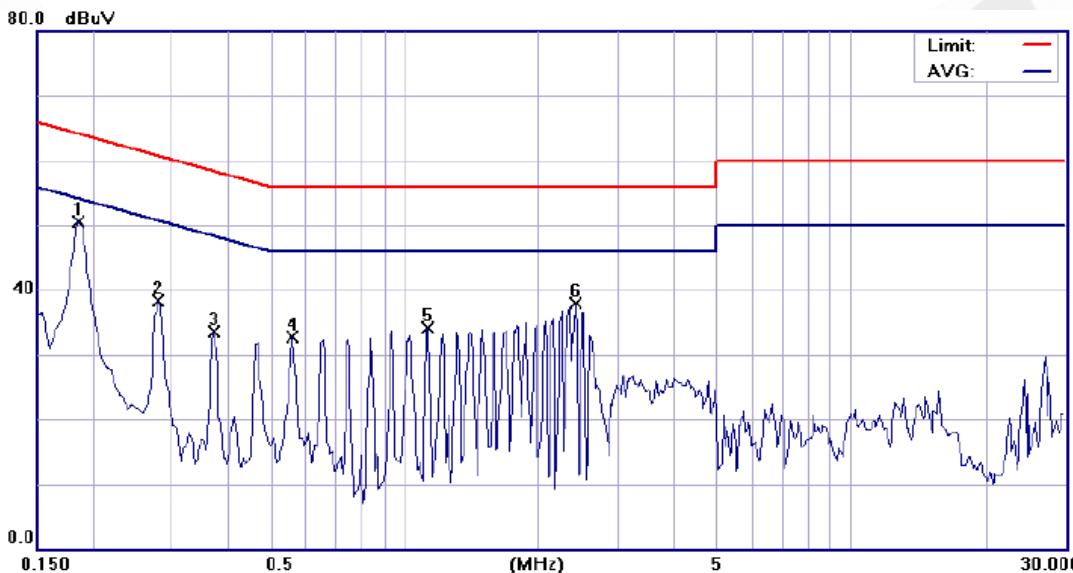
#### 5.5. Measurement Result

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.

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**AC POWER LINE CONDUCTED EMISSION TEST DATA**

|                 |                |           |      |            |               |
|-----------------|----------------|-----------|------|------------|---------------|
| Operation Mode: | Bluetooth Mode |           |      | Test Date: | Sep. 04, 2009 |
| Temperature:    | 23 °C          | Humidity: | 59 % | Test By:   | Sky           |



Site SGS CONDUCTED #1

Phase: **L1**

Temperature: 23 °C

Limit: CISPR22/11/EN55022 Class B

Power: AC 120V/60Hz

Humidity: 60 %

EUT: PDA Scanner

Distance:

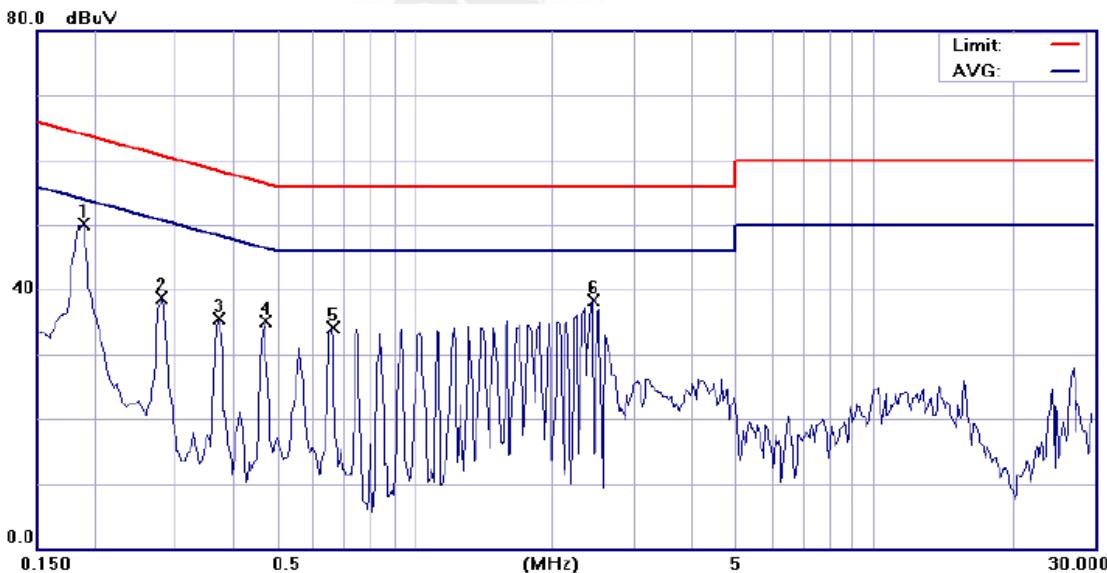
Air Pressure: hpa

M/N: HT680

Note: BT MODE

| No. | Mk. | Freq.  | Reading | Factor | Measure- | Limit | Over   | Detector | Comment |
|-----|-----|--------|---------|--------|----------|-------|--------|----------|---------|
|     |     |        | Level   |        | ment     |       |        |          |         |
| 1   | *   | 0.1850 | 50.04   | 0.56   | 50.60    | 64.26 | -13.66 | peak     |         |
| 2   |     | 0.2800 | 37.68   | 0.60   | 38.28    | 60.82 | -22.54 | peak     |         |
| 3   |     | 0.3750 | 32.87   | 0.64   | 33.51    | 58.39 | -24.88 | peak     |         |
| 4   |     | 0.5600 | 32.02   | 0.70   | 32.72    | 56.00 | -23.28 | peak     |         |
| 5   |     | 1.1200 | 33.16   | 0.86   | 34.02    | 56.00 | -21.98 | peak     |         |
| 6   |     | 2.4200 | 37.03   | 0.92   | 37.95    | 56.00 | -18.05 | peak     |         |

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Site SGS CONDUCTED #1

Phase: *N*

Temperature: 23 °C

Limit: CISPR22/11/EN55022 Class B

Power: AC 120V/60Hz

Humidity: 60 %

EUT: PDA Scanner

Distance:

Air Pressure: hpa

M/N: HT680

Note: BT MODE

| No. | Mk. | Freq.  | Reading | Factor | Measure- | Limit | Over   |          |
|-----|-----|--------|---------|--------|----------|-------|--------|----------|
|     |     |        | Level   |        | ment     |       | dB     | Detector |
|     |     | MHz    | dBuV    |        | dBuV     |       |        |          |
| 1   | *   | 0.1900 | 49.45   | 0.57   | 50.02    | 64.04 | -14.02 | peak     |
| 2   |     | 0.2800 | 38.20   | 0.60   | 38.80    | 60.82 | -22.02 | peak     |
| 3   |     | 0.3750 | 34.94   | 0.64   | 35.58    | 58.39 | -22.81 | peak     |
| 4   |     | 0.4700 | 34.35   | 0.67   | 35.02    | 56.51 | -21.49 | peak     |
| 5   |     | 0.6600 | 33.40   | 0.73   | 34.13    | 56.00 | -21.87 | peak     |
| 6   |     | 2.4400 | 37.25   | 1.02   | 38.27    | 56.00 | -17.73 | peak     |

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## 6. PEAK OUTPUT POWER MEASUREMENT

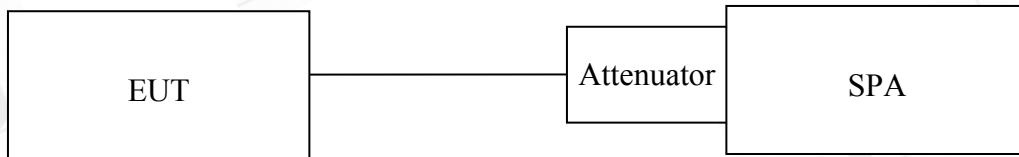
### 6.1. Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

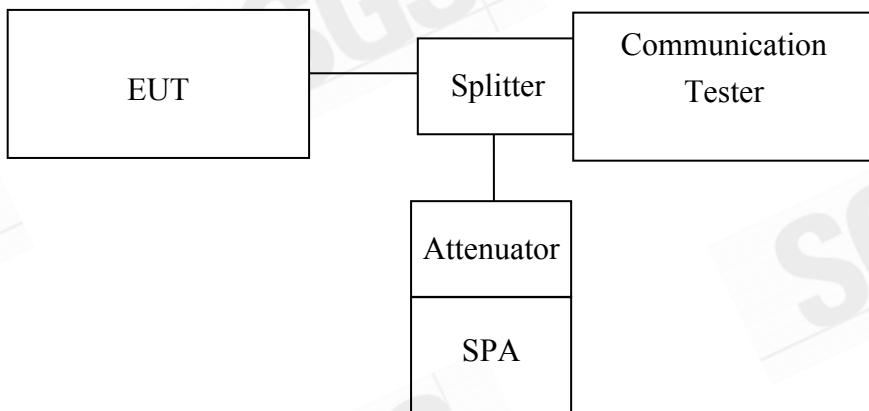
### 6.2. Measurement Equipment Used

| Conducted Emission Test Site |              |                 |               |            |            |
|------------------------------|--------------|-----------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR          | MODEL NUMBER    | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer            | Agilent      | E4446A          | MY43360126    | 04/19/2008 | 04/18/2010 |
| Spectrum Analyzer            | Agilent      | E4440A          | MY45304525    | 01/23/2008 | 01/22/2010 |
| DC Block                     | Agilent      | BLK-18          | 155452        | 07/05/2009 | 07/04/2010 |
| Low Loss Cable               | HUBER+SUHNER | SUCOFLEX 104PEA | N/A           | 01/05/2009 | 01/04/2010 |
| Attenuator                   | Mini-Circuit | BW-S6W5         | 001           | 07/05/2009 | 07/04/2010 |
| Attenuator                   | Mini-Circuit | BW-S10W5        | 001           | 07/05/2009 | 07/04/2010 |
| Attenuator                   | Mini-Circuit | BW-S20W5        | 001           | 07/05/2009 | 07/04/2010 |
| Splitter                     | Agilent      | 11636B          | N/A           | 07/05/2009 | 07/04/2010 |

### 6.3. Test Set-up:



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#### 6.4. Measurement 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 power meter or spectrum. (Max peak function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

#### 6.5. Measurement Result

BDR mode:

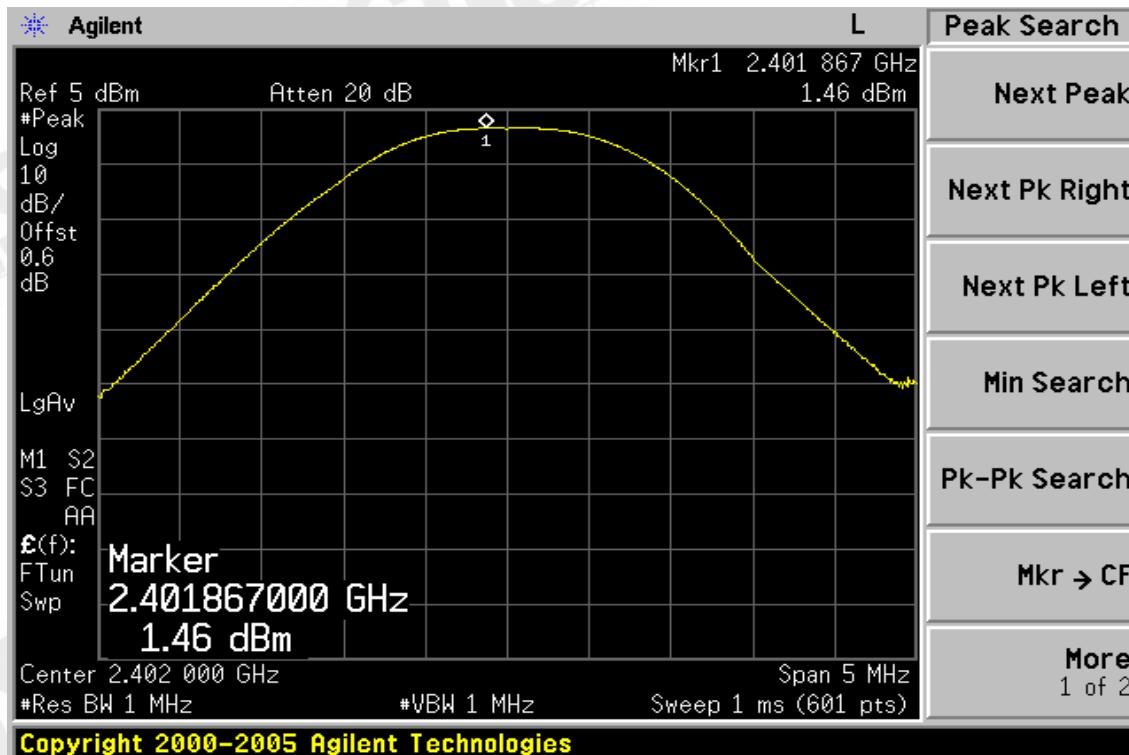
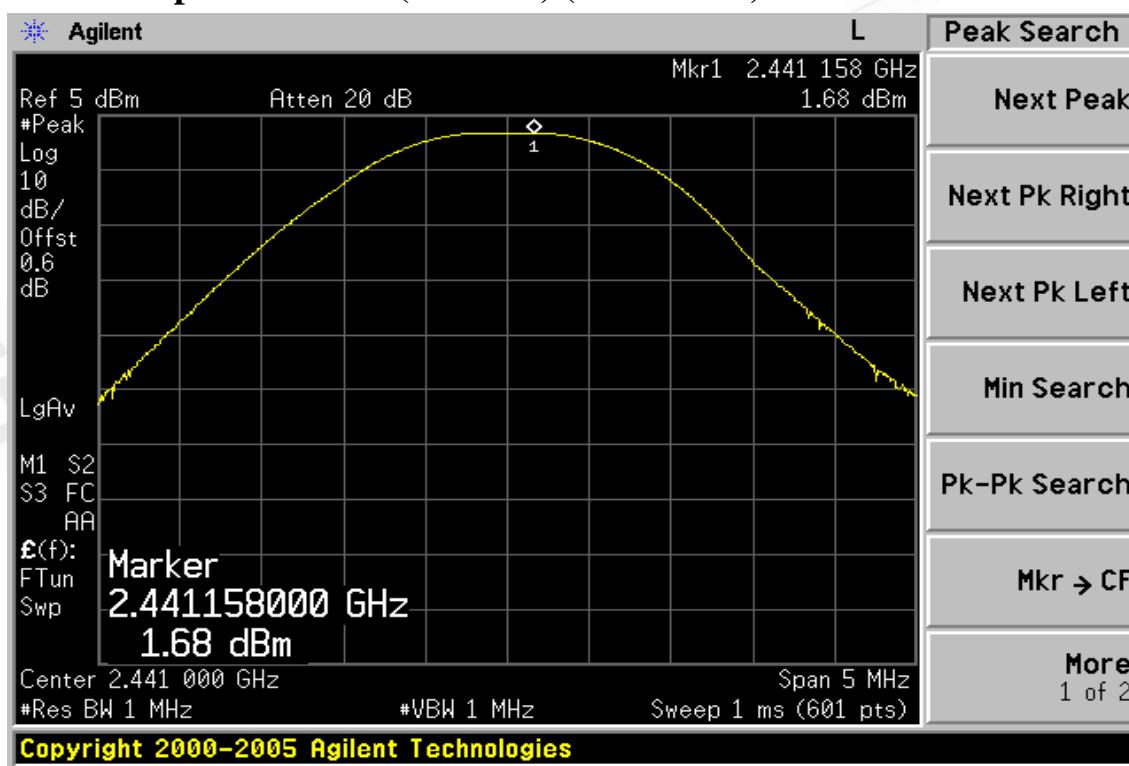
| Frequency (MHz) | Reading Power (dBm) | Cable Loss | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|------------|--------------------|------------------|-----------|
| 2402.00         | 1.46                | 0.00       | 1.46               | 0.00140          | 1         |
| 2441.00         | 1.68                | 0.00       | 1.68               | 0.00147          | 1         |
| 2480.00         | 1.50                | 0.00       | 1.50               | 0.00141          | 1         |

EDR mode:

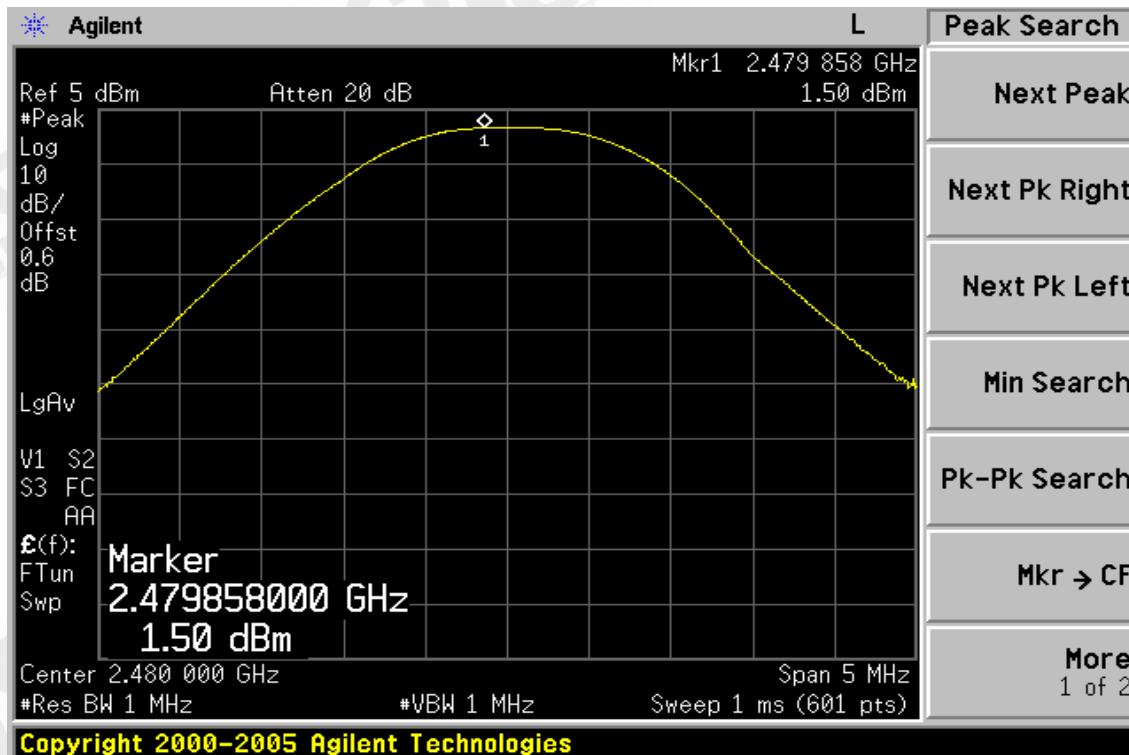
| Frequency (MHz) | Reading Power (dBm) | Cable Loss | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|------------|--------------------|------------------|-----------|
| 2402.00         | 0.55                | 0.00       | 0.55               | 0.00114          | 1         |
| 2441.00         | 1.03                | 0.00       | 1.03               | 0.00127          | 1         |
| 2480.00         | 1.01                | 0.00       | 1.01               | 0.00126          | 1         |

**NOTE: offset: 0.6dB**

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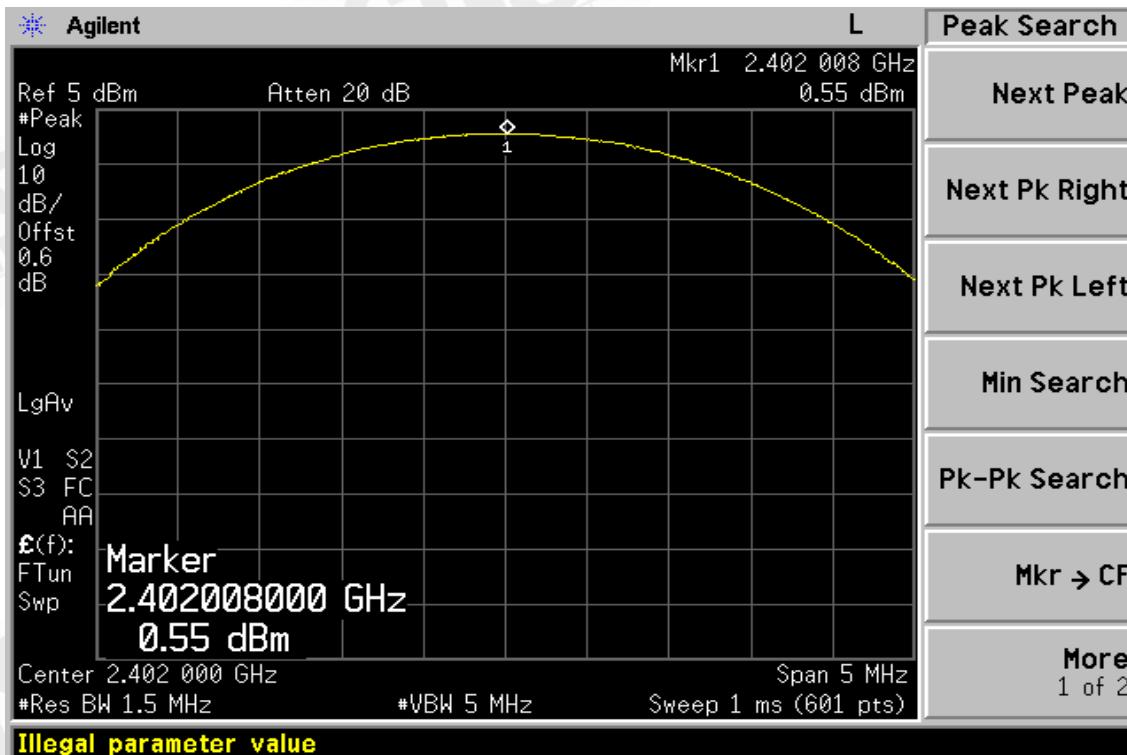
**Peak Power Output Data Plot (CH Low) (BDR mode)****Peak Power Output Data Plot (CH Mid) (BDR mode)**

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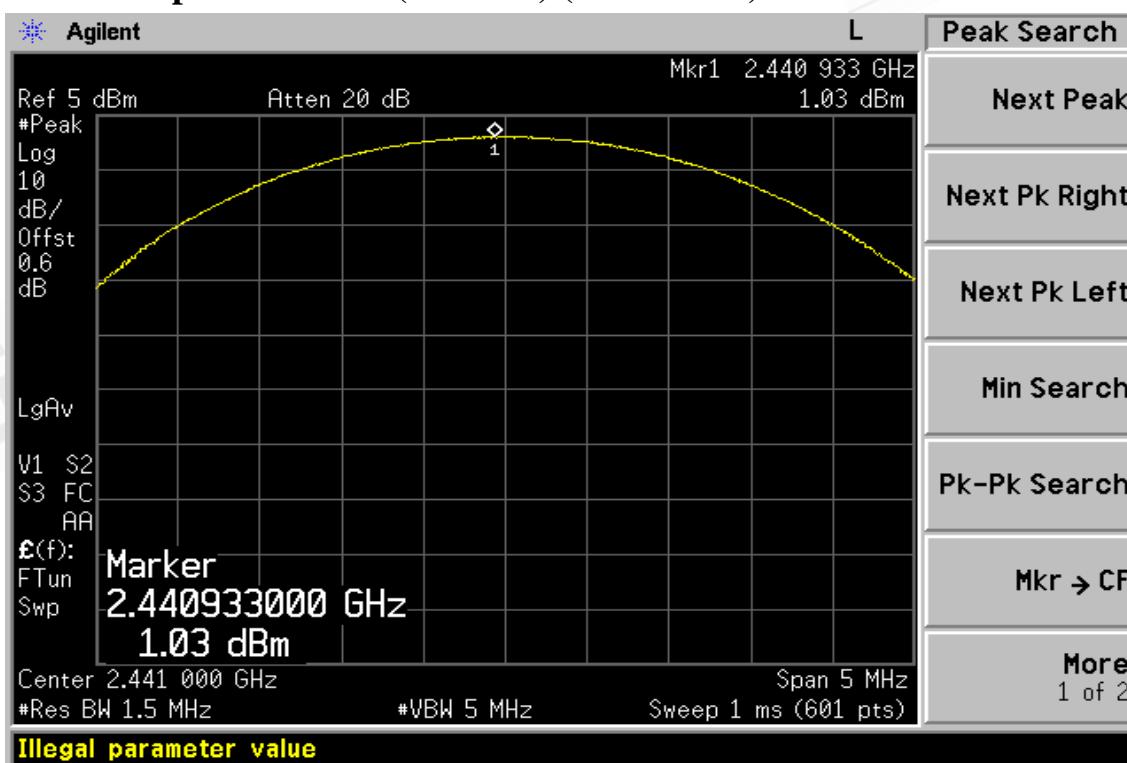
**Peak Power Output Data Plot (CH High) (BDR mode)**

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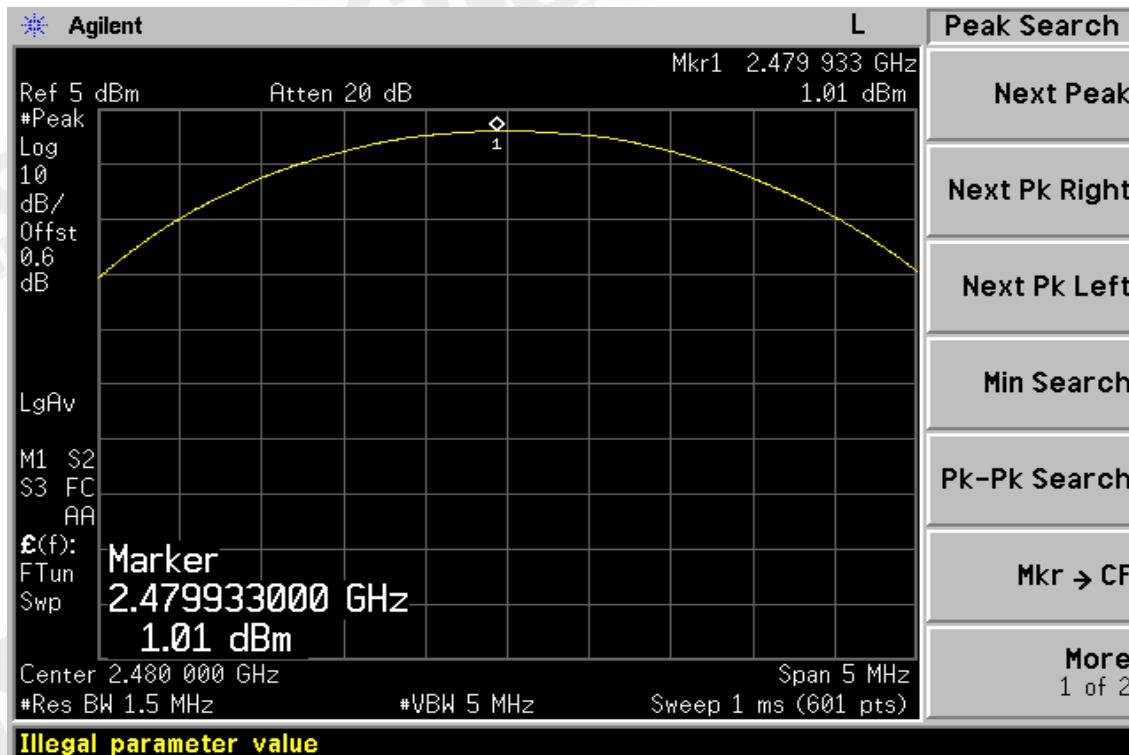
### Peak Power Output Data Plot (CH Low) (EDR mode)



### Peak Power Output Data Plot (CH Mid) (EDR mode)



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**Peak Power Output Data Plot (CH High) (EDR mode)**

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## **7. 20dB BAND WIDTH**

### **7.1. Standard Applicable**

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

### **7.2. Measurement Equipment Used**

Refer to section 6.2 for details.

### **7.3. Test Set-up**

Refer to section 6.3 for details.

### **7.4. Measurement 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=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

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**7.5. Measurement Result:**

BDR mode:

| CH     | Bandwidth (kHz) |
|--------|-----------------|
| Lower  | 885.145         |
| Mid    | 885.981         |
| Higher | 866.015         |

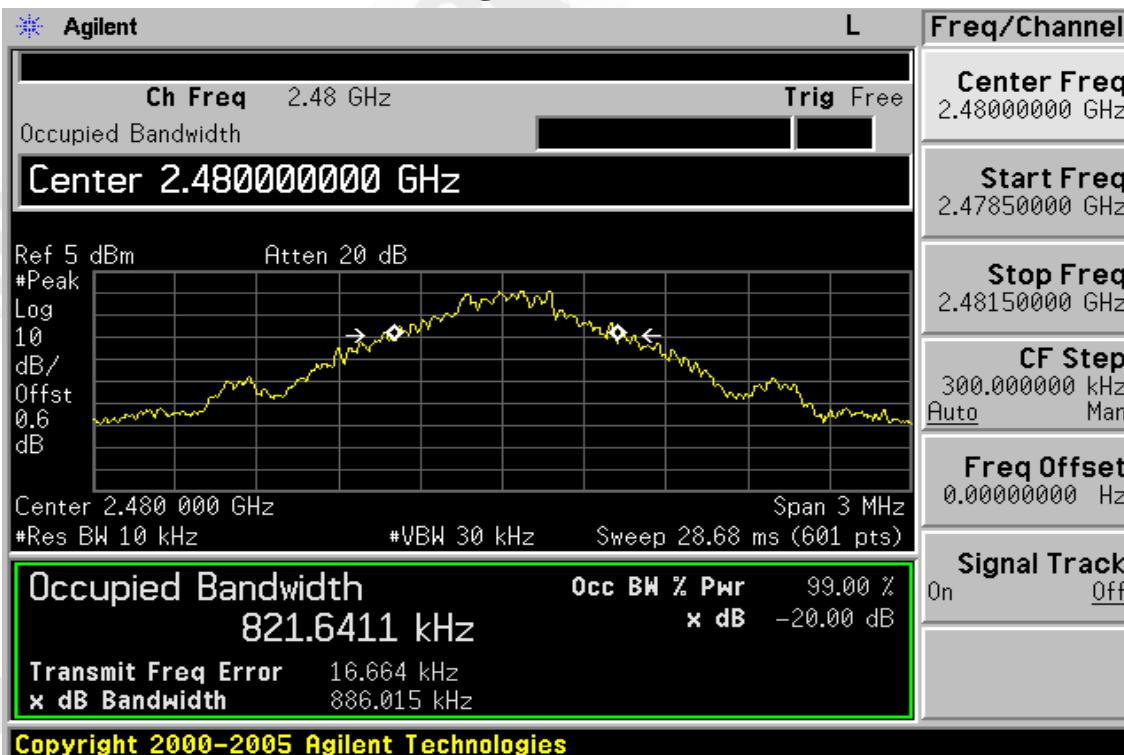
EDR mode:

| CH     | Bandwidth (MHz) | 2/3 Bandwidth (MHz) |
|--------|-----------------|---------------------|
| Lower  | 1.274           | 0.849               |
| Mid    | 1.273           | 0.849               |
| Higher | 1.269           | 0.846               |

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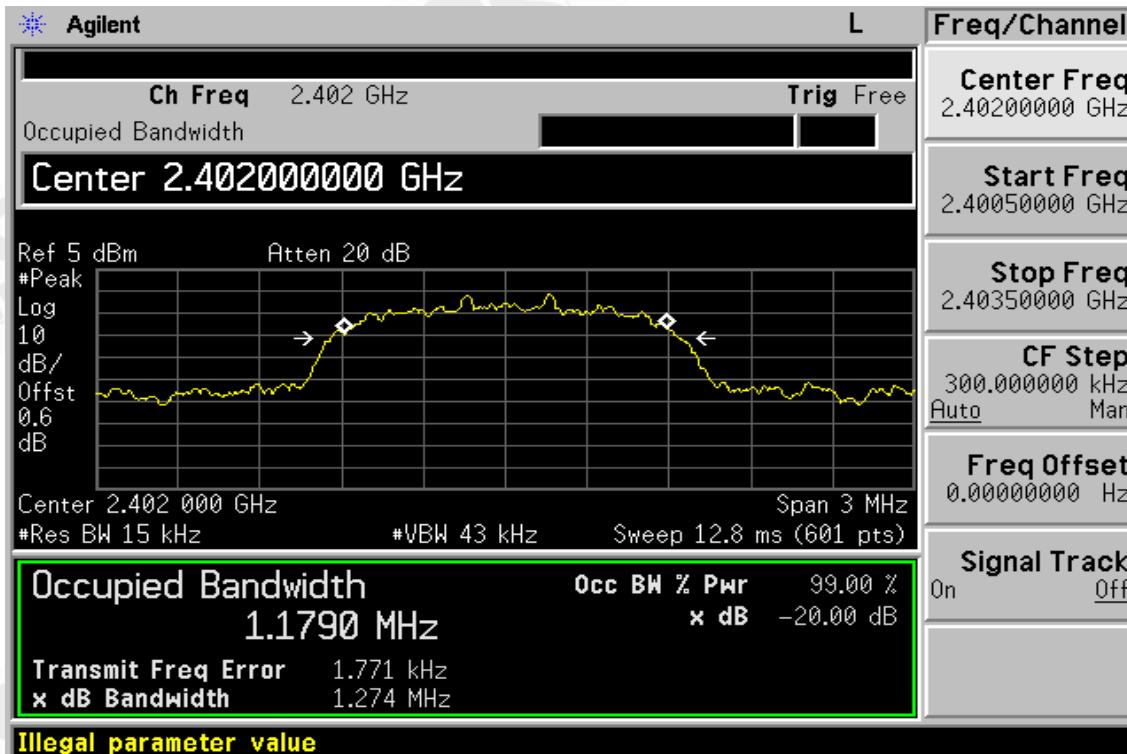
**20dB Band Width Test Data CH-Low (BDR mode)****20dB Band Width Test Data CH-Mid (BDR mode)**

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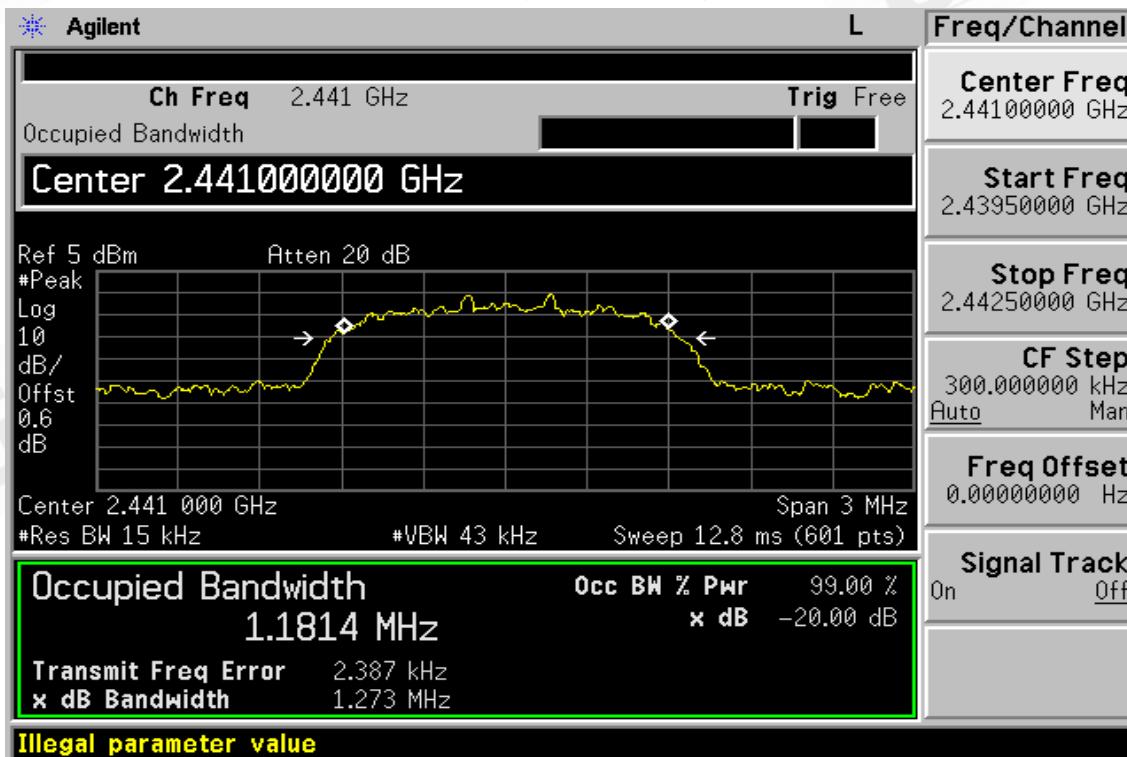
**20dB Band Width Test Data CH-High (BDR mode)**

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## 20dB Band Width Test Data CH-Low (EDR mode)

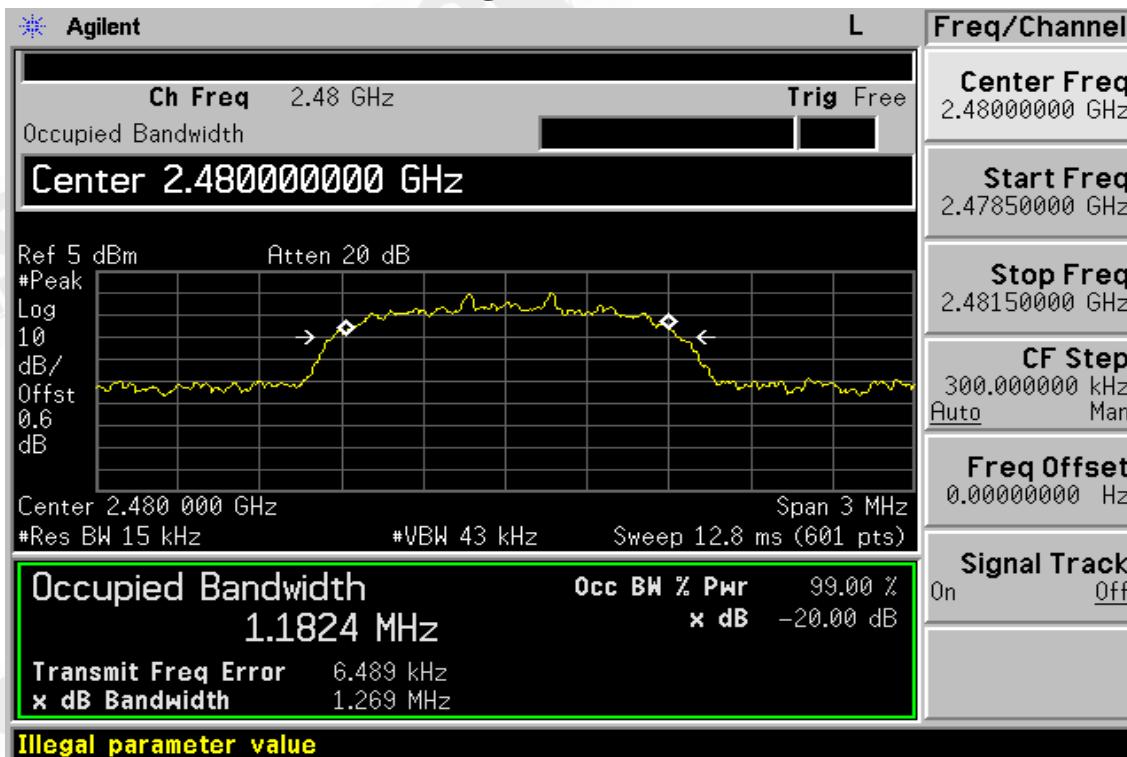


## 20dB Band Width Test Data CH-Mid (EDR mode)



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**20dB Band Width Test Data CH-High (EDR mode)**

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## 8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

### 8.1. Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power. 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).

### 8.2. Measurement Equipment Used

#### 8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

#### 8.2.2. Radiated emission:

| 966 Chamber       |              |                     |               |            |            |
|-------------------|--------------|---------------------|---------------|------------|------------|
| EQUIPMENT TYPE    | MFR          | MODEL NUMBER        | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer | R&S          | FSP 40              | 100034        | 02/12/2009 | 02/11/2010 |
| Loop antenna      | MESSTEC      | FLA30               | 03/10086      | 07/08/2009 | 07/07/2011 |
| Bilog Antenna     | SCHWAZBECK   | VULB9160            | 9160-3136     | 11/15/2008 | 11/14/2009 |
| Horn antenna      | SCHWAZBECK   | BBHA 9120D          | 9120D-673     | 05/09/2008 | 05/08/2010 |
| Pre-Amplifier     | Agilent      | 8447D               | 1937A02834    | 11/19/2009 | 11/18/2010 |
| Pre-Amplifier     | Agilent      | 8449B               | 3008A01973    | 01/05/2009 | 01/04/2010 |
| Turn Table        | HD           | DT420               | N/A           | N.C.R      | N.C.R      |
| Antenna Tower     | HD           | MA240-N             | 240/657       | N.C.R      | N.C.R      |
| Controller        | HD           | HD100               | N/A           | N.C.R      | N.C.R      |
| Low Loss Cable    | HUBER+SUHNER | SUCOFLEX 104PEA-10M | 10m           | 01/05/2009 | 01/04/2010 |
| Low Loss Cable    | HUBER+SUHNER | SUCOFLEX 104PEA-3M  | 3m            | 01/05/2009 | 01/04/2010 |
| 3m Site           | SGS          | 966 chamber         | N/A           | 11/08/2009 | 11/07/2010 |

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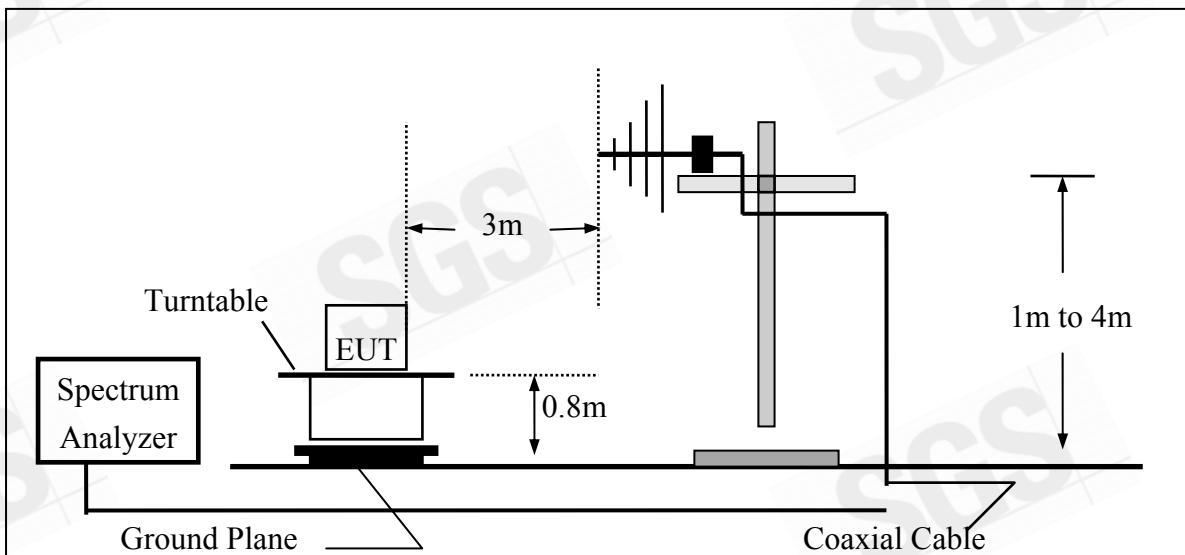
### 8.3. Test SET-UP:

#### 8.3.1. Conducted Emission at antenna port:

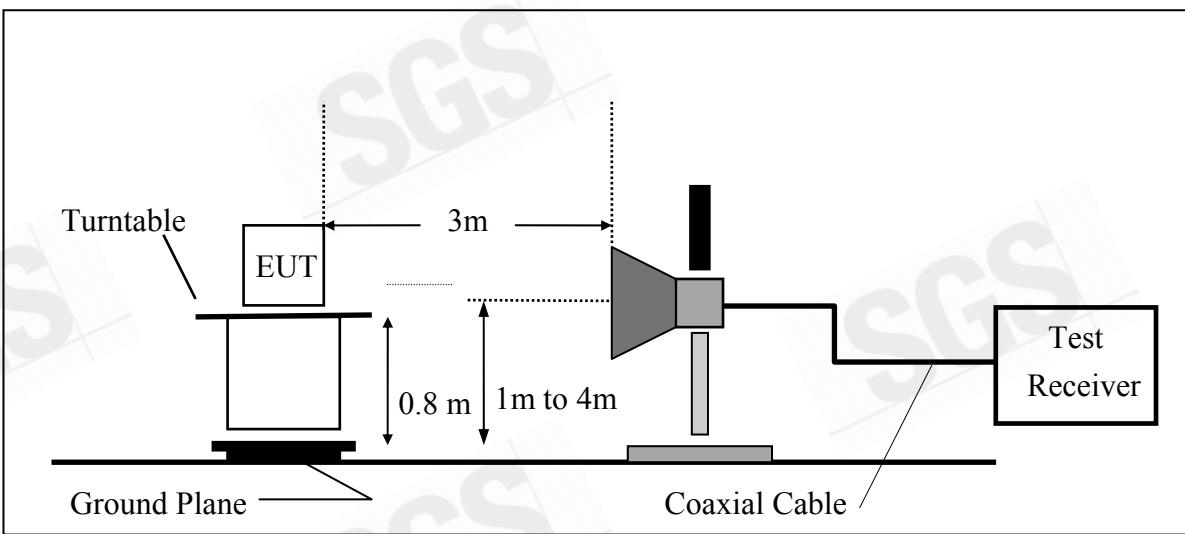
Refer to section 6.3 for details.

#### 8.3.2. Radiated emission:

##### (A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



##### (B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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#### **8.4. Measurement 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=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.
7. Radiated Emission refer to section 9.

#### **8.5. Field Strength Calculation**

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

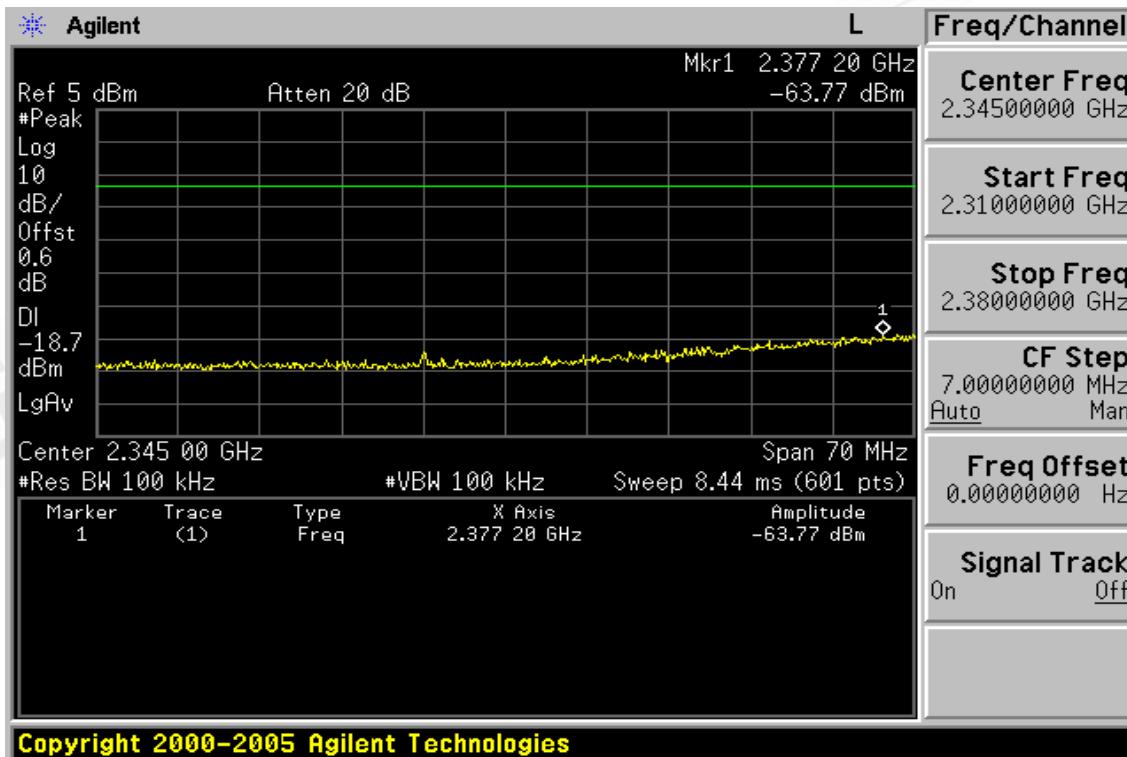
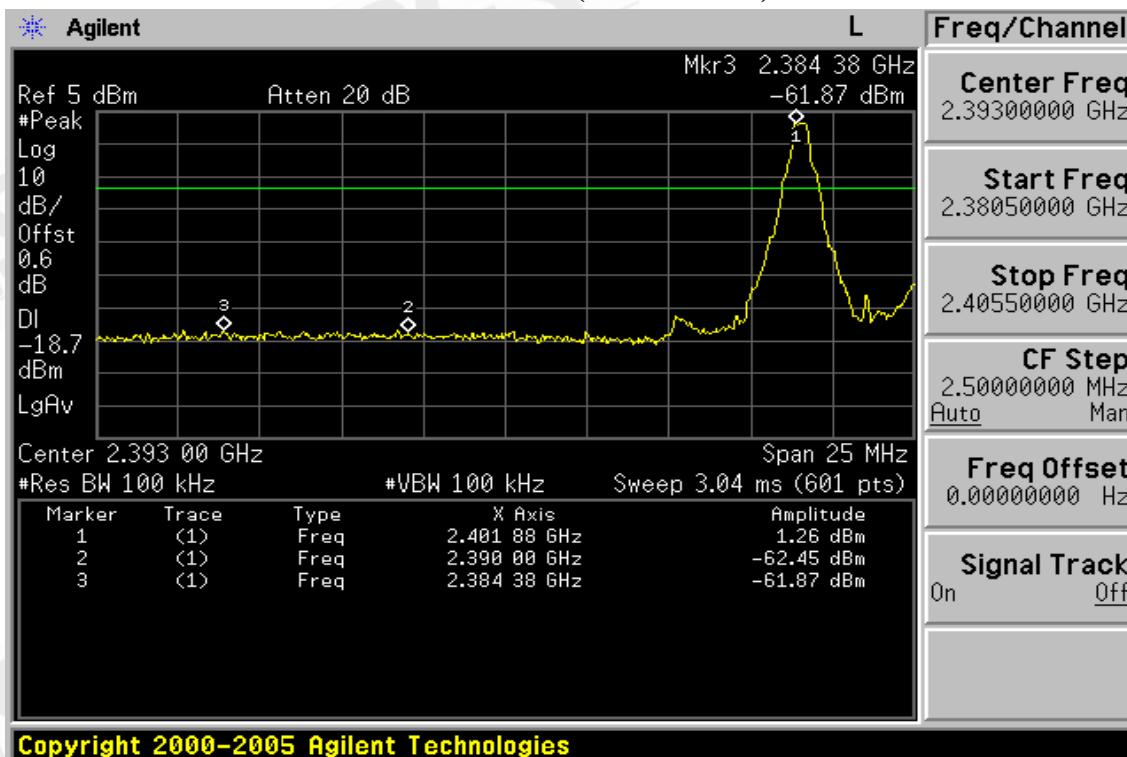
$$\mathbf{FS = RA + AF + CL - AG}$$

|       |                        |  |
|-------|------------------------|--|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |  |

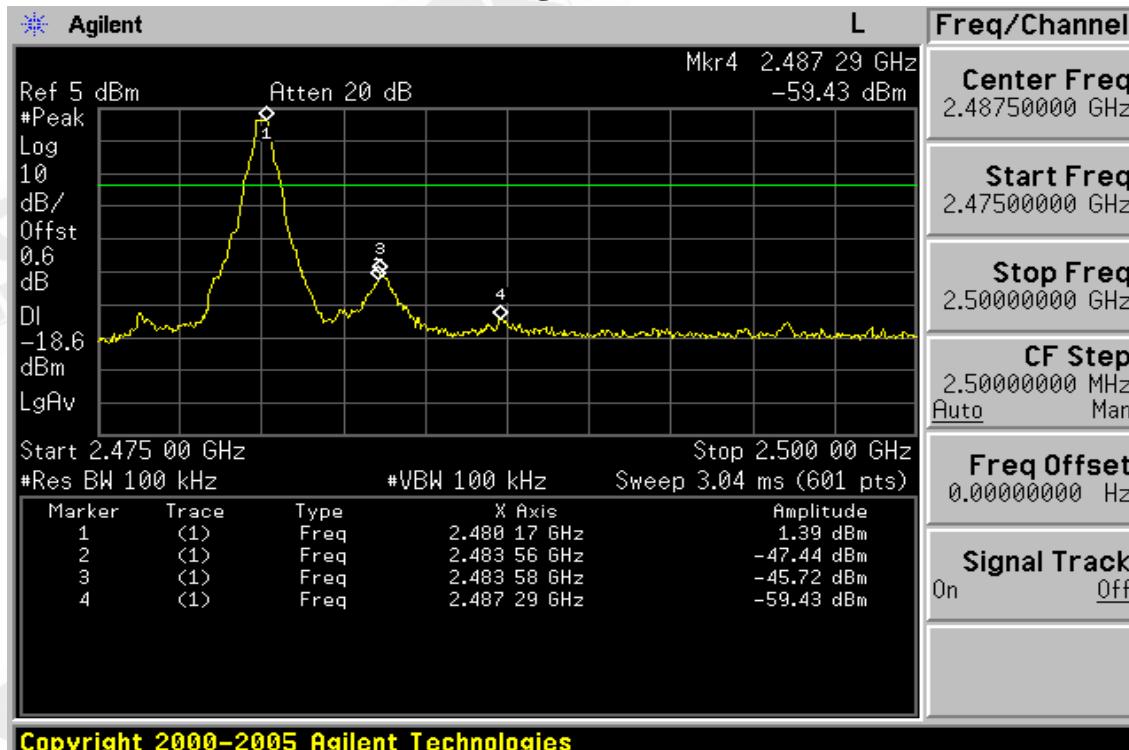
#### **8.6. Measurement Result**

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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**Conducted Emission: Test Data CH-Low (BDR mode)**

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**Conducted Emission: Test Data CH-High**

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**Radiated Emission: (BDR mode)**

Operation Mode TX CH Low  
Fundamental Frequency 2402 MHz  
Temperature 25 °C  
Humidity 65 %

Test Date Sep. 04, 2009  
Test By Sky  
Pol Ver.

| (MHz)   | (dBuV) | (dBuV) | C F(dB) | (dBuV/m) | (dBuV/m) | (dBuV/m) | (dBuV/m) | (dB)        |
|---------|--------|--------|---------|----------|----------|----------|----------|-------------|
| 2390.00 | 35.19  | ---    | -1.39   | 33.80    | ---      | 74.00    | 54.00    | -20.20 Peak |

Operation Mode TX CH Low  
Fundamental Frequency 2402 MHz  
Temperature 25 °C  
Humidity 65 %

Test Date Sep. 04, 2009  
Test By Sky  
Pol Hor.

| Freq.<br>(MHz) | Peak              | AV                | Actual FS         |          | Peak             | AV             | Margin<br>(dB) | Remark      |
|----------------|-------------------|-------------------|-------------------|----------|------------------|----------------|----------------|-------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | (dBuV/m) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) |                |             |
| 2390.00        | 35.03             | ---               | -1.39             | 33.64    | ---              | 74.00          | 54.00          | -20.36 Peak |

**Remark :**

- (1) 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.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column ◎
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Emission: (BDR mode)**

Operation Mode TX CH High  
Fundamental Frequency 2480 MHz  
Temperature 25 °C  
Humidity 65 %

Test Date Sep. 04, 2009  
Test By Sky  
Pol Ver.

| Freq.<br>(MHz) | Peak              | AV                | Actual FS         |                  | Peak            | AV    | Margin<br>(dB) | Remark     |
|----------------|-------------------|-------------------|-------------------|------------------|-----------------|-------|----------------|------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | A V<br>(dBuV/m) |       |                |            |
| 2483.56        | 45.06             | ---               | -0.92             | 44.14            | ---             | 74.00 | 54.00          | -9.86 Peak |

Operation Mode TX CH High  
Fundamental Frequency 2480 MHz  
Temperature 25 °C  
Humidity 65 %

Test Date Sep. 04, 2009  
Test By Sky  
Pol Hor.

| Freq.<br>(MHz) | Peak              | AV                | Actual FS         |                  | Peak            | AV    | Margin<br>(dB) | Remark      |
|----------------|-------------------|-------------------|-------------------|------------------|-----------------|-------|----------------|-------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | A V<br>(dBuV/m) |       |                |             |
| 2483.56        | 42.19             | ---               | -0.92             | 41.27            | ---             | 74.00 | 54.00          | -12.73 Peak |

**Remark :**

- (1) 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.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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## 9. SPURIOUS RADIATED EMISSION TEST

### 9.1. Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

### 9.2. Measurement Equipment Used:

#### 9.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

#### 9.2.2. Radiated emission:

Refer to section 7.2 for details.

### 9.3. Test SET-UP:

#### 9.3.1. Conducted Emission at antenna port:

Refer to section 6.3 for details.

#### 9.3.2. Radiated emission:

Refer to section 7.3 for details.

### 9.4. Measurement Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

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## 9.5. Field Strength Calculation

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

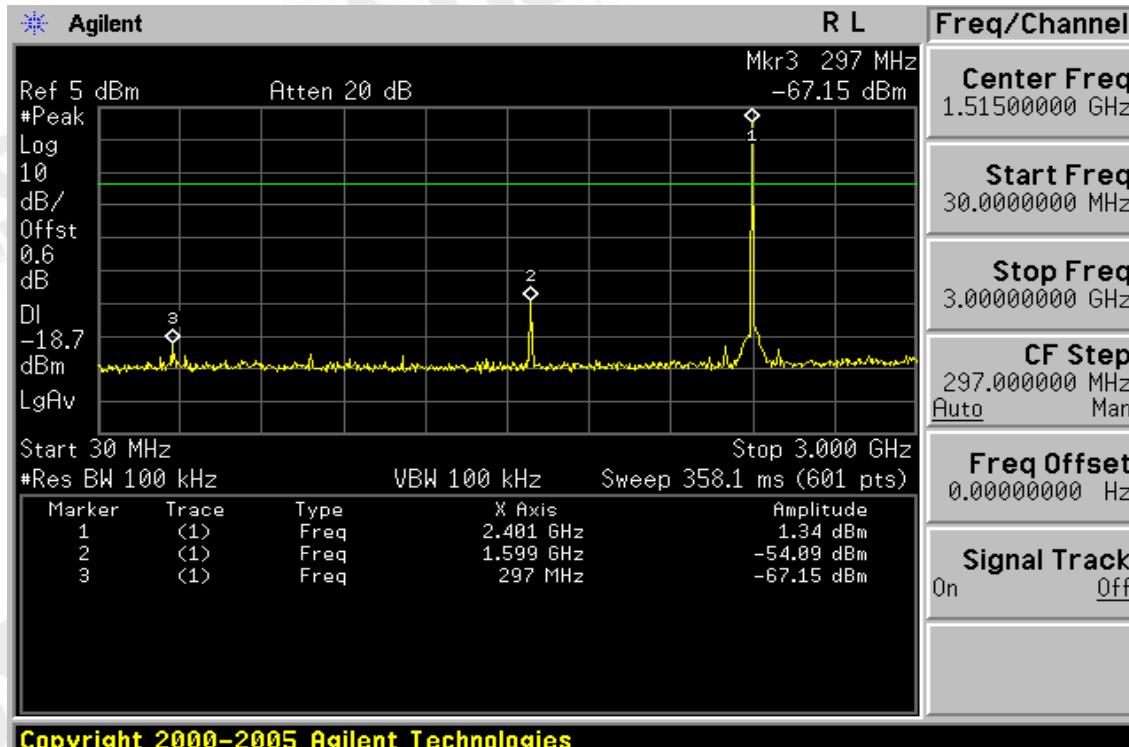
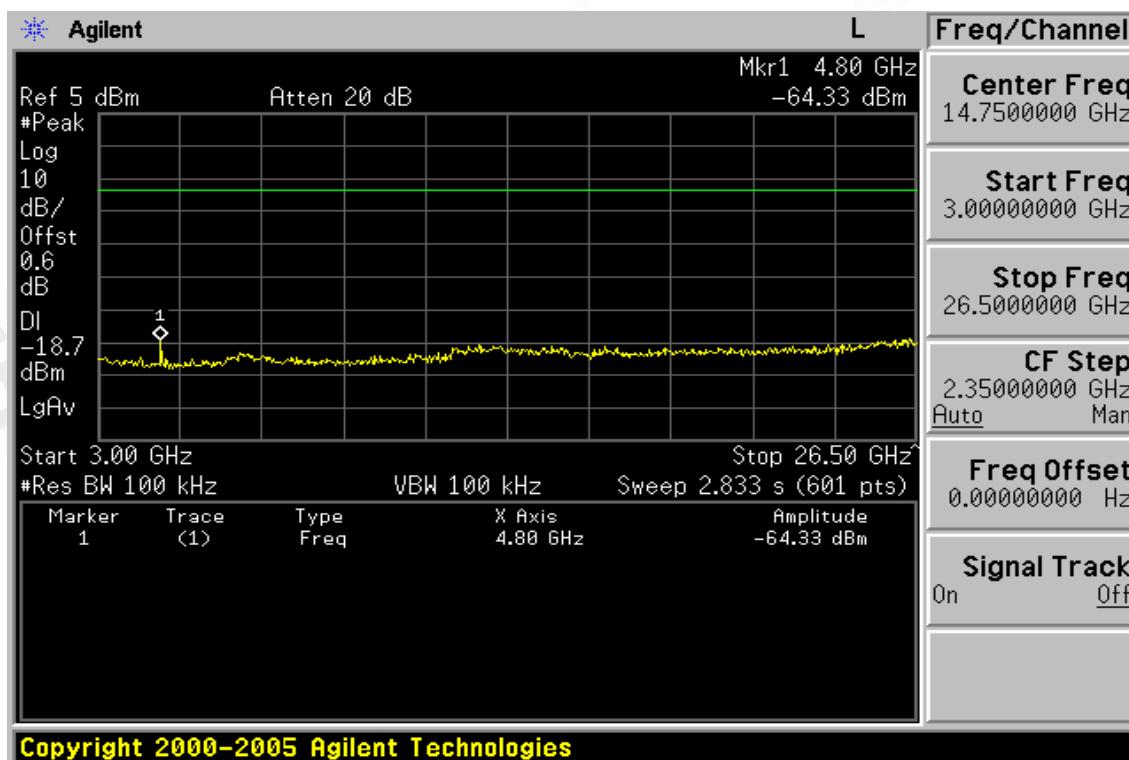
$$\mathbf{FS = RA + AF + CL - AG}$$

|                        |                     |  |
|------------------------|---------------------|--|
| Where                  | FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude |                     | AG = Amplifier Gain                        |
| AF = Antenna Factor    |                     |  |

## 9.6. Measurement Result:

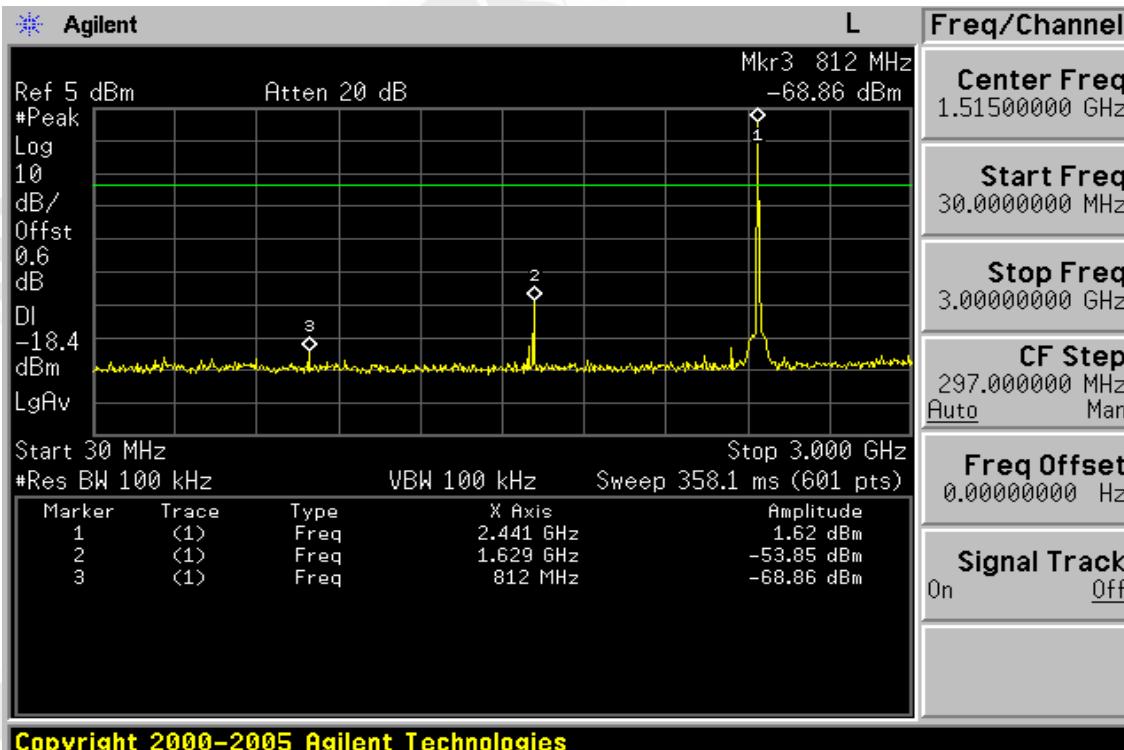
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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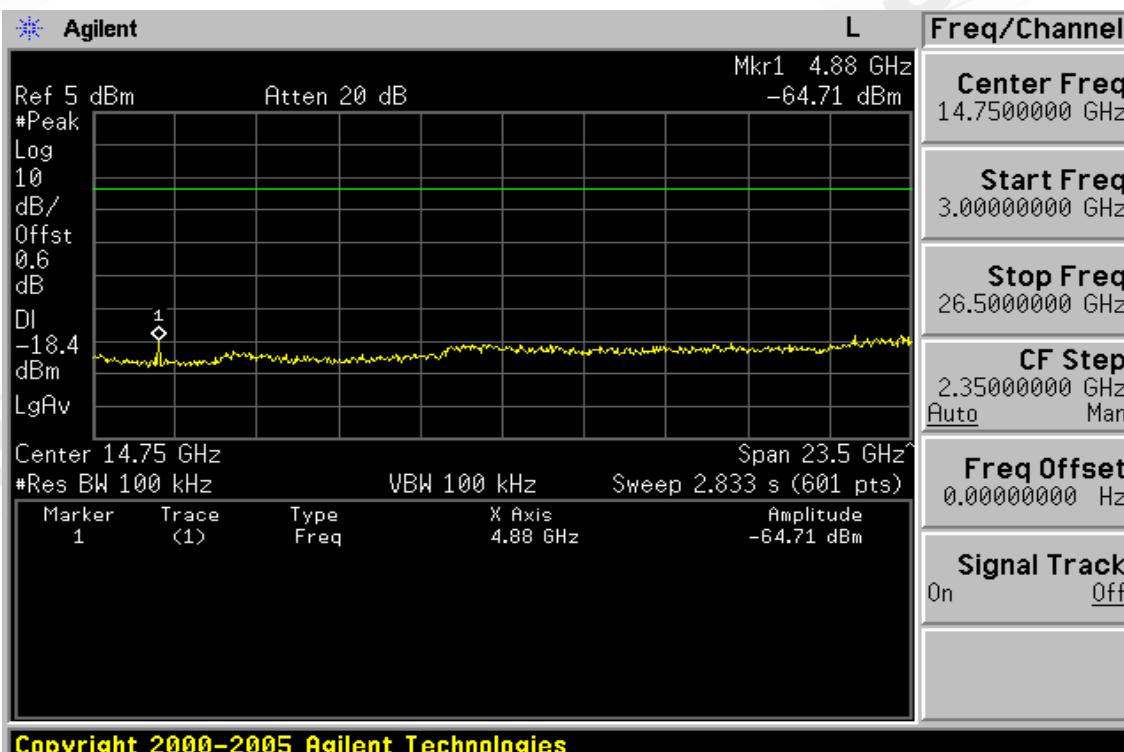
**Conducted Spurious Emission Measurement Result (BDR mode)****Ch Low 30MHz – 3GHz****Ch Low 3GHz – 26.5GHz**

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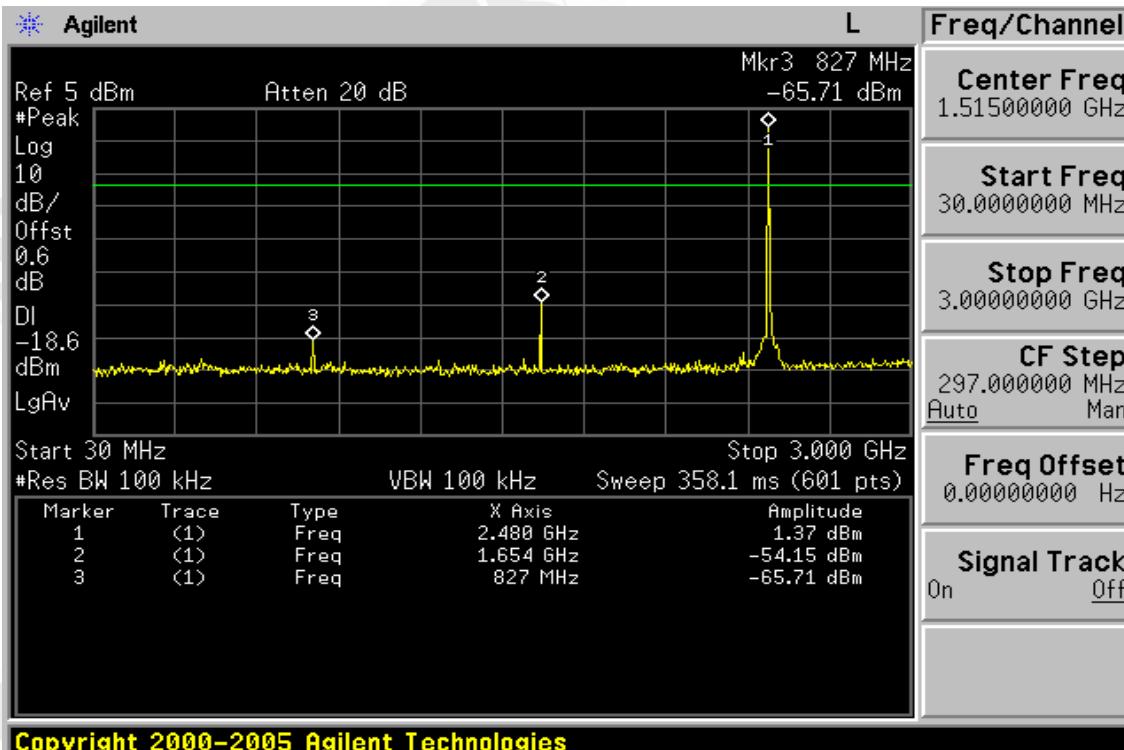
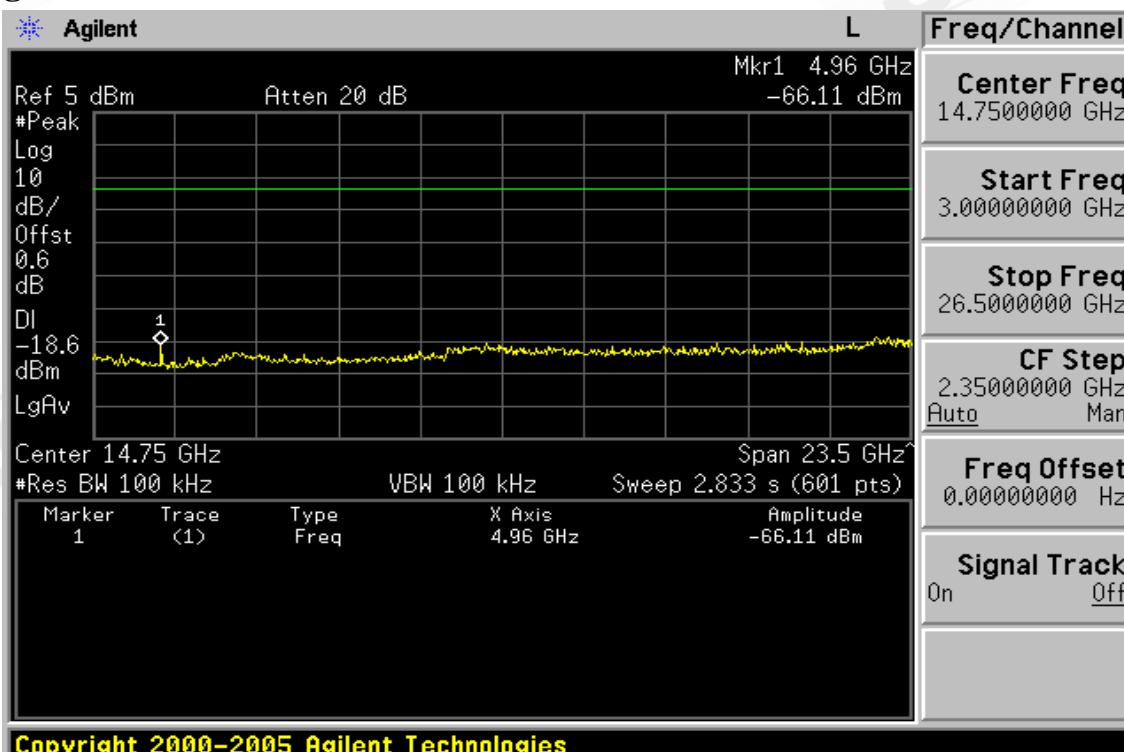
## Ch Mid 30MHz – 3GHz



## Ch Mid 3GHz – 26.5GHz



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**Ch High 30MHz – 3GHz****Ch High 3GHz – 26.5GHz**

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**Radiated Spurious Emission Measurement Result (below 1GHz) (BDR mode)**

|                       |           |           |               |
|-----------------------|-----------|-----------|---------------|
| Operation Mode        | TX CH Low | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2402MHz   | Test By   | Sky           |
| Temperature           | 25 °C     | Pol       | Ver./Hor.     |
| Humidity              | 65 %      |           |               |

| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Detector<br>Mode<br>(PK/QP) | Reading<br>(dBuV) | Factor<br>(dB) | Actual FS<br>(dBuV/m) | Limit3m<br>(dBuV/m) | Safe Margin<br>(dB) |
|----------------|-----------------|-----------------------------|-------------------|----------------|-----------------------|---------------------|---------------------|
| 92.08          | V               | Peak                        | 51.09             | -17.38         | 33.71                 | 43.50               | -9.79               |
| 259.89         | V               | Peak                        | 46.30             | -13.64         | 32.66                 | 46.00               | -13.34              |
| 281.23         | V               | Peak                        | 44.77             | -13.31         | 31.46                 | 46.00               | -14.54              |
| 300.63         | V               | Peak                        | 45.93             | -13.11         | 32.82                 | 46.00               | -13.18              |
| 322.94         | V               | Peak                        | 43.97             | -12.47         | 31.50                 | 46.00               | -14.50              |
| 342.34         | V               | Peak                        | 41.41             | -11.97         | 29.44                 | 46.00               | -16.56              |
| 240.49         | H               | Peak                        | 43.40             | -14.11         | 29.29                 | 46.00               | -16.71              |
| 259.89         | H               | Peak                        | 44.38             | -13.64         | 30.74                 | 46.00               | -15.26              |
| 281.23         | H               | Peak                        | 44.00             | -13.31         | 30.69                 | 46.00               | -15.31              |
| 300.63         | H               | Peak                        | 44.53             | -13.11         | 31.42                 | 46.00               | -14.58              |
| 322.94         | H               | Peak                        | 43.75             | -12.47         | 31.28                 | 46.00               | -14.72              |
| 342.34         | H               | Peak                        | 41.84             | -11.97         | 29.87                 | 46.00               | -16.13              |
| 92.08          | V               | Peak                        | 51.09             | -17.38         | 33.71                 | 43.50               | -9.79               |

**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/QP detector mode.
- 3 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.
- 4 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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**Radiated Spurious Emission Measurement Result (below 1GHz)**

|                       |           |           |               |
|-----------------------|-----------|-----------|---------------|
| Operation Mode        | TX CH Mid | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2441MHz   | Test By   | Sky           |
| Temperature           | 25 °C     | Pol       | Ver./Hor.     |
| Humidity              | 65 %      |           |               |

| <b>Freq.<br/>(MHz)</b> | <b>Ant.Pol.<br/>H/V</b> | <b>Detector<br/>Mode<br/>(PK/QP)</b> | <b>Reading<br/>(dBuV)</b> | <b>Factor<br/>(dB)</b> | <b>Actual FS<br/>(dBuV/m)</b> | <b>Limit3m<br/>(dBuV/m)</b> | <b>Safe Margin<br/>(dB)</b> |
|------------------------|-------------------------|--------------------------------------|---------------------------|------------------------|-------------------------------|-----------------------------|-----------------------------|
| 92.08                  | V                       | Peak                                 | 50.90                     | -17.38                 | 33.52                         | 43.50                       | -9.98                       |
| 240.49                 | V                       | Peak                                 | 42.97                     | -14.11                 | 28.86                         | 46.00                       | -17.14                      |
| 259.89                 | V                       | Peak                                 | 44.56                     | -13.64                 | 30.92                         | 46.00                       | -15.08                      |
| 281.23                 | V                       | Peak                                 | 12.73                     | -13.31                 | 31.13                         | 46.00                       | -14.87                      |
| 300.63                 | V                       | Peak                                 | 44.41                     | -13.11                 | 31.30                         | 46.00                       | -14.70                      |
| 322.94                 | V                       | Peak                                 | 13.72                     | -12.47                 | 31.32                         | 46.00                       | -14.68                      |
| 240.49                 | H                       | Peak                                 | 43.34                     | -14.11                 | 29.23                         | 46.00                       | -16.77                      |
| 259.89                 | H                       | Peak                                 | 44.70                     | -13.64                 | 31.06                         | 46.00                       | -14.94                      |
| 281.23                 | H                       | Peak                                 | 43.98                     | -13.31                 | 30.67                         | 46.00                       | -15.33                      |
| 300.63                 | H                       | Peak                                 | 43.99                     | -13.11                 | 30.88                         | 46.00                       | -15.12                      |
| 322.94                 | H                       | Peak                                 | 44.29                     | -12.47                 | 31.82                         | 46.00                       | -14.18                      |
| 342.34                 | H                       | Peak                                 | 40.52                     | -11.97                 | 28.55                         | 46.00                       | -17.45                      |
| 92.08                  | V                       | Peak                                 | 50.90                     | -17.38                 | 33.52                         | 43.50                       | -9.98                       |

**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/QP detector mode.
- 3 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.
- 4 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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**Radiated Spurious Emission Measurement Result (below 1GHz)**

|                       |            |           |               |
|-----------------------|------------|-----------|---------------|
| Operation Mode        | TX CH High | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2480MHz    | Test By   | Sky           |
| Temperature           | 25 °C      | Pol       | Ver./Hor.     |
| Humidity              | 65 %       |           |               |

| <b>Freq.<br/>(MHz)</b> | <b>Ant.Pol.<br/>H/V</b> | <b>Detector<br/>Mode<br/>(PK/QP)</b> | <b>Reading<br/>(dBuV)</b> | <b>Factor<br/>(dB)</b> | <b>Actual FS<br/>(dBuV/m)</b> | <b>Limit3m<br/>(dBuV/m)</b> | <b>Safe Margin<br/>(dB)</b> |
|------------------------|-------------------------|--------------------------------------|---------------------------|------------------------|-------------------------------|-----------------------------|-----------------------------|
| 92.08                  | V                       | Peak                                 | 51.50                     | -17.38                 | 34.12                         | 43.50                       | -9.38                       |
| 259.89                 | V                       | Peak                                 | 45.52                     | -13.64                 | 31.88                         | 46.00                       | -14.12                      |
| 281.23                 | V                       | Peak                                 | 44.54                     | -13.31                 | 31.23                         | 46.00                       | -14.77                      |
| 300.63                 | V                       | Peak                                 | 44.99                     | -13.11                 | 31.88                         | 46.00                       | -14.12                      |
| 322.94                 | V                       | Peak                                 | 44.62                     | -12.47                 | 32.15                         | 46.00                       | -13.85                      |
| 342.34                 | V                       | Peak                                 | 42.10                     | -11.97                 | 30.13                         | 46.00                       | -15.87                      |
| 240.49                 | H                       | Peak                                 | 43.59                     | -14.11                 | 29.48                         | 46.00                       | -16.52                      |
| 259.89                 | H                       | Peak                                 | 45.06                     | -13.64                 | 31.42                         | 46.00                       | -14.58                      |
| 281.23                 | H                       | Peak                                 | 44.36                     | -13.31                 | 31.05                         | 46.00                       | -14.95                      |
| 300.63                 | H                       | Peak                                 | 44.30                     | -13.11                 | 31.19                         | 46.00                       | -14.81                      |
| 322.94                 | H                       | Peak                                 | 44.03                     | -12.47                 | 31.56                         | 46.00                       | -14.44                      |
| 342.34                 | H                       | Peak                                 | 41.22                     | -11.97                 | 29.25                         | 46.00                       | -16.75                      |
| 92.08                  | V                       | Peak                                 | 51.50                     | -17.38                 | 34.12                         | 43.50                       | -9.38                       |

**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/QP detector mode.
- 3 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.
- 4 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |           |           |               |
|-----------------------|-----------|-----------|---------------|
| Operation Mode        | TX CH Low | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2402 MHz  | Test By   | Sky           |
| Temperature           | 25 °C     | Pol       | Ver.          |
| Humidity              | 65 %      |           |               |

| Freq.<br>(MHz) | Peak              | AV                | Actual FS         |                  | Peak           | AV                | Margin<br>(dB)    |        |
|----------------|-------------------|-------------------|-------------------|------------------|----------------|-------------------|-------------------|--------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |        |
| 4804.0         | 34.94             | ---               | 6.04              | 40.98            | ---            | 74.00             | 54.00             | -13.02 |
| 7206.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 9608.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 12010.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 14412.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 16814.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 19216.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 21618.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |
| 24020.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |        |

## Remark:

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) 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.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |           |           |               |
|-----------------------|-----------|-----------|---------------|
| Operation Mode        | TX CH Low | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2402 MHz  | Test By   | Sky           |
| Temperature           | 25 °C     | Pol       | Hor.          |
| Humidity              | 65 %      |           |               |

| Freq.<br>(MHz) | Peak              | AV                |                   | Actual FS        |                | Peak              | AV                |  | Margin<br>(dB) |
|----------------|-------------------|-------------------|-------------------|------------------|----------------|-------------------|-------------------|--|----------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |  |                |
| 4804.0         | 34.73             | ---               | 6.04              | 40.77            | ---            | 74.00             | 54.00             |  | -13.23         |
| 7206.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 9608.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 12010.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 14412.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 16814.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 19216.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 21618.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 24020.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |

## Remark:

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) 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.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |           |           |               |
|-----------------------|-----------|-----------|---------------|
| Operation Mode        | TX CH Mid | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2441 MHz  | Test By   | Sky           |
| Temperature           | 25 °C     | Pol       | Ver.          |
| Humidity              | 65 %      |           |               |

| Freq.<br>(MHz) | Peak              | AV                |                   | Actual FS        |                | Peak              | AV                |  | Margin<br>(dB) |
|----------------|-------------------|-------------------|-------------------|------------------|----------------|-------------------|-------------------|--|----------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |  |                |
| 4882.0         | 34.46             | ---               | 6.17              | 40.63            | ---            | 74.00             | 54.00             |  | -13.37         |
| 7323.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 9764.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 12205.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 14646.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 17087.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 19528.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 21969.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 24410.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |

## Remark:

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) 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.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |           |           |               |
|-----------------------|-----------|-----------|---------------|
| Operation Mode        | TX CH Mid | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2441 MHz  | Test By   | Sky           |
| Temperature           | 25 °C     | Pol       | Hor.          |
| Humidity              | 65 %      |           |               |

| Freq.<br>(MHz) | Peak              | AV                |                   | Actual FS        |                | Peak              | AV                |  | Margin<br>(dB) |
|----------------|-------------------|-------------------|-------------------|------------------|----------------|-------------------|-------------------|--|----------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |  |                |
| 4882.0         | 34.11             | ---               | 6.17              | 40.28            | ---            | 74.00             | 54.00             |  | -13.72         |
| 7323.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 9764.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 12205.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 14646.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 17087.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 19528.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 21969.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 24410.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |

## Remark:

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) 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.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |            |           |               |
|-----------------------|------------|-----------|---------------|
| Operation Mode        | TX CH High | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2480 MHz   | Test By   | Sky           |
| Temperature           | 25 °C      | Pol       | Ver.          |
| Humidity              | 65 %       |           |               |

| Freq.<br>(MHz) | Peak              | AV                |                   | Actual FS        |                | Peak              | AV                |  | Margin<br>(dB) |
|----------------|-------------------|-------------------|-------------------|------------------|----------------|-------------------|-------------------|--|----------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |  |                |
| 4960.0         | 34.07             | ---               | 6.36              | 40.43            | ---            | 74.00             | 54.00             |  | -13.57         |
| 7440.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 9920.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 12400.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 14880.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 17360.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 19840.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 22320.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 24800.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |

## Remark:

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) 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.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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**Radiated Spurious Emission Measurement Result (above 1GHz)**

|                       |            |           |               |
|-----------------------|------------|-----------|---------------|
| Operation Mode        | TX CH High | Test Date | Sep. 04, 2009 |
| Fundamental Frequency | 2480 MHz   | Test By   | Sky           |
| Temperature           | 25 °C      | Pol       | Hor.          |
| Humidity              | 65 %       |           |               |

| Freq.<br>(MHz) | Peak              | AV                |                   | Actual FS        |                | Peak              | AV                |  | Margin<br>(dB) |
|----------------|-------------------|-------------------|-------------------|------------------|----------------|-------------------|-------------------|--|----------------|
|                | Reading<br>(dBuV) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |  |                |
| 4960.0         | 34.98             | ---               | 6.36              | 41.34            | ---            | 74.00             | 54.00             |  | -12.66         |
| 7440.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 9920.0         | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 12400.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 14880.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 17360.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 19840.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 22320.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |
| 24800.0        | ----              |                   |                   |                  |                | 74.00             | 54.00             |  |                |

## Remark:

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) 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.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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## 10. FREQUENCY SEPARATION

### 10.1. Standard Applicable

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3\*20dB bandwidth of the hopping channel, whichever is greater.

### 10.2. Measurement Equipment Used:

Refer to section 6.2 for details.

### 10.3. Test Set-up:

Refer to section 6.3 for details.

### 10.4. Measurement Procedure:

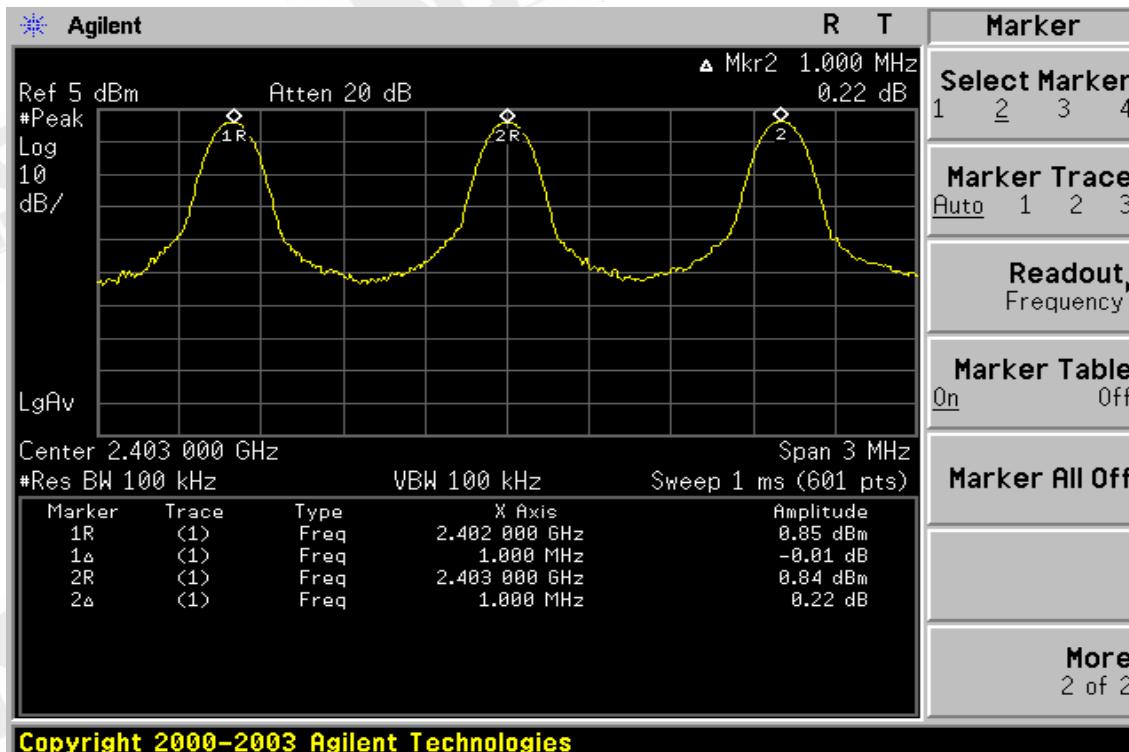
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz, Adjust Span to 3.0 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

### 10.5. Measurement Result:

| Channel separation<br>(MHz) | Limit                                  | Result |
|-----------------------------|--|--------|
| 1                           | >=25KHz or<br>2/3 times 20dB bandwidth | PASS   |

Note: Refer to next page for plots.

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**Frequency Separation Test Data**

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## 11. NUMBER OF HOPPING FREQUENCY

### 11.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

### 11.2. Measurement Equipment Used:

Refer to section 6.2 for details.

### 11.3. Test Set-up:

Refer to section 6.3 for details.

### 11.4. Measurement 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 = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW=430KHz,, VBW=1MHz.
5. Max hold, view and count how many channel in the band.

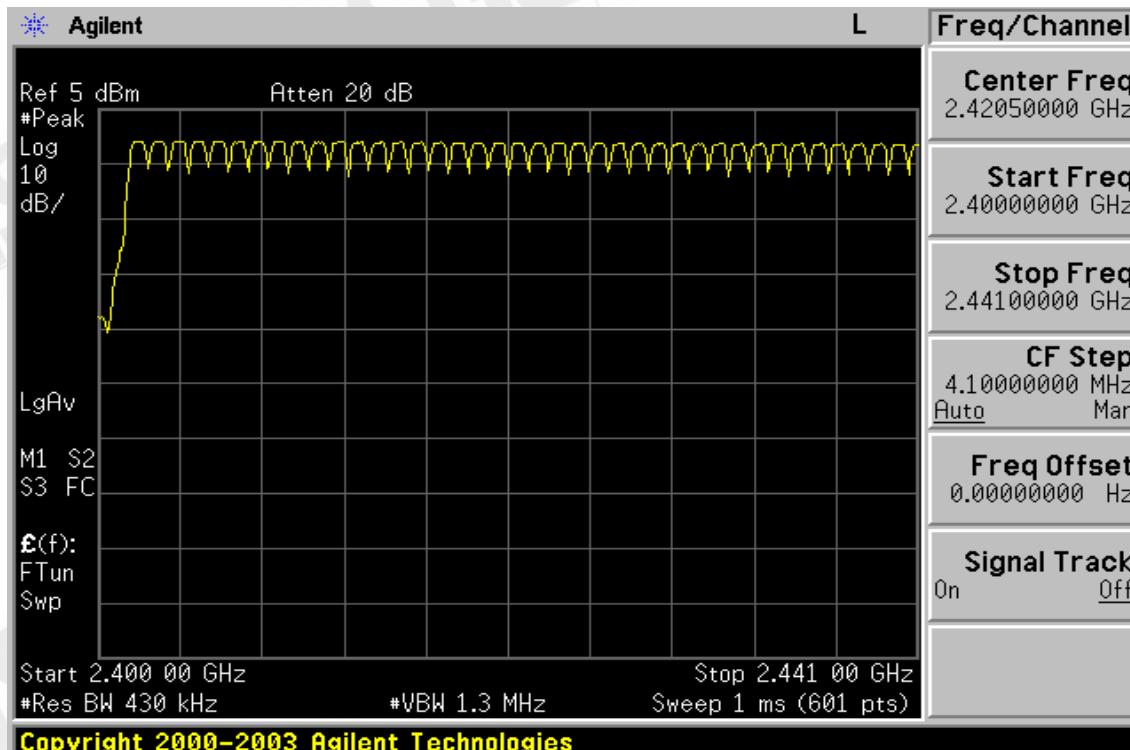
### 11.5. Measurement Result:

Note: Refer to next page for plots.

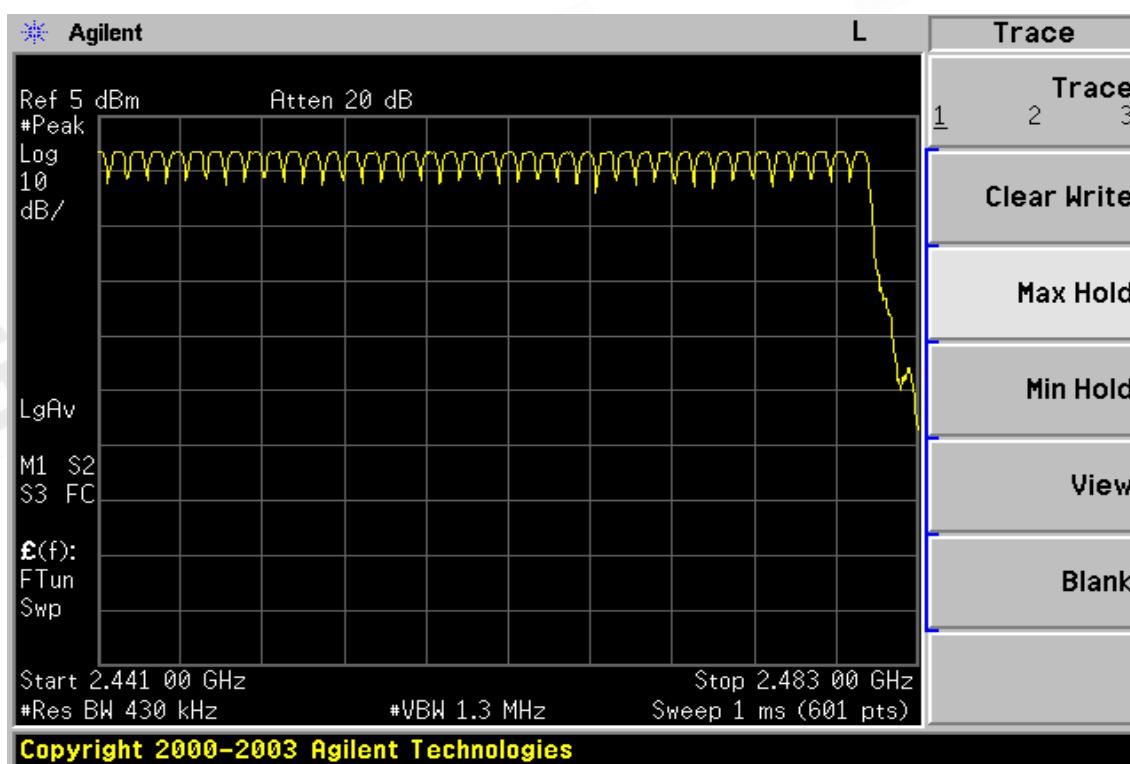
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## Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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## **12. TIME OF OCCUPANCY (DWELL TIME)**

### **12.1. Standard Applicable**

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

### **12.2. Measurement Equipment Used:**

Refer to section 6.2 for details.

### **12.3. Test Set-up:**

Refer to section 6.3 for details.

### **12.4. Measurement 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=100KHz, Span = 0Hz , Adjust Sweep = 30s.
5. Repeat above procedures until all frequency measured were complete.

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## 12.5. Measurement Result

A period time =  $0.4 \text{ (ms)} * 79 = 31.6 \text{ (s)}$

CH Low: DH1 time slot =  $0.405 \text{ (ms)} * (1600/(1*79)) * 31.6 = 259.2 \text{ (ms)}$

DH3 time slot =  $1.675 \text{ (ms)} * (1600/(3*79)) * 31.6 = 357.3 \text{ (ms)}$

DH5 time slot =  $2.925 \text{ (ms)} * (1600/(5*79)) * 31.6 = 374.4 \text{ (ms)}$

CH Mid: DH1 time slot =  $0.405 \text{ (ms)} * (1600/(1*79)) * 31.6 = 259.2 \text{ (ms)}$

DH3 time slot =  $1.675 \text{ (ms)} * (1600/(3*79)) * 31.6 = 357.3 \text{ (ms)}$

DH5 time slot =  $2.906 \text{ (ms)} * (1600/(5*79)) * 31.6 = 371.9 \text{ (ms)}$

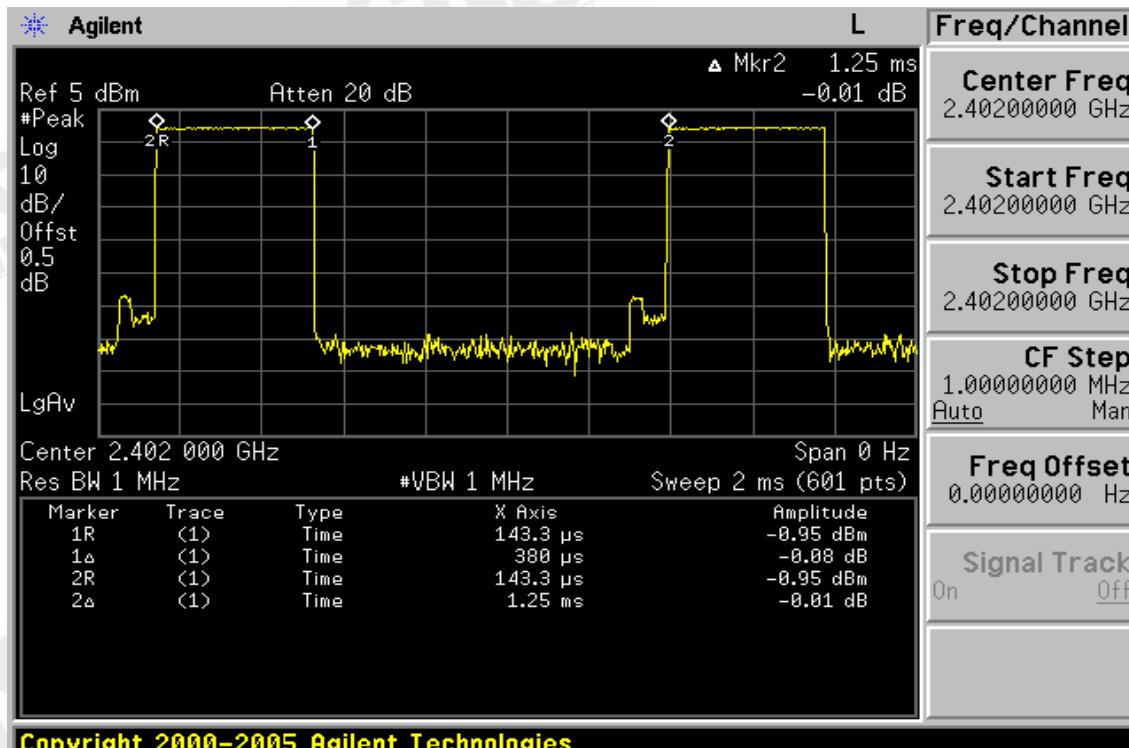
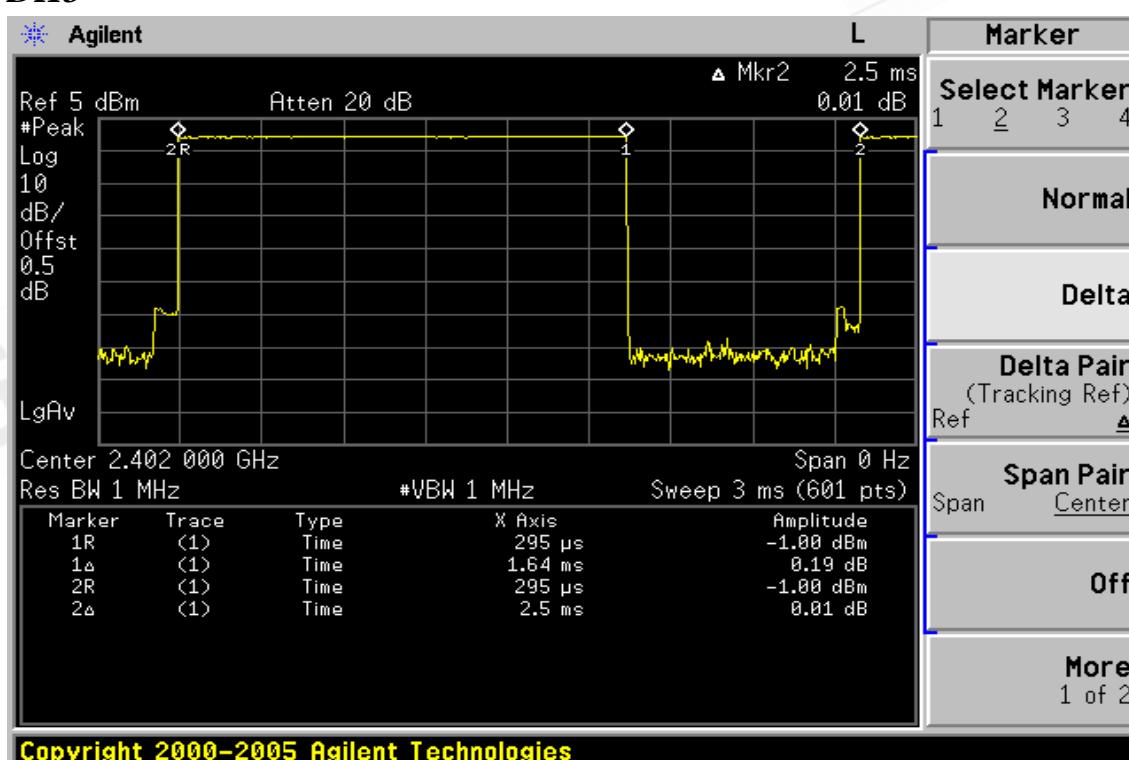
CH High: DH1 time slot =  $0.416 \text{ (ms)} * (1600/(1*79)) * 31.6 = 266.2 \text{ (ms)}$

DH3 time slot =  $1.662 \text{ (ms)} * (1600/(3*79)) * 31.6 = 354.5 \text{ (ms)}$

DH5 time slot =  $2.906 \text{ (ms)} * (1600/(5*79)) * 31.6 = 371.9 \text{ (ms)}$

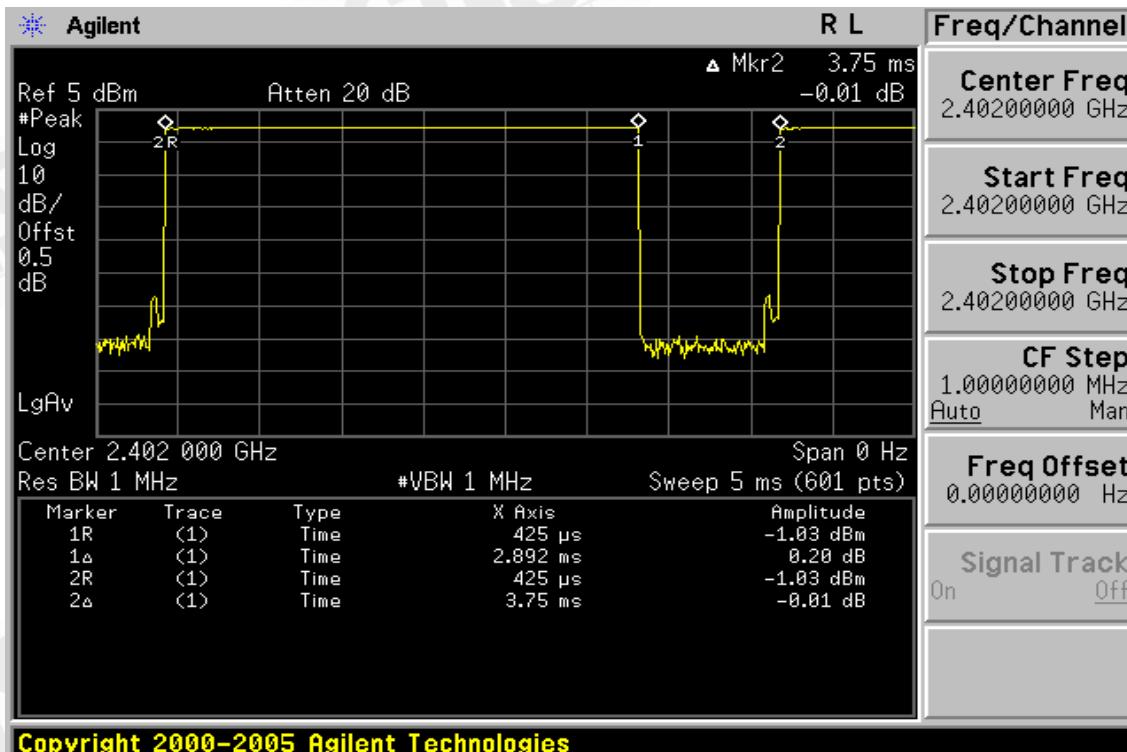
Note: Refer to next page for plots.

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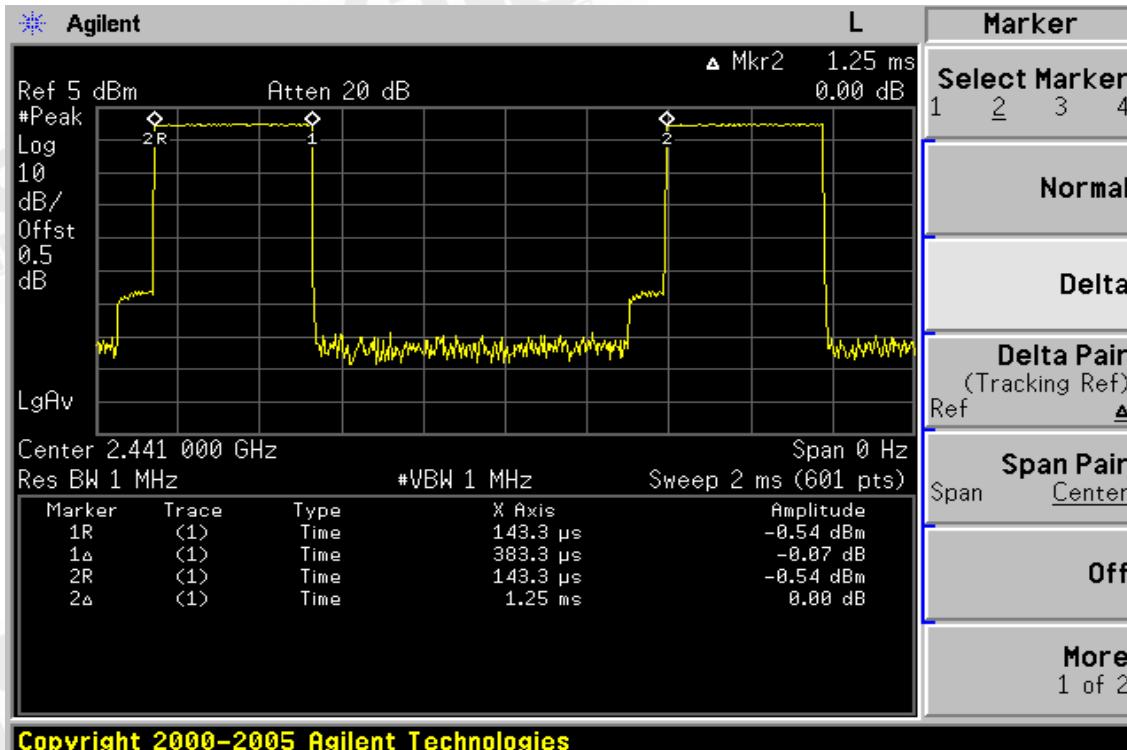
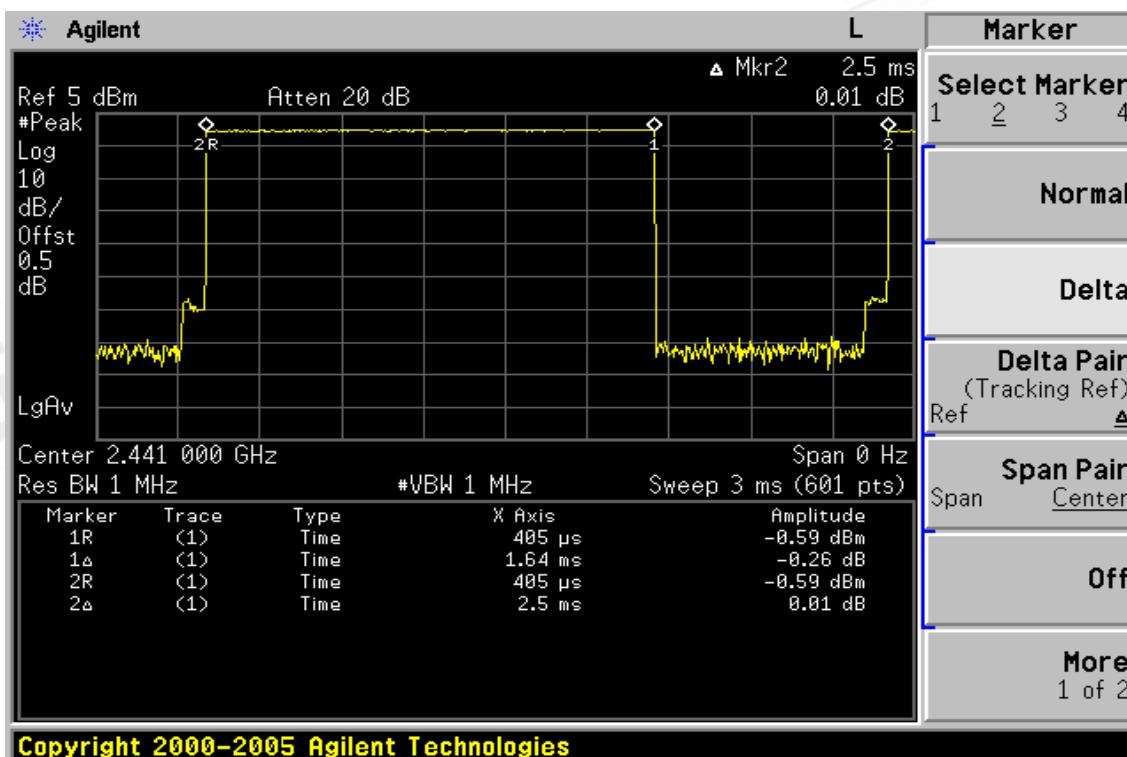
**CH-Low**
**DH1**

**DH3**


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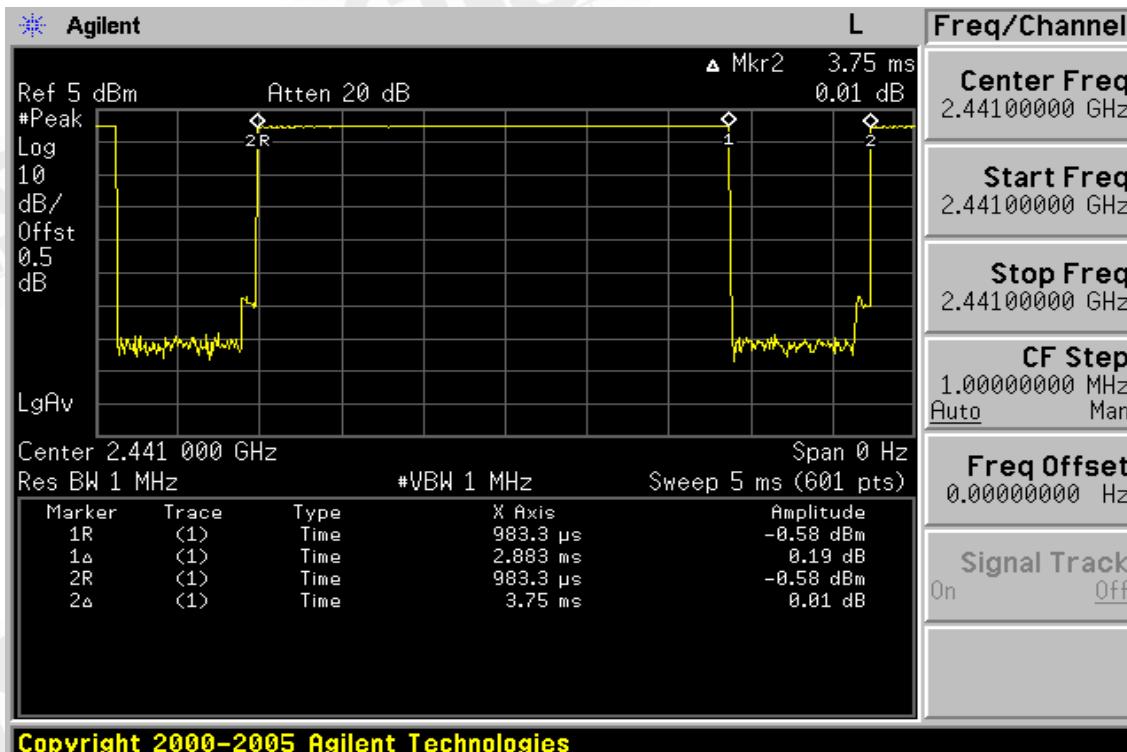
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**DH5**

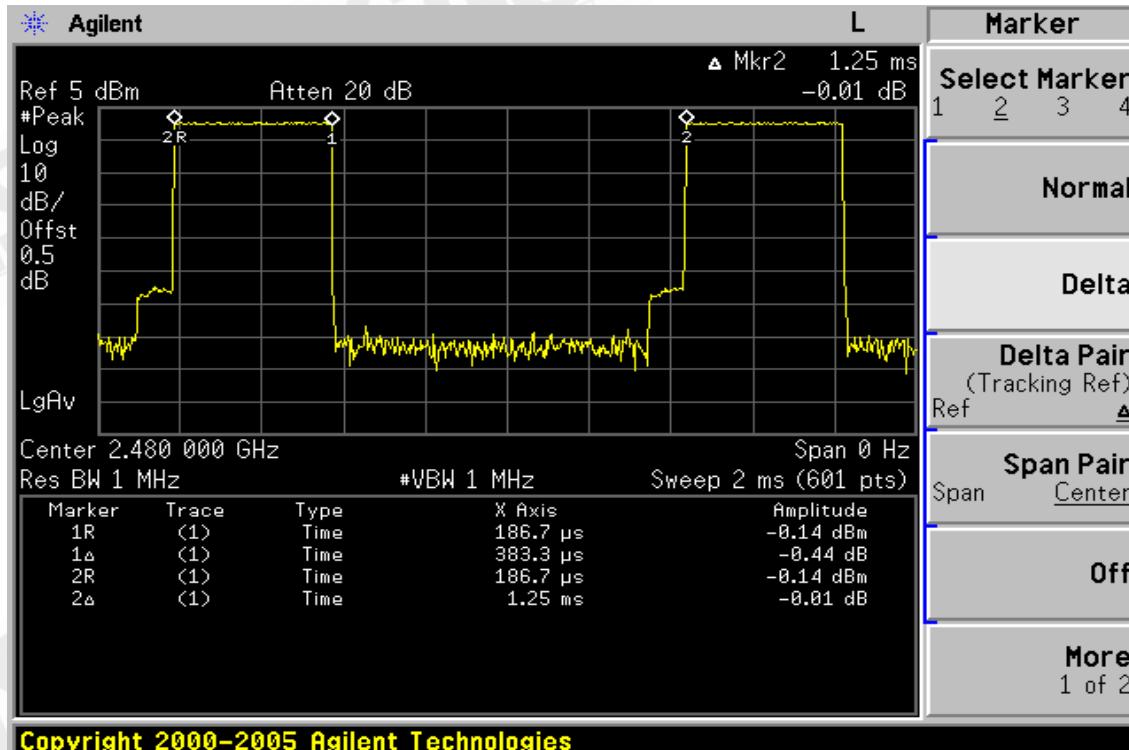
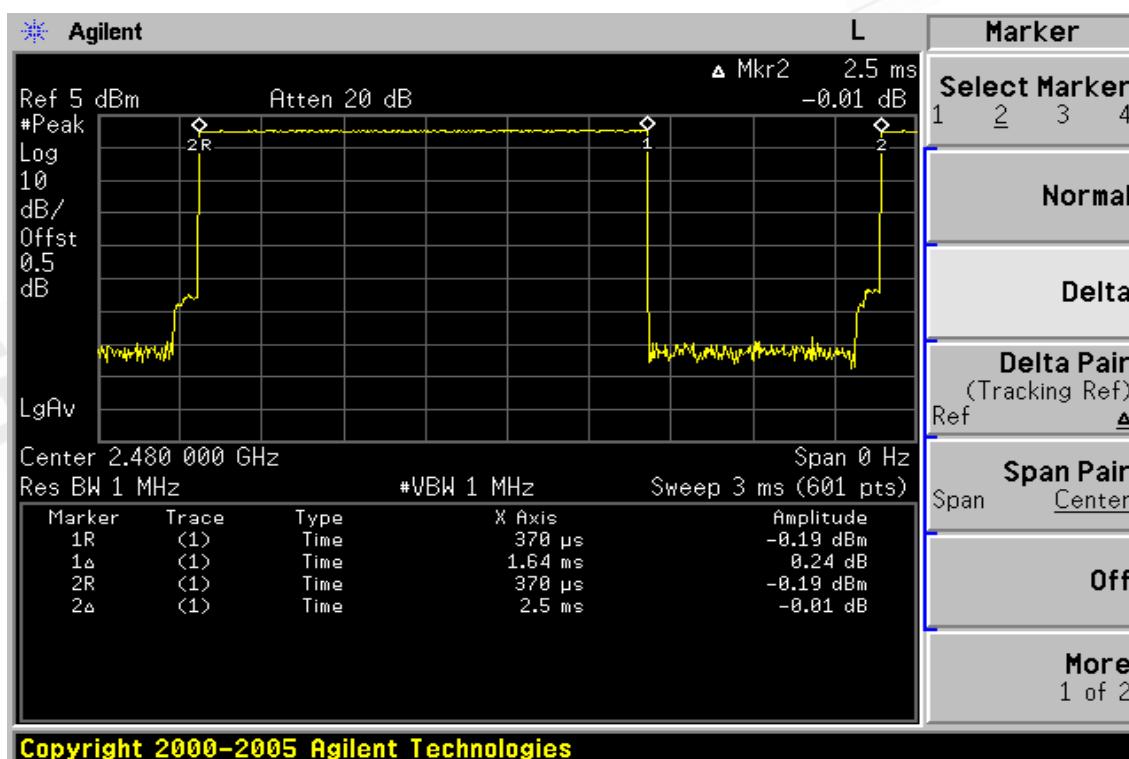
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**CH-Mid**
**DH1**

**DH3**


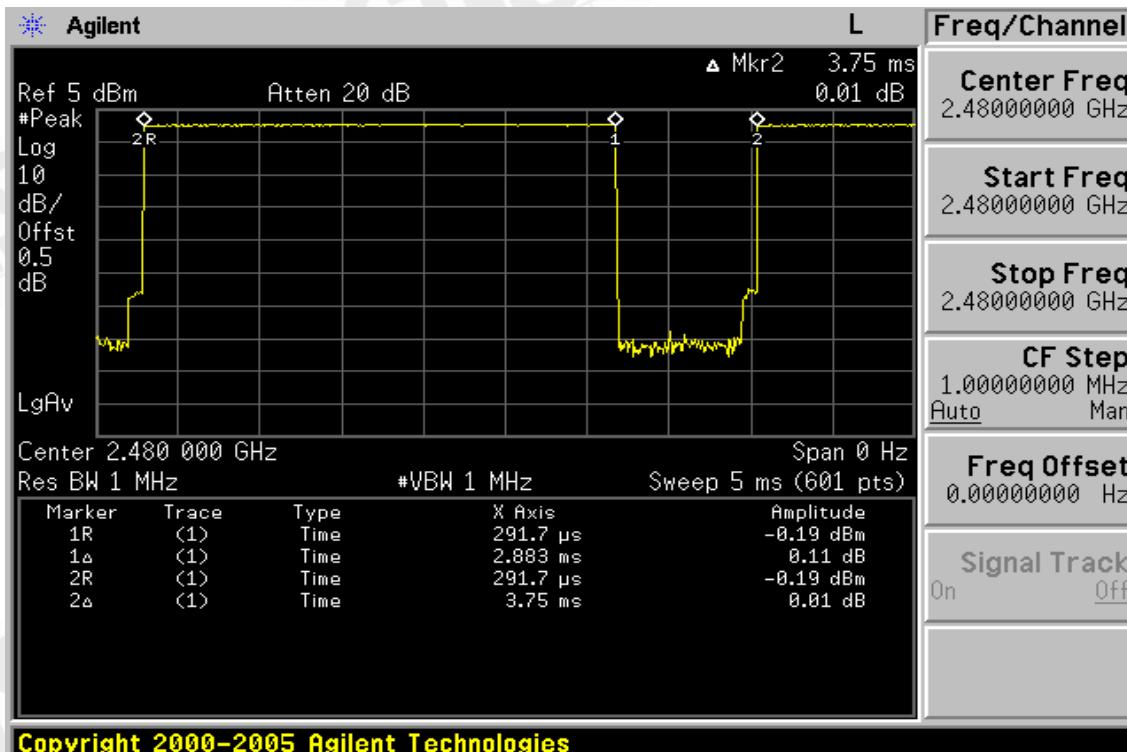
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**DH5**

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**CH-High****DH1****DH3**

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**DH5**

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## **13. ANTENNA REQUIREMENT**

### **13.1. Standard Applicable**

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

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

### **13.2. Antenna Connected Construction**

The directional gains of antenna used for transmitting is 1.71 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

*~ End of Report ~*

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