

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

### INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRY CANADA RSS-210

OF

**Product Name:** Vehicle Mount Terminal  
**Brand Name:** Honeywell  
**Marketing Name:** Thor VM2  
**Model No.:** VM2W  
**Model Difference:** N/A  
**IC:** 1693B-VM2W01  
**FCC ID:** KDZVM2W01  
**Report No.:** EH/2012/A0035  
**Issue Date:** Nov. 08, 2012  
**Rule Part:** §15.247, Cat: DSS  
**Prepared for:** Honeywell International Inc.,  
Honeywell Scanning and Mobility  
9680 Old Bailes Road, Fort Mill, SC 29707, USA  
**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
No.134, Wu Kung Road, New Taipei Industrial  
Park, Wuku District, New Taipei City, Taiwan  
24803



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## CERTIFICATION OF COMPLIANCE

**Applicant:** Honeywell International Inc.,  
Honeywell Scanning and Mobility  
9680 Old Bailes Road, Fort Mill, SC 29707, USA

**Product Name:** Vehicle Mount Terminal

**Brand Name:** Honeywell

**Marketing Name:** Thor VM2

**IC:** 1693B-VM2W01

**FCC ID:** KDZVM2W01

**Model No.:** VM2W

**Model Difference:** N/A

**File Number:** EH/2012/A0035

**Date of test:** Oct. 05, 2012 ~ Nov. 01, 2012

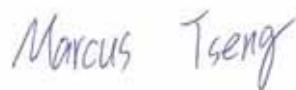
**Date of EUT Received:** Oct. 05, 2012

**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 (2009) and RSS-Gen. issue 3:2010, 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 15C:2007, §15.247 and RSS-210 issue 8: 2010 Annex 8.

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

**Test By:**

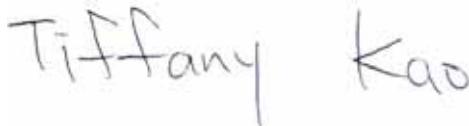


**Date:**

Nov. 08, 2012

*Marcus Tseng / Engineer*

**Prepared By:**

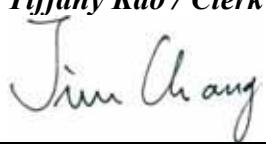


**Date:**

Nov. 08, 2012

*Tiffany Kao / Clerk*

**Approved By:**



**Date:**

Nov. 08, 2012

*Jim Chang / Supervisor*

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## Version

| Version No. | Date          | Description                  |
|-------------|---------------|------------------------------|
| 00          | Nov. 08, 2012 | Initial creation of document |
|             |               |                              |
|             |               |                              |

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## 1. GENERAL INFORMATION

### 1.1. Product Description

General:

|                   |   |
|-------------------|---|
| Product Name:     | Vehicle Mount Terminal  |
| Marketing Name:   | Thor VM2  |
| Brand Name:       | Honeywell   |
| Model No.:        | VM2W  |
| Model Difference: | N/A   |
| Hardware Version: | N/A   |
| Software Version: | N/A   |
| Power Supply:     | 10.8Vdc Li-ion battery or 100-240Vdc from AC/DC adapter<br>Battery: Model No.: OVT310L1R00<br>Supplier: TOTEX International Limited<br>Adapter: Model No.:GT-81081-6015-T3, Supplier: GlobTek, Inc. |

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 type="checkbox"/> V2.0 + EDR (GFSK + /4DQPSK + 8DPSK)<br><input checked="" type="checkbox"/> V2.1 + EDR (GFSK + /4DQPSK + 8DPSK) |
| Frequency Range      | 2402 – 2480MHz  |
| Channel number       | 79 channels max.  |
| Rated Power          | 3.80 dBm (Peak)   |
| Modulation type      | Frequency Hopping Spread Spectrum   |
| Antenna Designation: | Chip Antenna, -1.20dBi  |

The EUT is compliance with Bluetooth V2.1 + EDR (GFSK +  $\pi$ /4DQPSK + 8DPSK) standard.

This test report applies for Bluetooth.

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## 1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: KDZVM2W01** filing to comply with Section 15.247 of the FCC Part 15C, Subpart C Rules. And **IC: 1693B-VM2W01** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 8.

## 1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2009) and RSS-Gen: 2010. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

## 1.4. 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. 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: 2009. FCC Registration Number are: 990257 and 236194, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. 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.

## 1.5. Special Accessories

Not available for this EUT intended for grant.

## 1.6. 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 tested with a test program to fix the Tx/RX frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

### 2.3. Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7, 13 of ANSI C63.4-2009 and RSS-Gen:2010. 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 a 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 of ANSI C63.4-2009 and DA 00-705..

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## 2.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System

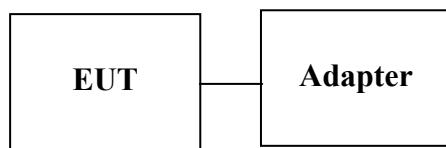


Table 2-1 Equipment Used in Tested System

| Item | Equipment      | Mfr/Brand | Model/Type No. | Series No. | Data Cable | Power Cord |
|------|----------------|-----------|----------------|------------|------------|------------|
| 1.   | CSR Blue Test3 | N/A       | N/A            | N/A        | N/A        | N/A        |

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### 3. SUMMARY OF TEST RESULTS

| FCC Rules   | Description Of Test                          | Result    |
|---|--|-----------|
| §15.207(a)/<br>RSS-Gen §7.2.4                                   | AC Power line Conducted Emission             | Compliant |
| §15.247(b)(1)/<br>RSS-210 issue 8,§A8.4(2)                      | Peak Output Power                            | Compliant |
| §15.247(d)<br>RSS-210 issue 8,§A8.5                             | 100 KHz Bandwidth Of<br>Frequency Band Edges | Compliant |
| §15.247(c)<br>RSS-Gen §7.2.3<br>RSS-210 issue 8,§A2.9           | TX/RX Spurious Emission                      | Compliant |
| §15.247(a)(1)/<br>RSS-210 issue 8,§A8.1(b)                      | Frequency Separation                         | Compliant |
| §15.247(a)(1)(iii)/<br>RSS-210 issue 8,§A8.1(d)                 | Number of hopping frequency                  | Compliant |
| §15.247(a)(1)(ii)/<br>RSS-210 issue 8,§A8.1(d)                  | Time of Occupancy                            | Compliant |
| §15.247/<br>RSS-210 issue 8,§A8.2(b)                            | Peak Power Density                           | Compliant |
| §15.247(a)(1)<br>RSS-210 issue 8,§A8.1(b)                       | 20dB Bandwidth<br>&<br>99% Power Bandwidth   | Compliant |
| §15.203, §15.247(c)/<br>RSS-GEN 7.1.2,<br>RSS-210 issue 8,§A8.4 | 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 (2402MHz)、mid (2441MHz) and high (2480MHz) with worst case EDR mode and DH5 highest data rate are chosen for full testing.

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## 5 MEASUREMENT UNCERTAINTY FOR FIELD STRENGTH OF SPURIOUS RADIATION

|  |                        |
|--|------------------------|
| Measurement uncertainty<br>(Polarization : <b>Vertical</b> ) | 30MHz - 180MHz: 3.37dB |
|  | 180MHz -417MHz: 3.19dB |
|  | 0.417GHz-1GHz: 3.19dB  |
|  | 1GHz - 18GHz: 4.04dB   |
|  | 18GHz - 40GHz: 4.04dB  |

|  |                        |
|--|------------------------|
| Measurement uncertainty<br>(Polarization : <b>Horizontal</b> ) | 30MHz - 167MHz: 4.22dB |
|  | 167MHz -500MHz: 3.44dB |
|  | 0.5GHz-1GHz: 3.39dB    |
|  | 1GHz - 18GHz: 4.08dB   |
|  | 18GHz - 40GHz: 4.08dB  |

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## 6. AC POWER LINE CONDUCTED EMISSION TEST

### 6.1. Standard Applicable:

According to §15.207 and RSS-Gen §7.2.2, frequency range 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.

### 6.2. Measurement Equipment Used:

| Conducted Emission Test Site |            |                         |                  |              |            |
|------------------------------|------------|-------------------------|------------------|--------------|------------|
| EQUIPMENT<br>TYPE            | MFR        | MODEL<br>NUMBER         | SERIAL<br>NUMBER | LAST<br>CAL. | CAL DUE.   |
| EMI Test Receiver            | R&S        | ESCI7                   | 100759           | 05/20/2011   | 05/19/2013 |
| EMI Receiver                 | R&S        | ESCS 30                 | 828985/004       | 09/23/2012   | 09/22/2013 |
| LISN                         | Rolf-Heine | NNB-2/16Z               | 99012            | 03/23/2012   | 03/22/2013 |
| LISN                         | FCC        | FCC-LISN-50/250-25-2-01 | 04034            | 03/23/2012   | 03/22/2013 |
| Coaxial Cables               | N/A        | WK CE Cable             | N/A              | 01/05/2012   | 01/04/2013 |

### 6.3. 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 AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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#### 6.4. 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.

#### 6.5. 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.

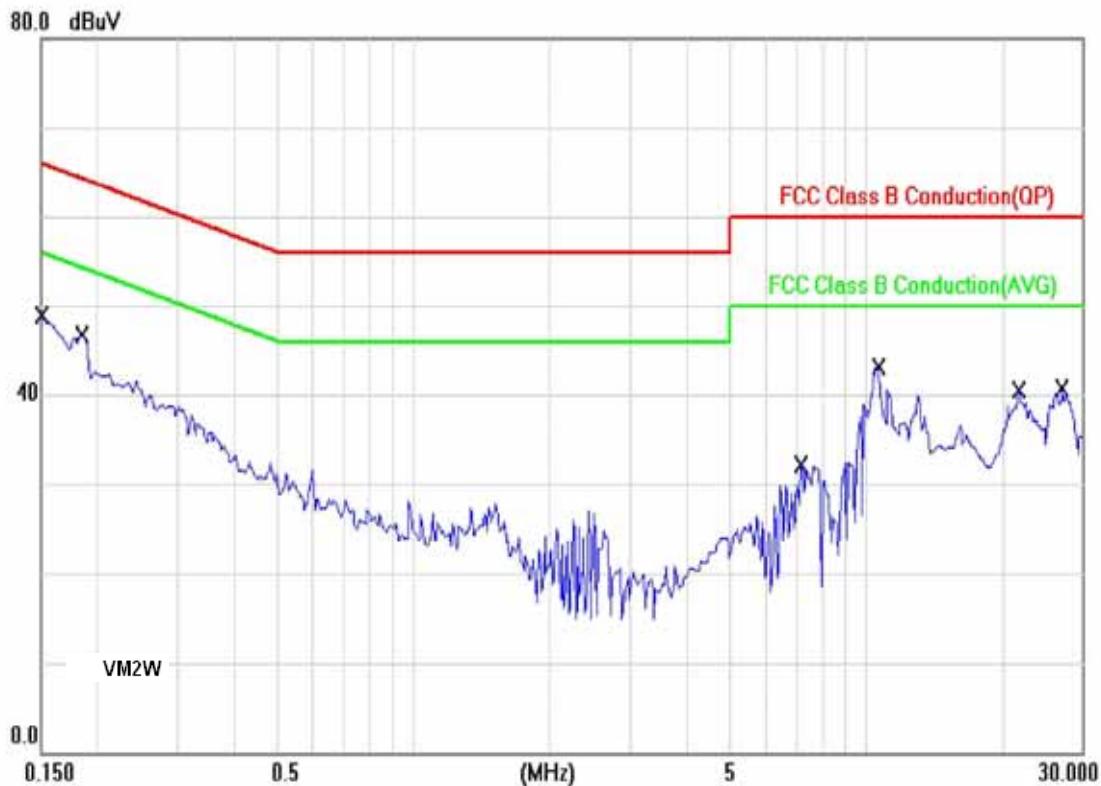
Note: Refer to next page for measurement data and plots.

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## AC POWER LINE CONDUCTED EMISSION TEST DATA

|                 |                |           |      |            |               |
|-----------------|----------------|-----------|------|------------|---------------|
| Operation Mode: | Bluetooth Mode |           |      | Test Date: | Nov. 24, 2012 |
| Temperature:    | 23             | Humidity: | 57 % | Test By:   | Marcus        |



| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measure-ment | Limit | Over   | Detector | Comment |
|-----|-----|---------|---------------|----------------|--------------|-------|--------|----------|---------|
|     |     | MHz     | dBuV          | dB             | dBuV         | dBuV  | dB     |          |         |
| 1   |     | 0.1500  | 48.57         | 0.25           | 48.82        | 66.00 | -17.18 | QP       |         |
| 2   |     | 0.1852  | 46.53         | 0.23           | 46.76        | 64.25 | -17.49 | QP       |         |
| 3   |     | 7.2110  | 31.73         | 0.37           | 32.10        | 60.00 | -27.90 | QP       |         |
| 4   | *   | 10.6327 | 42.66         | 0.46           | 43.12        | 60.00 | -16.88 | QP       |         |
| 5   |     | 21.8242 | 39.59         | 0.94           | 40.53        | 60.00 | -19.47 | QP       |         |
| 6   |     | 27.1836 | 39.65         | 1.14           | 40.79        | 60.00 | -19.21 | QP       |         |

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| No. Mk. | Freq.<br>MHz | Reading<br>Level | Correct<br>Factor | Measure-<br>ment | Limit | Over     | Comment |
|---------|--------------|------------------|-------------------|------------------|-------|----------|---------|
|         |              | dBuV             | dB                | dBuV             | dB    | Detector |         |
| 1       | 0.1500       | 48.13            | 0.35              | 48.48            | 66.00 | -17.52   | QP      |
| 2       | 0.1812       | 46.08            | 0.33              | 46.41            | 64.43 | -18.02   | QP      |
| 3       | 0.5977       | 36.92            | 0.34              | 37.26            | 56.00 | -18.74   | QP      |
| 4 *     | 10.6327      | 42.74            | 0.48              | 43.22            | 60.00 | -16.78   | QP      |
| 5       | 21.8242      | 39.11            | 0.81              | 39.92            | 60.00 | -20.08   | QP      |
| 6       | 27.0040      | 39.15            | 0.92              | 40.07            | 60.00 | -19.93   | QP      |

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## 7. PEAK OUTPUT POWER MEASUREMENT

### 7.1. Standard Applicable:

According to §15.247(b)(1), 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.

According to RSS-210 issue 8,§A8.4(2), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

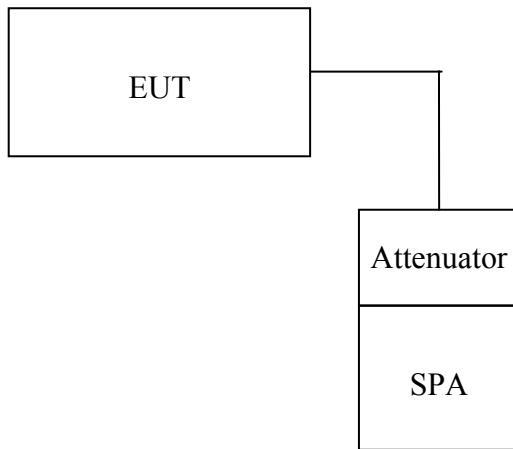
### 7.2. Measurement Equipment Used:

| Conducted Emission Test Site |               |                 |               |            |            |
|------------------------------|---------------|-----------------|---------------|------------|------------|
| EQUIPMENT TYPE               | MFR           | MODEL NUMBER    | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Power Sensor                 | Anritsu       | ML2495A         | 1005007       | 02/08/2012 | 02/07/2014 |
| Power Meter                  | Anritsu       | MA2411B         | 917032        | 02/08/2012 | 02/07/2014 |
| Spectrum Analyzer            | Agilent       | E4446A          | MY51100003    | 04/15/2011 | 04/14/2013 |
| Spectrum Analyzer            | Agilent       | E4440A          | MY45304525    | 03/17/2012 | 03/16/2014 |
| DC Block                     | Mini-Circuits | BLK-18-S+       | 1             | 02/28/2012 | 02/27/2013 |
| Low Loss Cable               | HUBER+SUHNER  | SUCOFLEX 104PEA | N/A           | 01/05/2012 | 01/04/2013 |
| Attenuator                   | Mini-Circuit  | BW-S10W2+       | 002           | 02/28/2012 | 02/27/2013 |
| Splitter                     | Agilent       | 11636B          | N/A           | 02/28/2012 | 02/27/2013 |

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### 7.3. .Test Set-up:



### 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 power meter or spectrum. (Max peak function, RBW> 20dB bandwidth, VBW>RBW)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

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## 7.5. Measurement Result:

### BDR mode (GFSK):

| Frequency (MHz) | Reading Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|--------------------|------------------|-----------|
| 2402.00         | 3.80                | 3.80               | 0.00240          | 1         |
| 2441.00         | 3.76                | 3.76               | 0.00238          | 1         |
| 2480.00         | 3.46                | 3.46               | 0.00222          | 1         |

### EDR mode ( $\pi/4$ DQPSK):

| Frequency (MHz) | Reading Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|--------------------|------------------|-----------|
| 2402.00         | 2.38                | 2.38               | 0.00173          | 0.125     |
| 2441.00         | 1.92                | 1.92               | 0.00156          | 0.125     |
| 2480.00         | 1.21                | 1.21               | 0.00132          | 0.125     |

### EDR mode (8DPSK):

| Frequency (MHz) | Reading Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|--------------------|------------------|-----------|
| 2402.00         | 2.74                | 2.74               | 0.00188          | 0.125     |
| 2441.00         | 2.26                | 2.26               | 0.00168          | 0.125     |
| 2480.00         | 1.64                | 1.64               | 0.00146          | 0.125     |

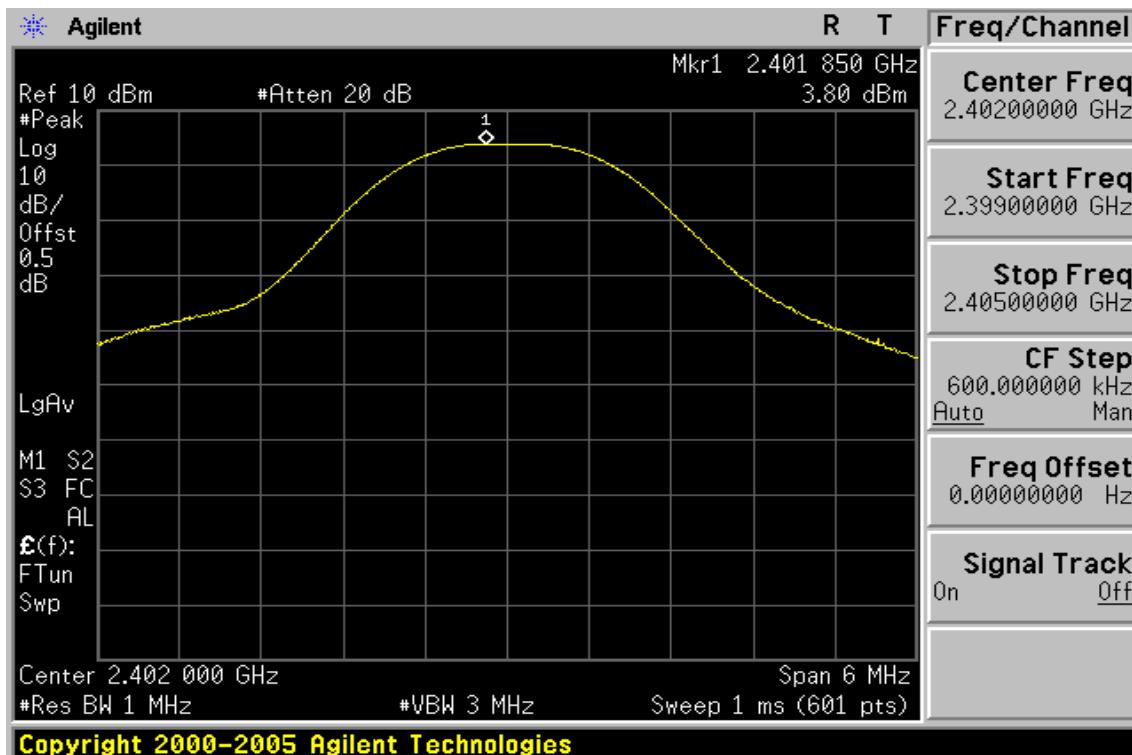
\*Note: offset 0.5dB

Note: Refer to next page for plots.

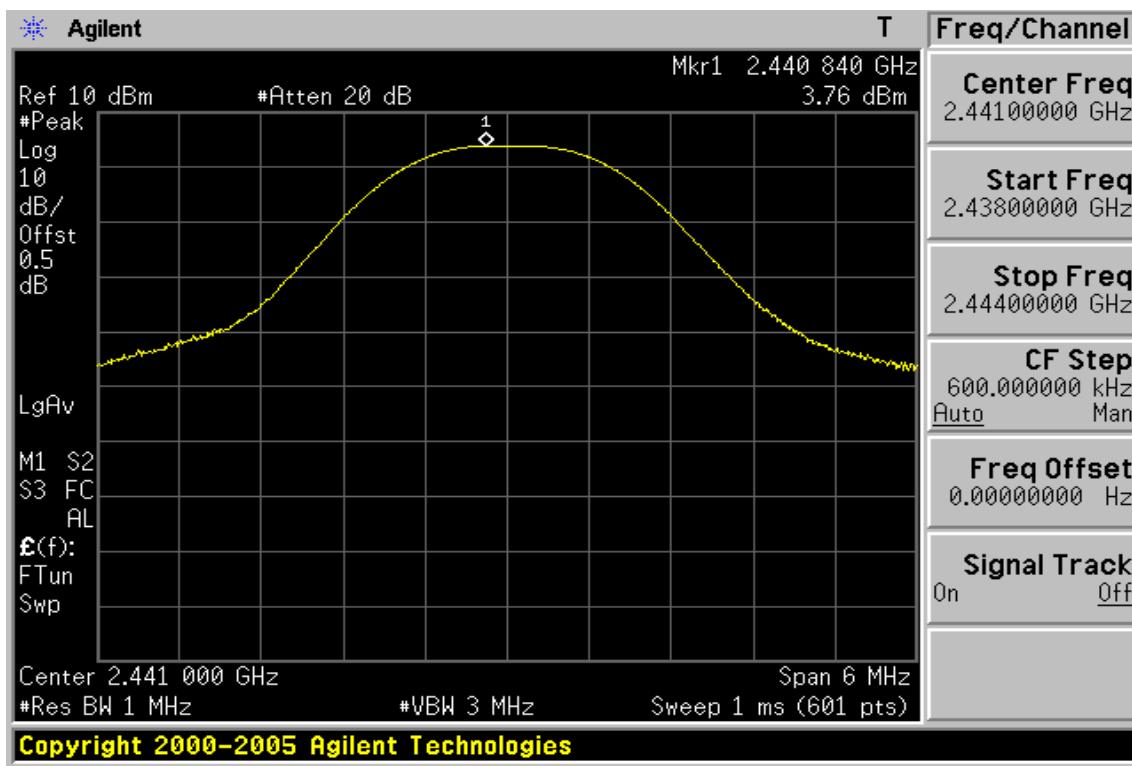
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## Peak Power Output Data Plot (CH Low) (BDR mode GFSK)



## Peak Power Output Data Plot (CH Mid) (BDR mode GFSK)

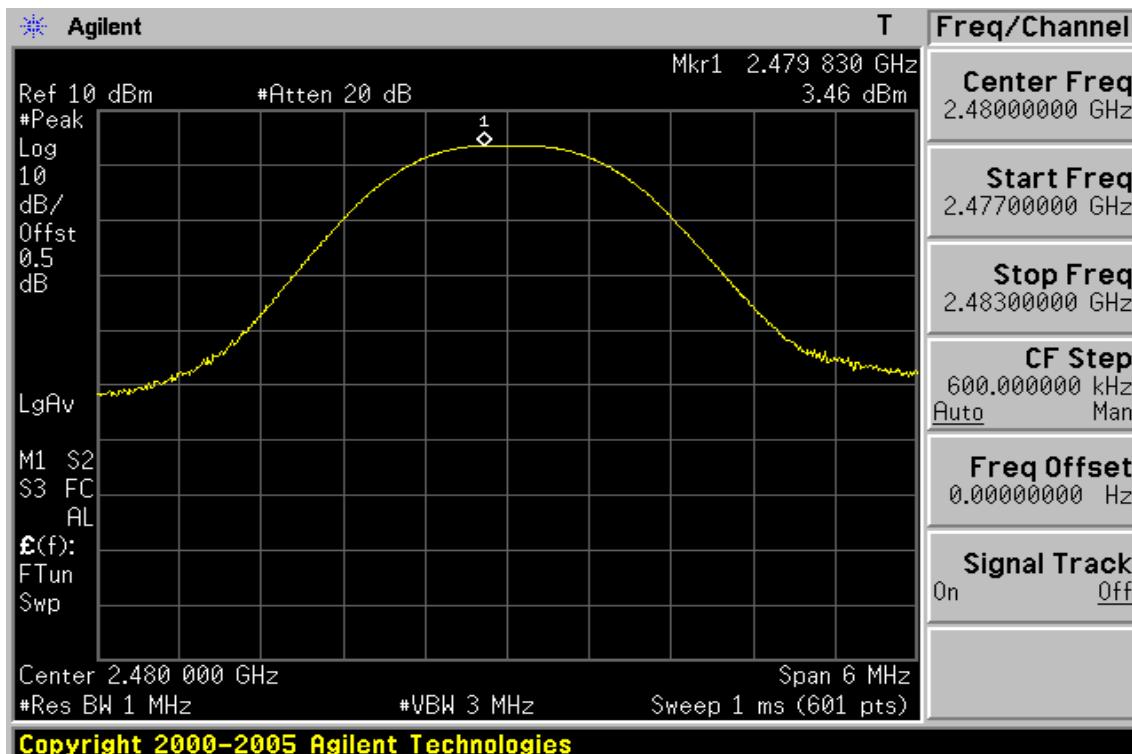


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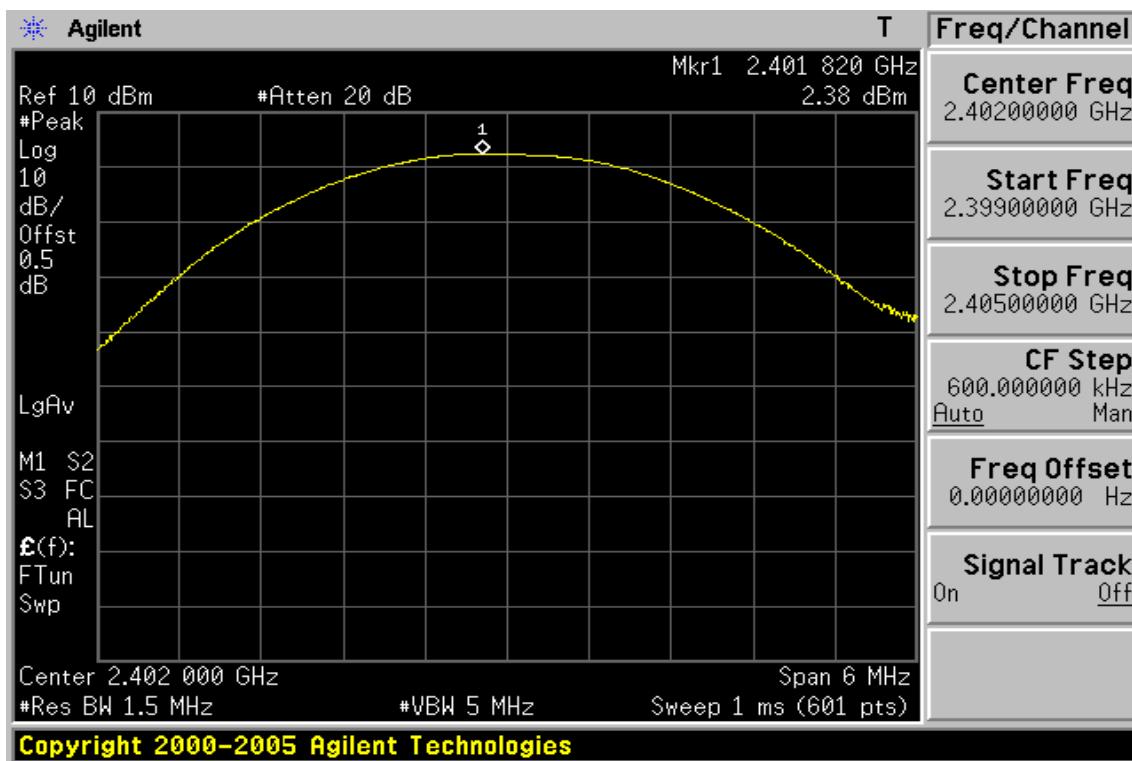
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## Peak Power Output Data Plot (CH High) (BDR mode GFSK)



## Peak Power Output Data Plot (CH Low) (EDR mode $\pi/4$ DQPSK)

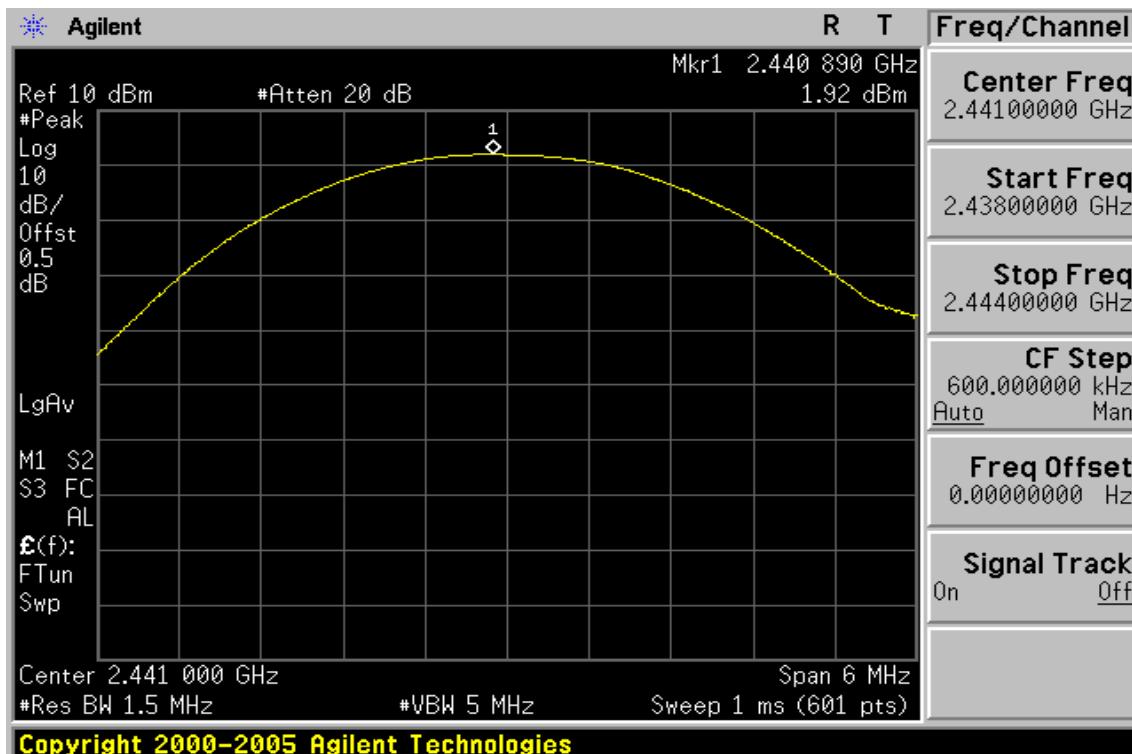


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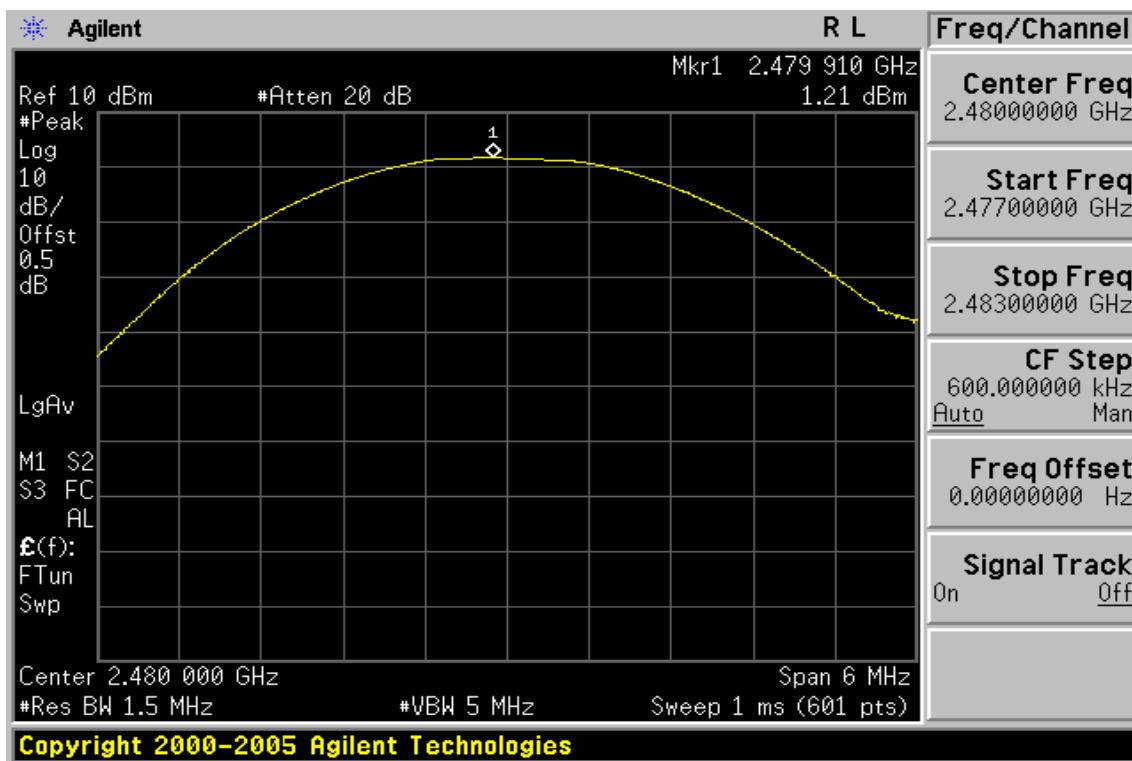
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### Peak Power Output Data Plot (CH Mid) (EDR mode $\pi/4$ DQPSK)



### Peak Power Output Data Plot (CH High) (EDR mode $\pi/4$ DQPSK)

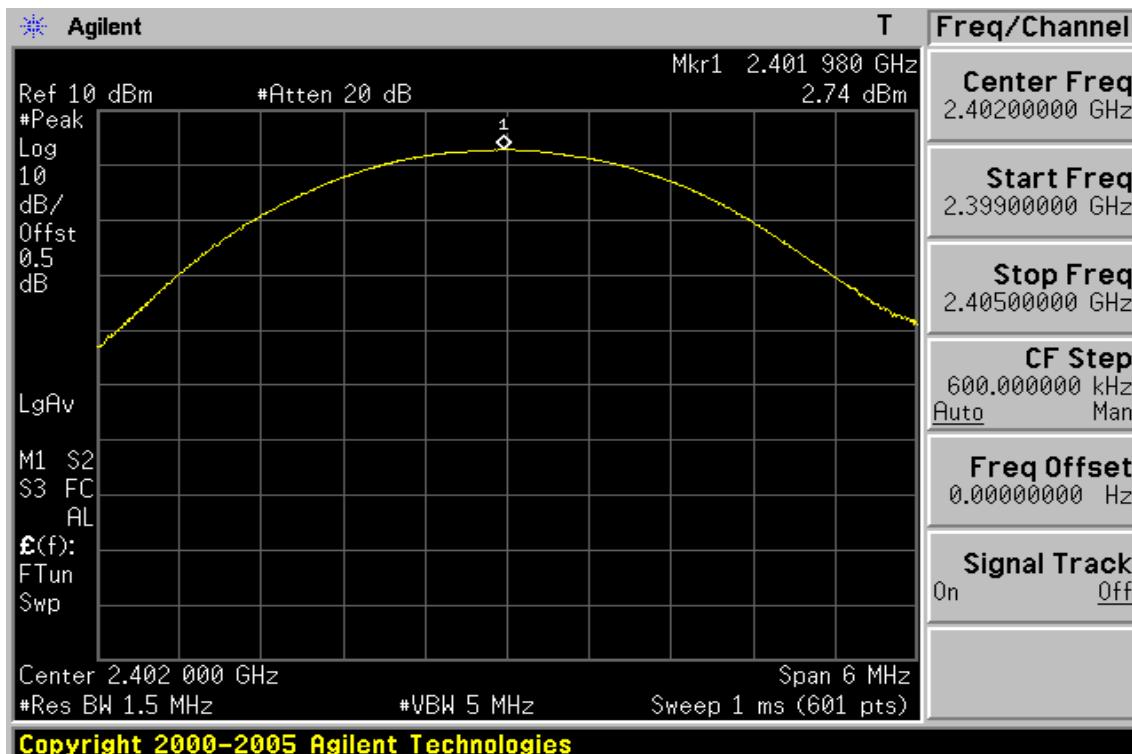


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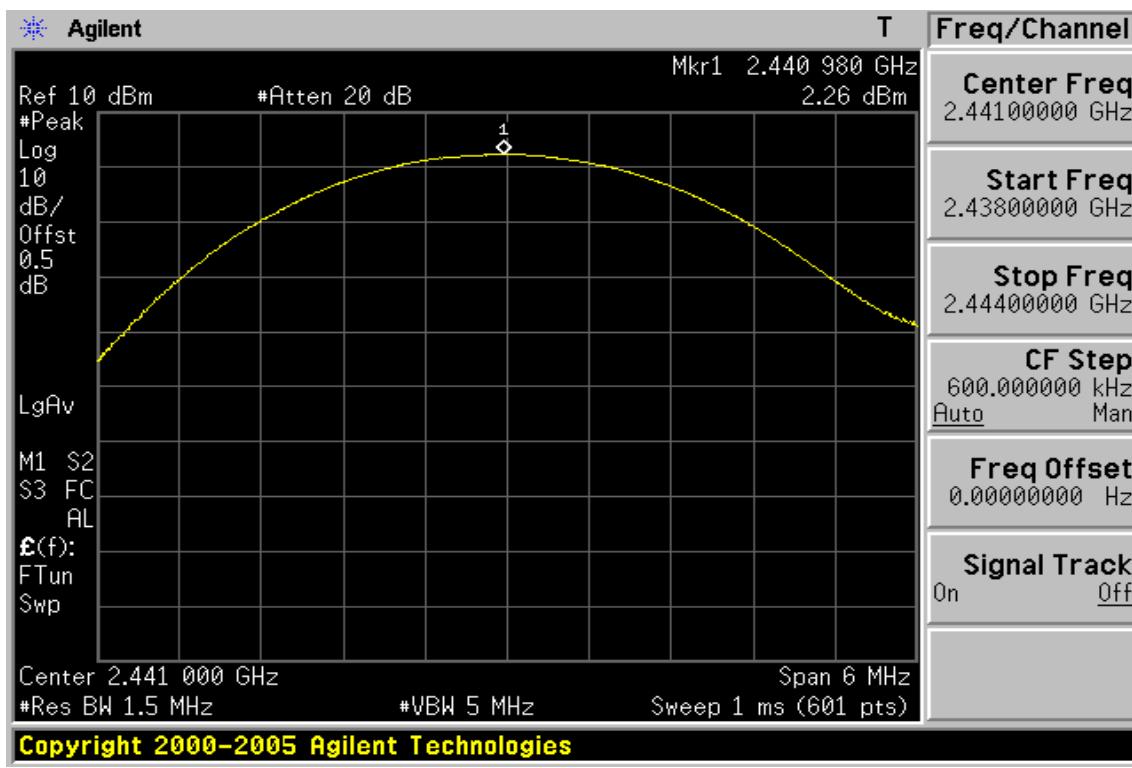
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## Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



## Peak Power Output Data Plot (CH Mid) (EDR mode 8DPSK)

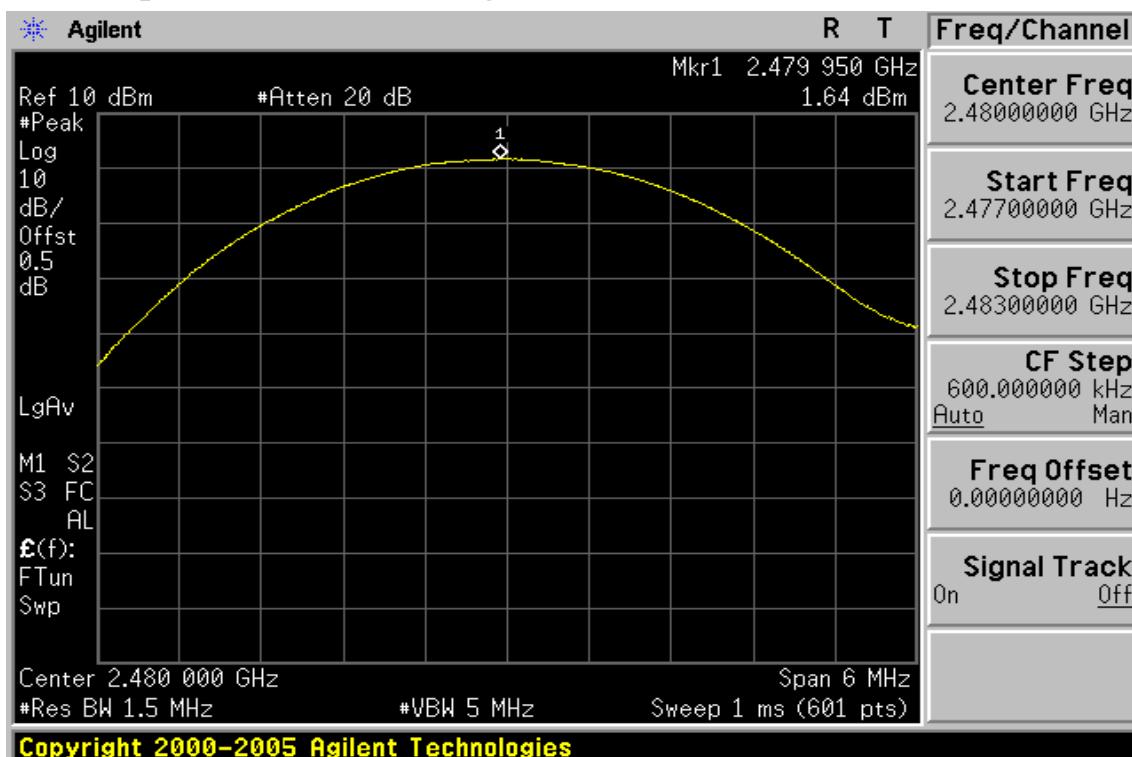


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## Peak Power Output Data Plot (CH High) (EDR mode 8DPSK)



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## 8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

### 8.1. Standard Applicable:

According to §15.247(d), 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).

According to RSS-210 issue 8, §A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

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## 8.2. Measurement Equipment Used:

### 8.2.1. Conducted Emission at antenna port:

Refer to section 7.2 for details.

### 8.2.2. Radiated emission:

| 966 Chamber            |                       |              |               |            |            |
|------------------------|-----------------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE         | MFR                   | MODEL NUMBER | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| EMI Test Receiver      | R&S                   | ESCI7        | 100759        | 05/20/2011 | 05/19/2013 |
| Spectrum Analyzer      | Agilent               | E4446A       | MY51100003    | 04/15/2011 | 04/14/2013 |
| EXA Spectrum Analyzer  | Agilent               | N9010A       | MY50420195    | 02/15/2011 | 02/14/2013 |
| Spectrum Analyzer      | R&S                   | FSV-30       | 101398        | 10/18/2011 | 10/17/2013 |
| Bilog Antenna          | SCHWAZBECK            | VULB9168     | 378           | 01/10/2012 | 01/09/2014 |
| Horn antenna           | ETS.LINDGREN          | 3117         | 123995        | 05/19/2011 | 05/18/2013 |
| Horn Antenna           | Schwarzbeck           | BBHA9170     | 185           | 07/11/2011 | 07/10/2013 |
| Pre-Amplifier          | Agilent               | 8447D        | 2944A07676    | 01/04/2012 | 01/03/2013 |
| Pre-Amplifier          | EMC Instruments Corp. | EMC0126530   | 980038        | 01/04/2012 | 01/03/2013 |
| Filter 2400-2483.5 MHz | EWT                   | EWT-14-0166  | M2            | 02/28/2012 | 02/28/2013 |
| Attenuator             | Mini-Circuit          | BW-S10W2+    | 004           | 02/28/2012 | 02/27/2013 |
| 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          | 966_Rx       | 9             | 01/04/2012 | 01/03/2013 |
| 3m Site NSA            | SGS                   | 966 chamber  | N/A           | 07/15/2012 | 07/14/2013 |

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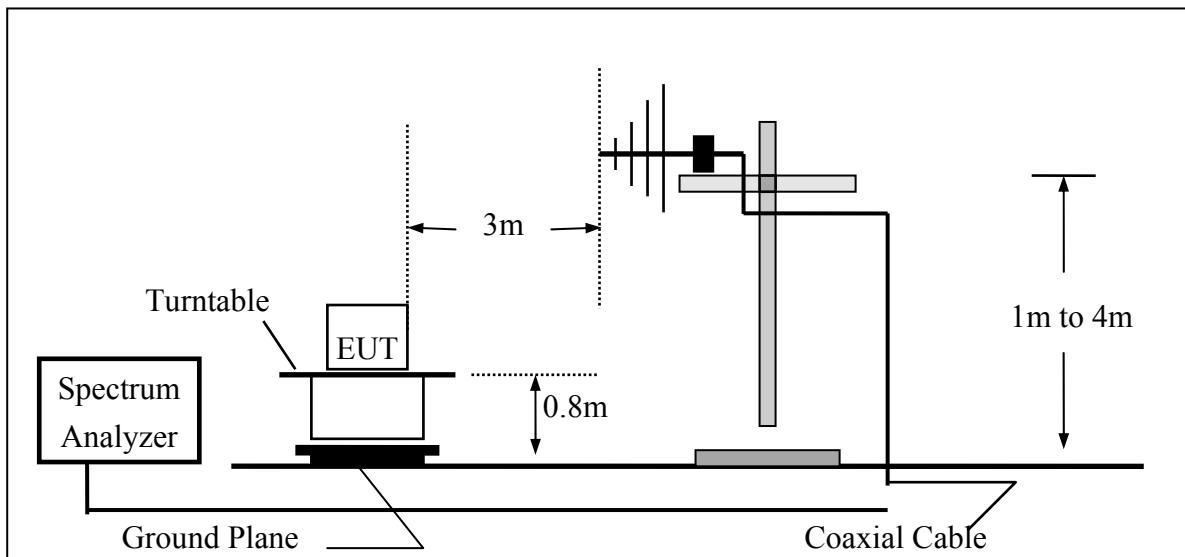
### 8.3. Test SET-UP:

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

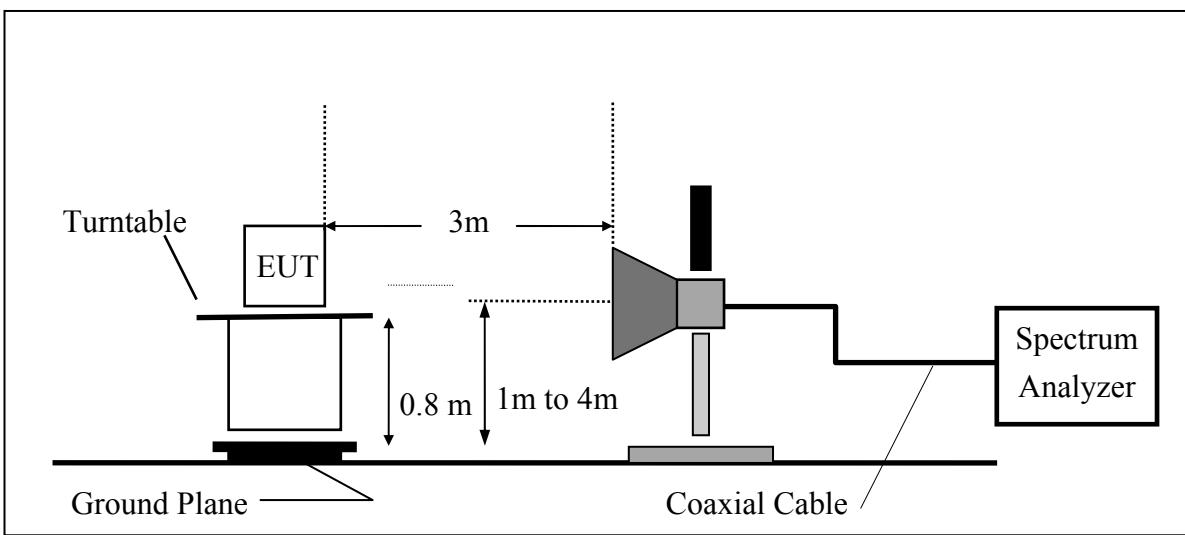
Refer to section 7.3 for details.

#### 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.

#### 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:

$$FS = RA + AF + CL - AG$$

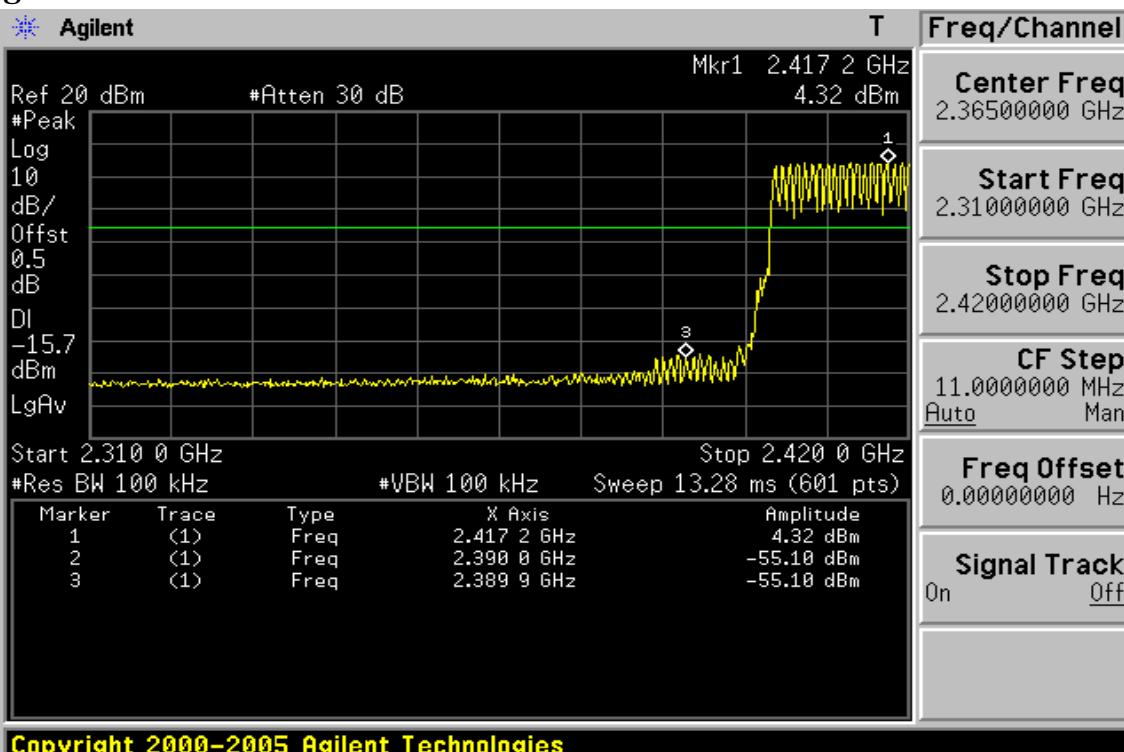
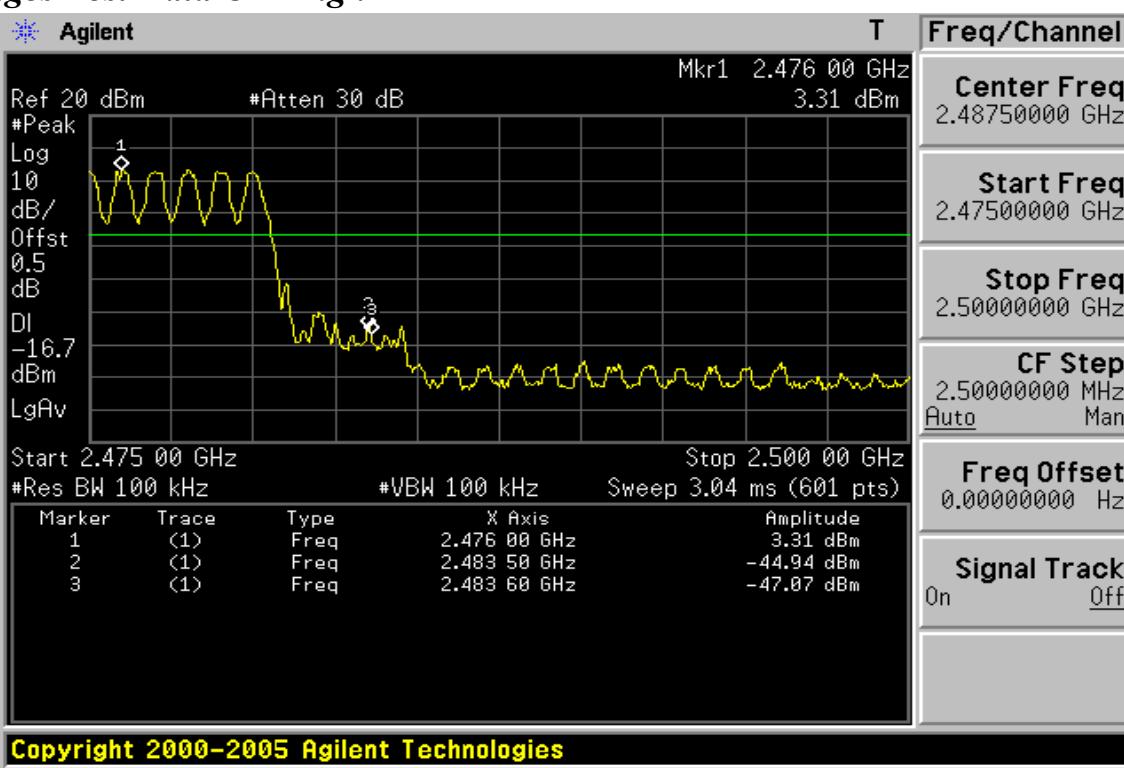
|       |                        |  |
|-------|------------------------|--|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |  |

#### 8.6. Measurement Result:

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

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**BDR Mode**  
**Band Edges Test Data CH-Low**

**Band Edges Test Data CH-High**


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**Radiated Emission: (BDR mode)**

|                       |               |                          |                 |
|-----------------------|---------------|--------------------------|-----------------|
| Operation Band        | :BDR          | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2402 MHz     | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE LOW | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan       | Measurement Antenna Pol. | :VERTICAL       |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 2390.00      | E               | Average          |          | 29.81                       | 4.68         | 34.49                        | 54.00                        | -19.51       |
| 2390.00      | E               | Peak             |          | 40.96                       | 4.68         | 45.64                        | 74.00                        | -28.36       |

|                       |               |                          |                 |
|-----------------------|---------------|--------------------------|-----------------|
| Operation Band        | :BDR          | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2402 MHz     | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE LOW | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan       | Measurement Antenna Pol. | :HORIZONTAL     |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 2390.00      | E               | Average          |          | 29.51                       | 5.30         | 34.81                        | 54.00                        | -19.19       |
| 2390.00      | E               | Peak             |          | 40.80                       | 5.30         | 46.10                        | 74.00                        | -27.90       |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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**Radiated Emission:**

|                       |                |                          |                 |
|-----------------------|----------------|--------------------------|-----------------|
| Operation Band        | :BDR           | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2480 MHz      | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE HIGH | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan        | Measurement Antenna Pol. | :VERTICAL       |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 2483.50      | E               | Average          |          | 30.89                       | 5.26         | 36.15                        | 54.00                        | -17.85       |
| 2483.50      | E               | Peak             |          | 44.44                       | 5.26         | 49.70                        | 74.00                        | -24.30       |

|                       |                |                          |                 |
|-----------------------|----------------|--------------------------|-----------------|
| Operation Band        | :BDR           | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2480 MHz      | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE HIGH | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan        | Measurement Antenna Pol. | :HORIZONTAL     |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 2483.50      | E               | Average          |          | 32.40                       | 6.29         | 38.69                        | 54.00                        | -15.31       |
| 2483.50      | E               | Peak             |          | 48.22                       | 6.29         | 54.51                        | 74.00                        | -19.49       |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

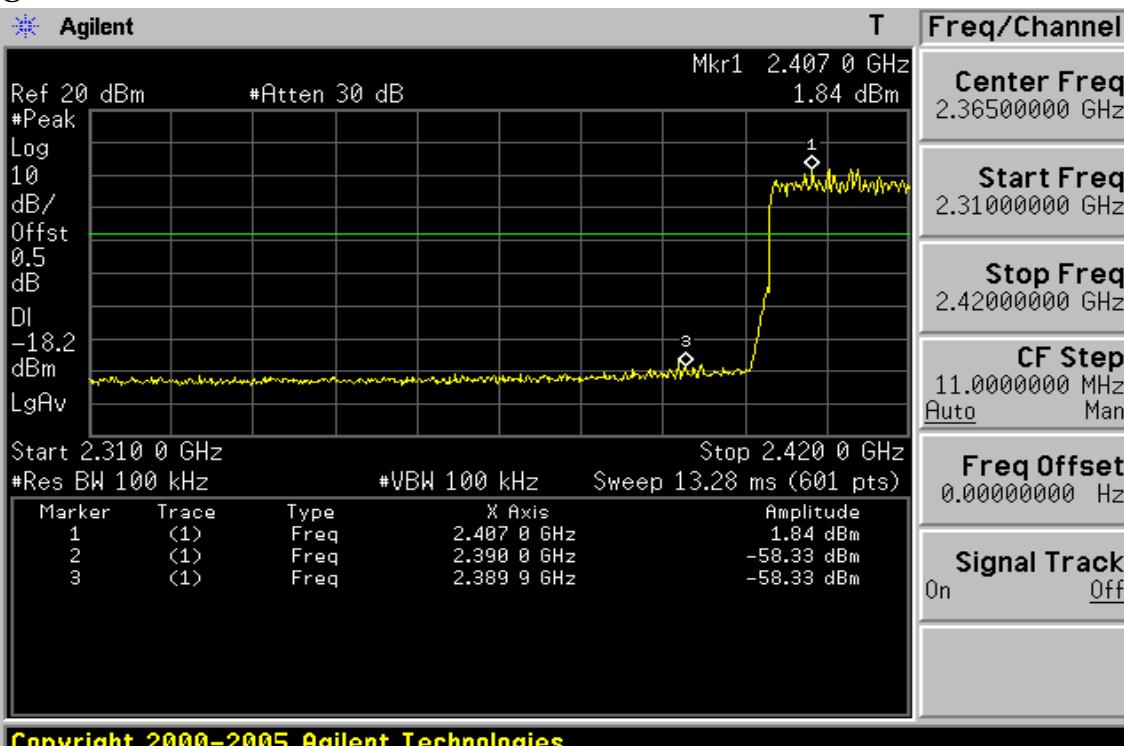
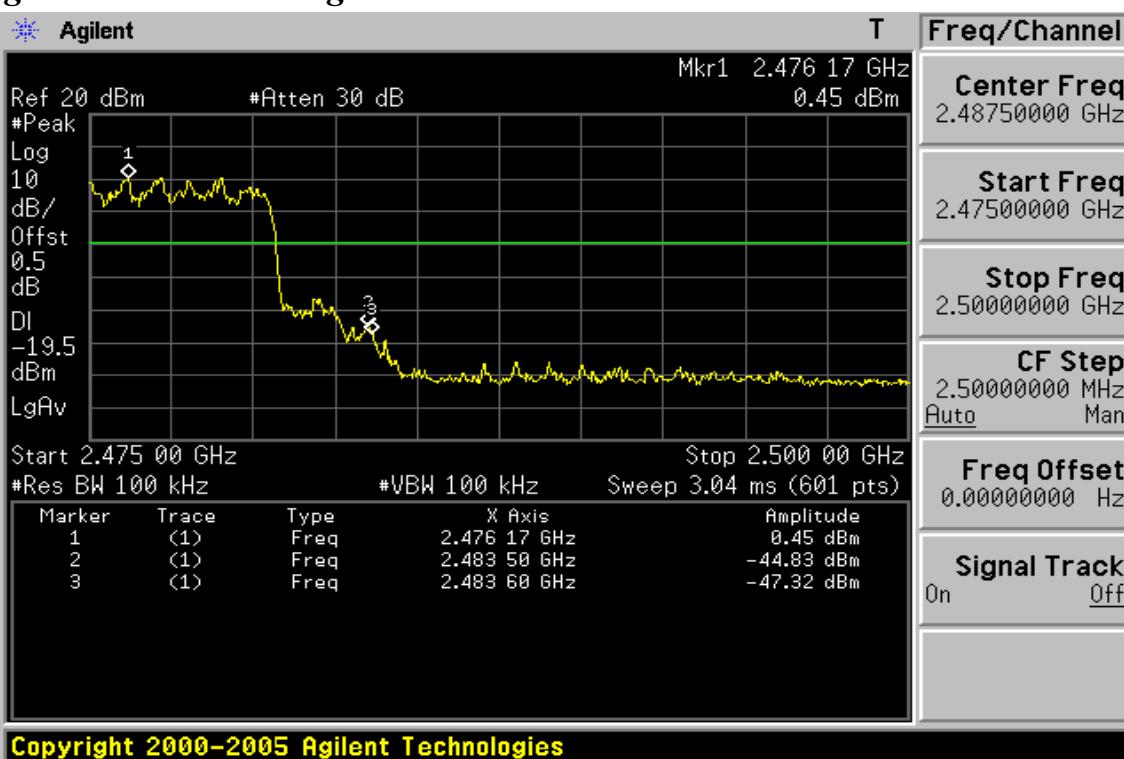
“---“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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**EDR Mode**  
**Band Edges Test Data CH-Low**

**Band Edges Test Data CH-High**


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**Radiated Emission: (EDR mode)**

|                       |               |                          |                 |
|-----------------------|---------------|--------------------------|-----------------|
| Operation Band        | :EDR          | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2402 MHz     | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE LOW | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan       | Measurement Antenna Pol. | :VERTICAL       |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 2390.00      | E               | Average          |          | 29.42                       | 4.68         | 34.10                        | 54.00                        | -19.90       |
| 2390.00      | E               | Peak             |          | 41.24                       | 4.68         | 45.92                        | 74.00                        | -28.08       |

|                       |               |                          |                 |
|-----------------------|---------------|--------------------------|-----------------|
| Operation Band        | :EDR          | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2402 MHz     | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE LOW | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan       | Measurement Antenna Pol. | :HORIZONTAL     |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 2390.00      | E               | Average          |          | 29.31                       | 5.30         | 34.61                        | 54.00                        | -19.39       |
| 2390.00      | E               | Peak             |          | 40.49                       | 5.30         | 45.79                        | 74.00                        | -28.21       |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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**Radiated Emission:**

|                       |                |                          |                 |
|-----------------------|----------------|--------------------------|-----------------|
| Operation Band        | :EDR           | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2480 MHz      | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE HIGH | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan        | Measurement Antenna Pol. | :VERTICAL       |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum |                     | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------------------|----------|---------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                              | Reading  | Level<br>dB $\mu$ V |              |                              |                              |              |
| 2483.50      | E               | Average                      | 30.12    | 5.26                | 35.38        | 54.00                        | -18.62                       |              |
| 2483.50      | E               | Peak                         | 46.77    | 5.26                | 52.03        | 74.00                        | -21.97                       |              |

|                       |                |                          |                 |
|-----------------------|----------------|--------------------------|-----------------|
| Operation Band        | :EDR           | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2480 MHz      | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :BANDEDGE HIGH | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan        | Measurement Antenna Pol. | :HORIZONTAL     |

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode<br>PK/QP/AV | Spectrum |                     | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------------------|----------|---------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                              | Reading  | Level<br>dB $\mu$ V |              |                              |                              |              |
| 2483.50      | E               | Average                      | 29.94    | 6.29                | 36.23        | 54.00                        | -17.77                       |              |
| 2483.50      | E               | Peak                         | 49.45    | 6.29                | 55.74        | 74.00                        | -18.26                       |              |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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## 9. SPURIOUS 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.

According to RSS-Gen §7.2.3 and RSS-210 issue 8,§A2.9, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

### 9.2. Measurement Equipment Used:

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

Refer to section 7.2 for details.

#### 9.2.2. Radiated emission:

Refer to section 8.2.2 for details.

### 9.3. Test SET-UP:

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

Refer to section 7.3 for details.

#### 9.3.2. Radiated emission:

Refer to section 8.3.2 for details.

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#### 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.

#### Conducted Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 100K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz
4. Via Software, combine 5 spans of frequency range into one plot

#### 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:

$$FS = RA + AF + CL - AG$$

|       |                        |  |
|-------|------------------------|--|
| 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.

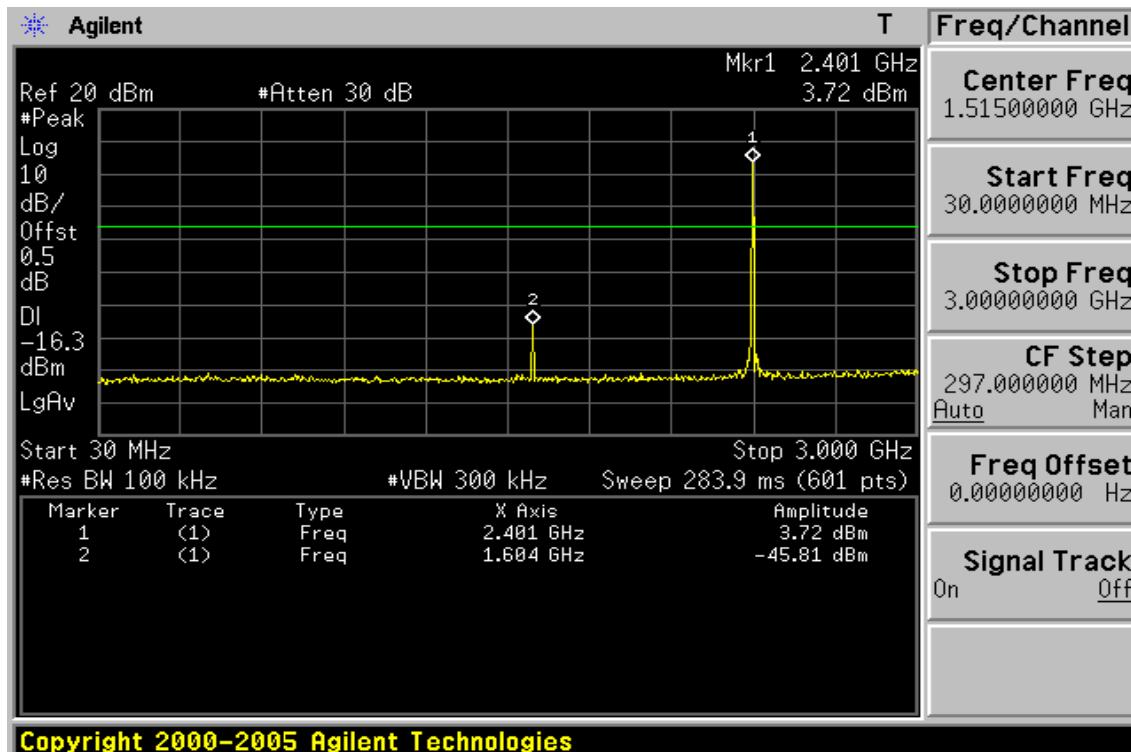
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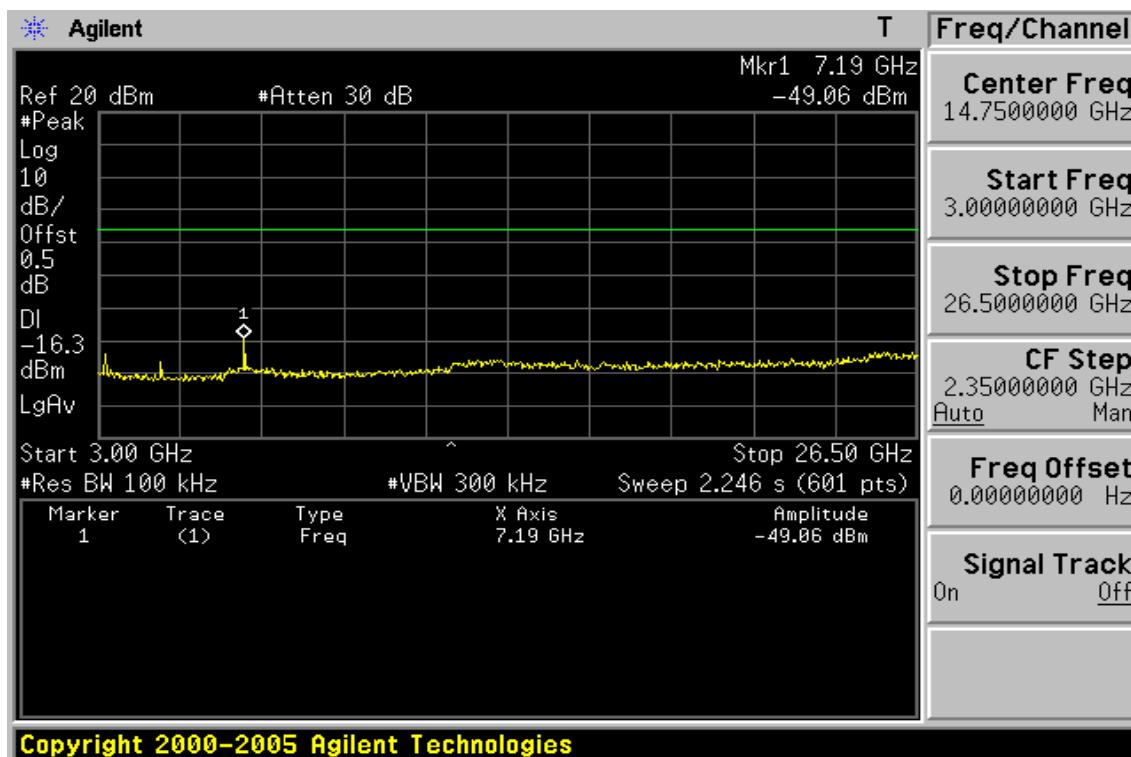
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### Conducted Spurious Emission Measurement Result (BDR mode)

#### Ch Low 30MHz – 3GHz



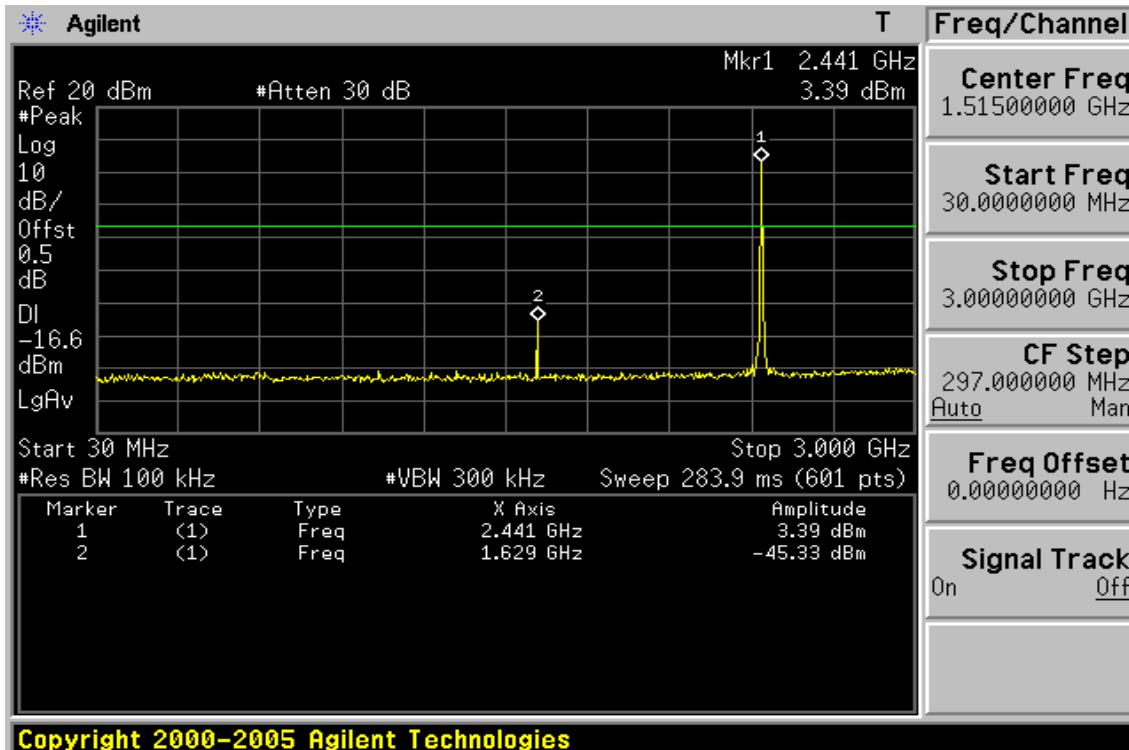
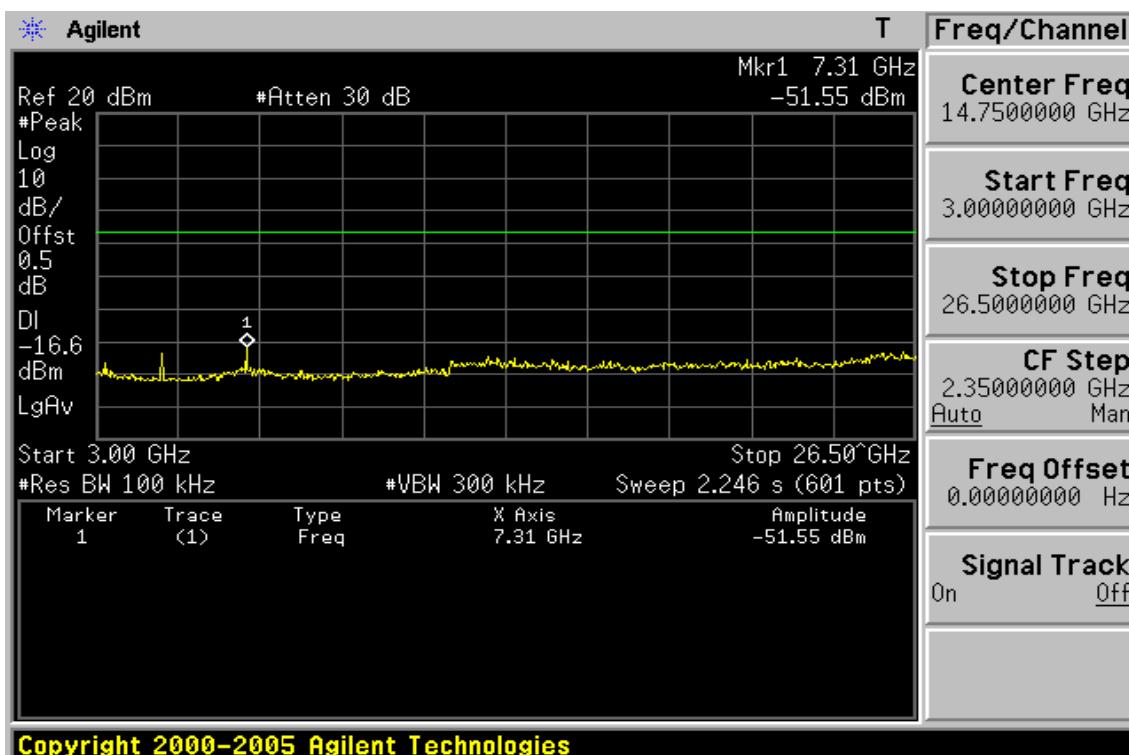
#### Ch Low 3GHz – 26.5GHz



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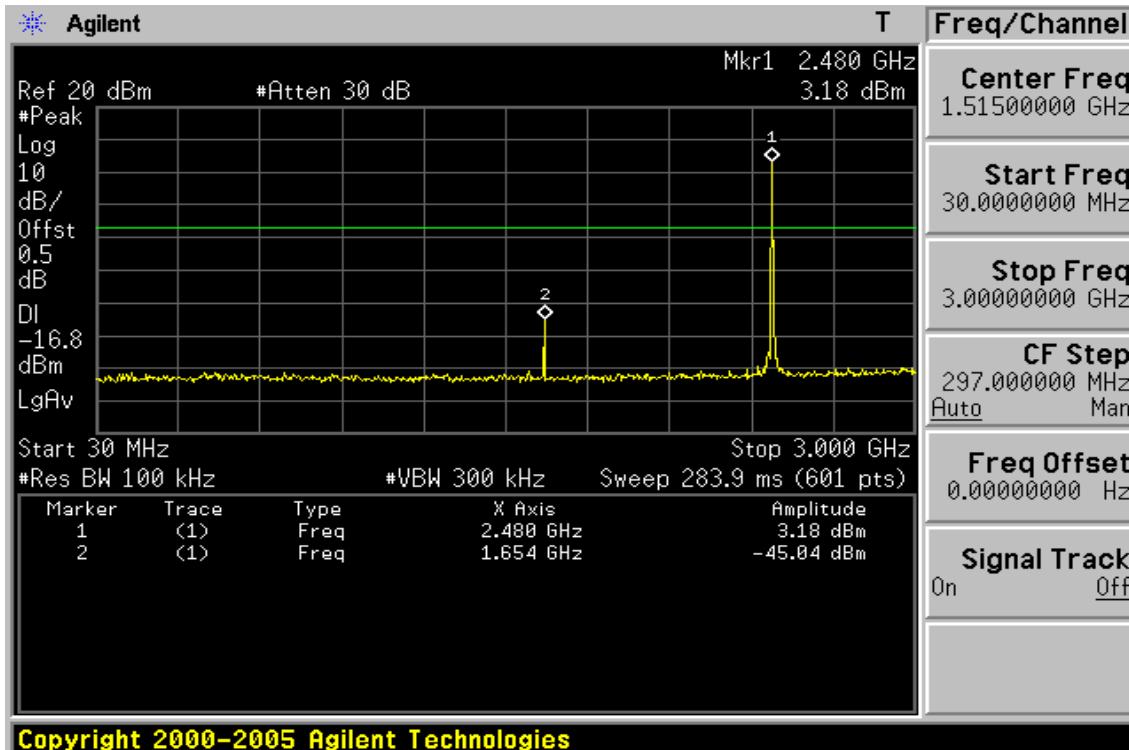
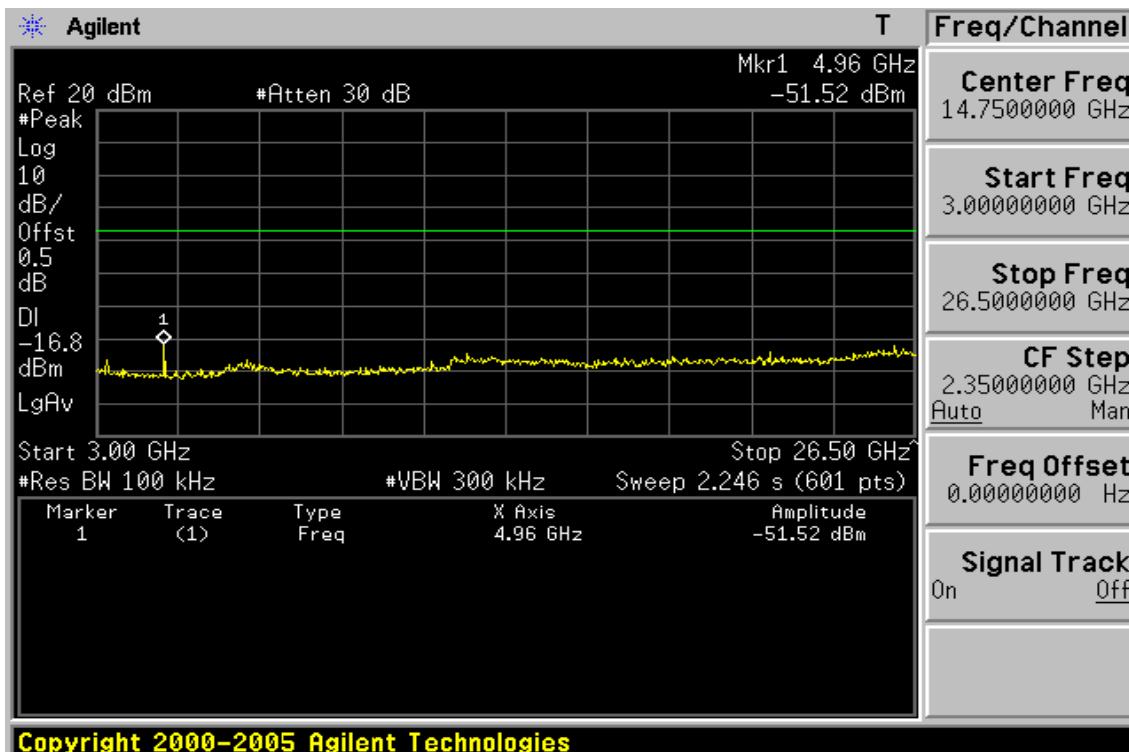
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**Ch Mid 30MHz – 3GHz**

**Ch Mid 3GHz – 26.5GHz**


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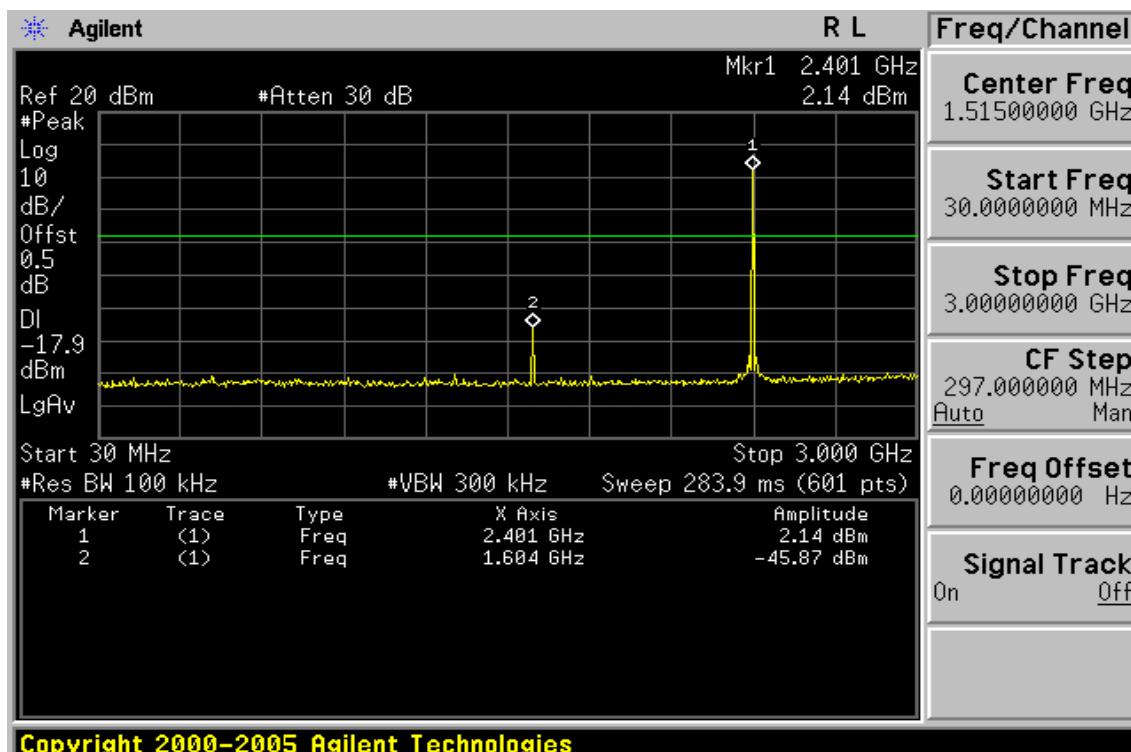
**Ch High 30MHz – 3GHz**

**Ch High 3GHz – 26.5GHz**


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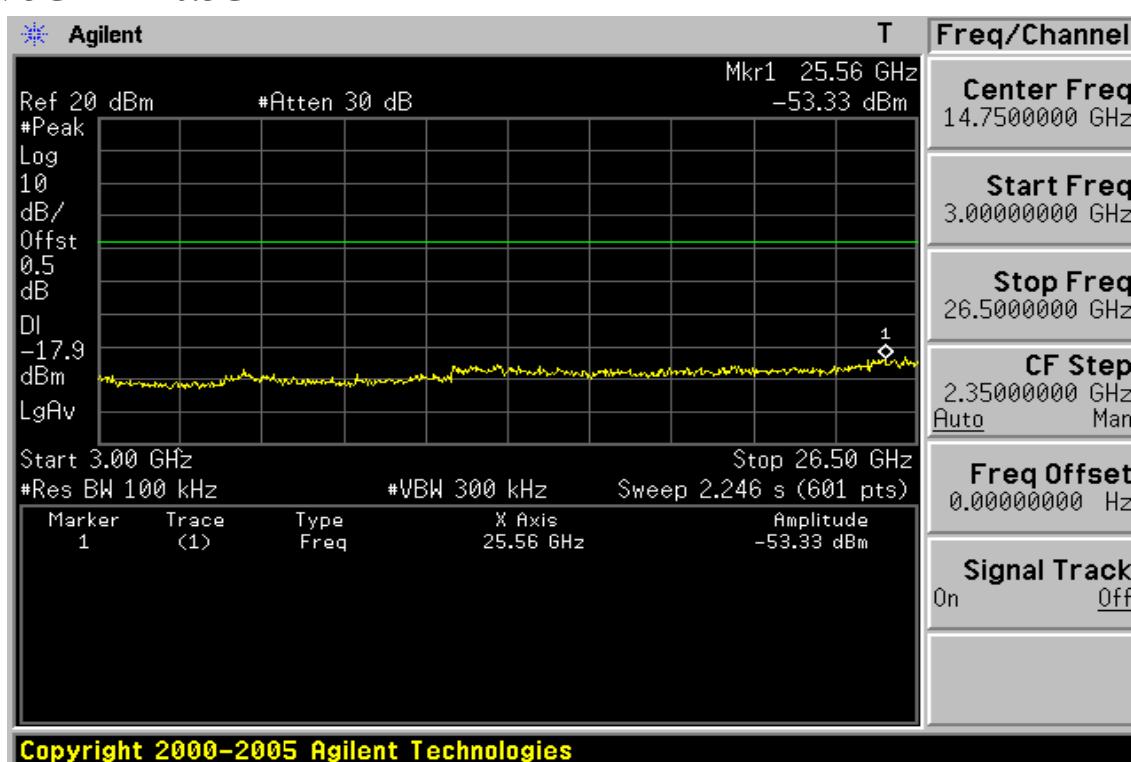
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**Conducted Spurious Emission Measurement Result (EDR mode)**  
**Ch Low 30MHz – 3GHz**



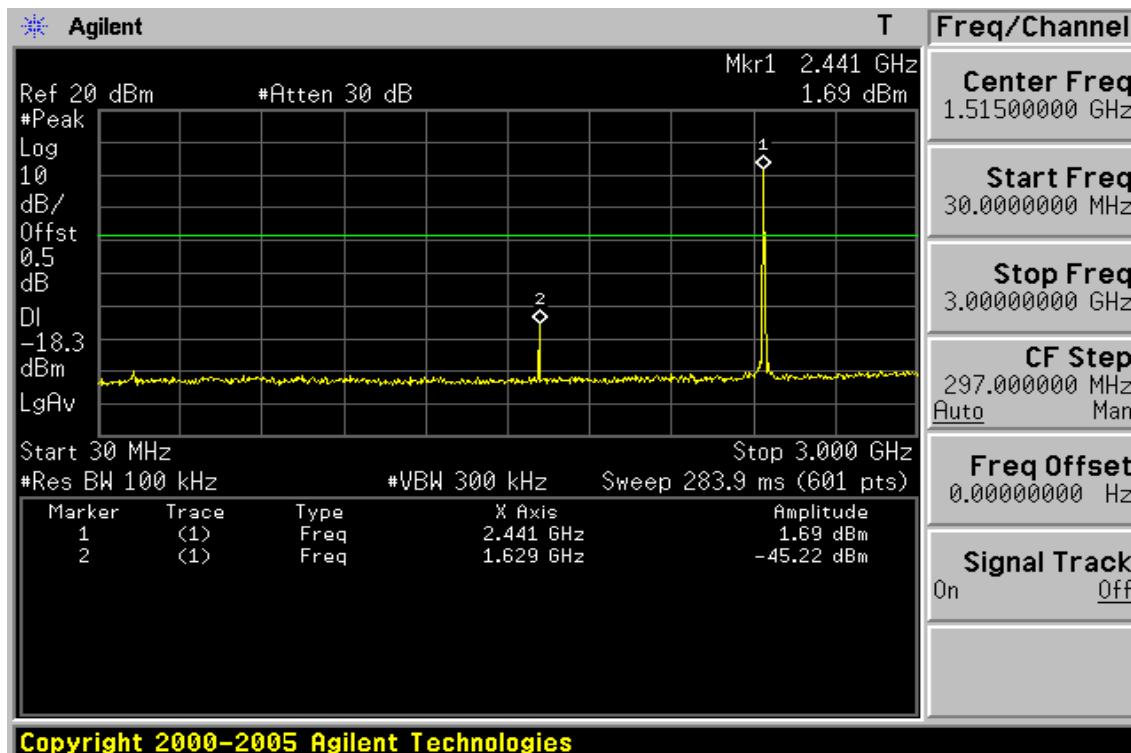
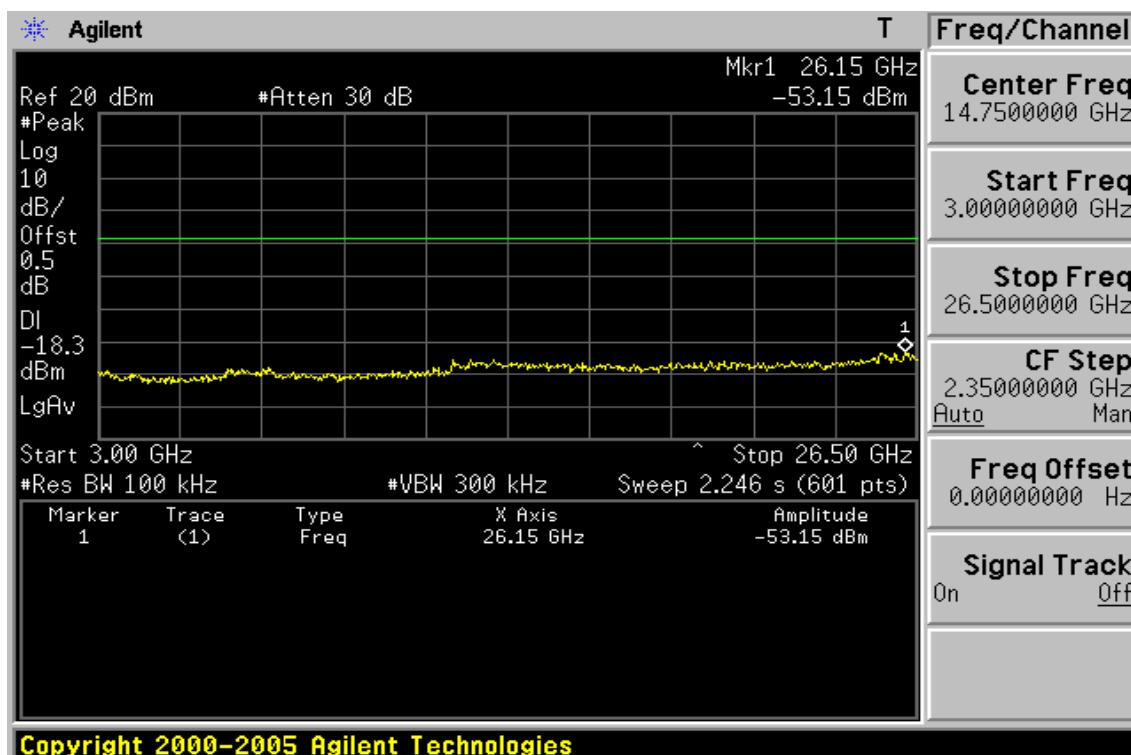
**Ch Low 3GHz – 26.5GHz**



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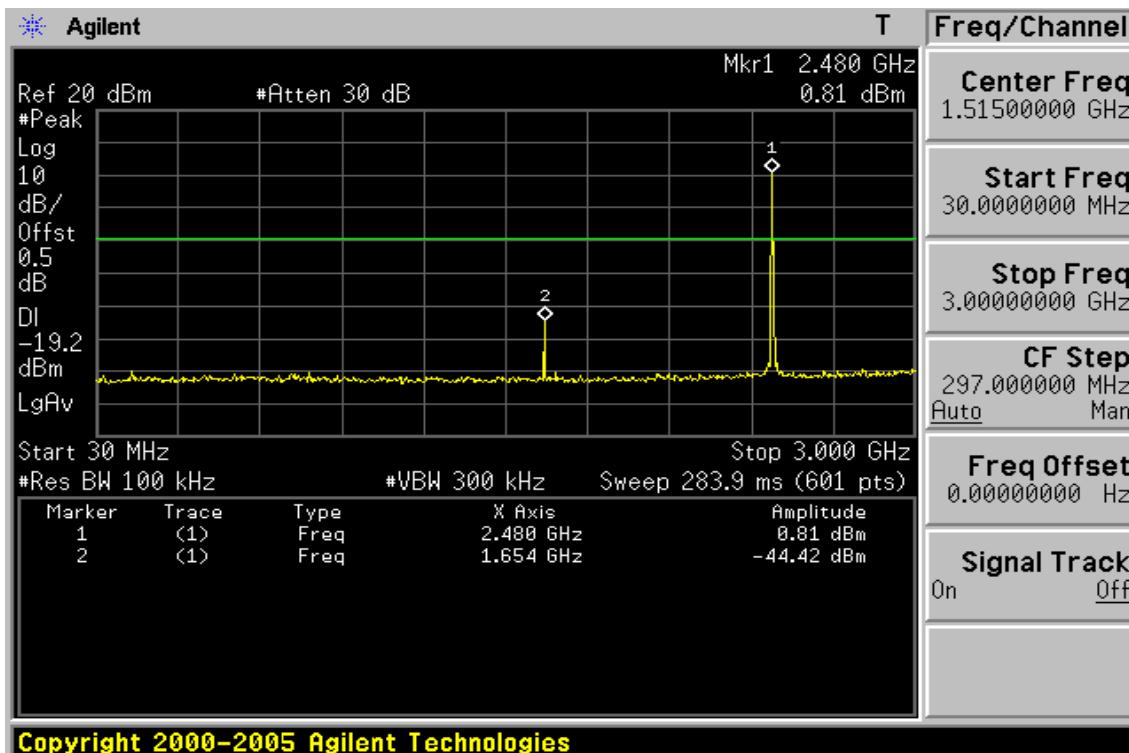
**Ch Mid 30MHz – 3GHz**

**Ch Mid 3GHz – 26.5GHz**


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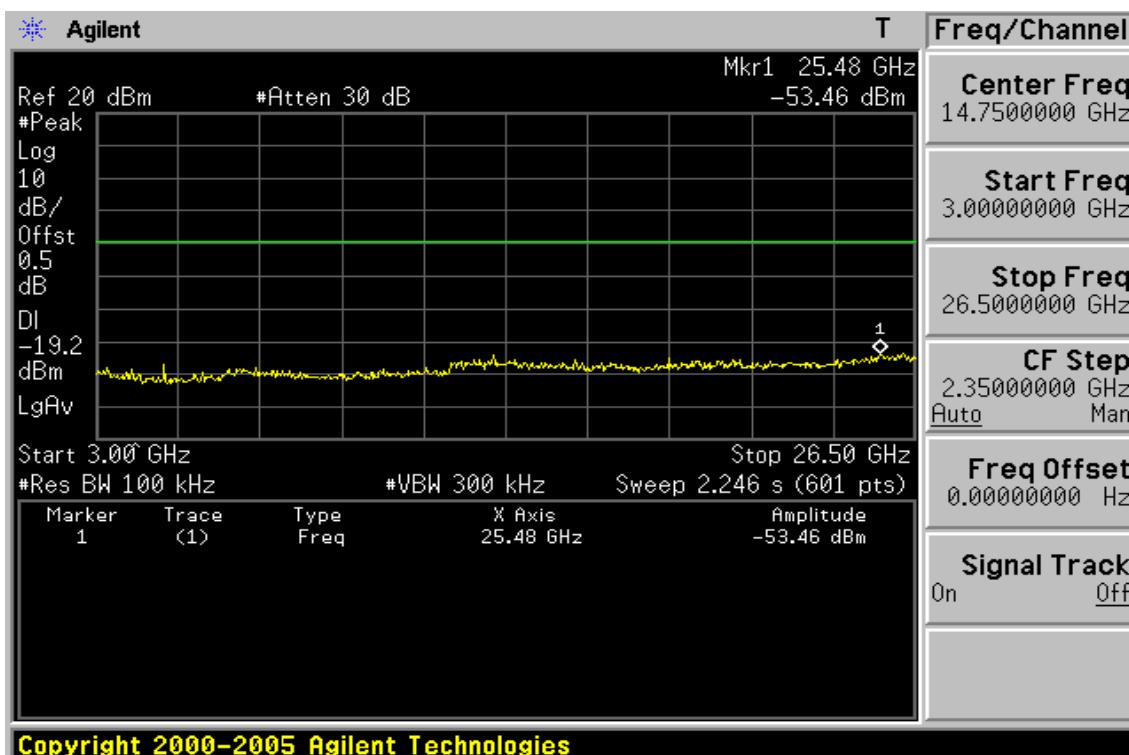
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## Ch High 30MHz – 3GHz



## Ch High 3GHz – 26.5GHz



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### Radiated Spurious Emission Measurement Result (Worst BDR mode)

|                       |           |                          |                 |
|-----------------------|-----------|--------------------------|-----------------|
| Operation Band        | :BDR      | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2402 MHz | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :TX LOW   | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan   | Measurement Antenna Pol. | :VERTICAL       |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum<br>Reading Level |            | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|---------------------------|------------|--------------|----------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV                  | dB $\mu$ V |              |                            |                              |              |
| 36.79        | S               | Peak             |                           | 44.56      | -13.86       | 30.70                      | 40.00                        | -9.30        |
| 95.96        | S               | Peak             |                           | 51.06      | -17.13       | 33.93                      | 43.50                        | -9.57        |
| 155.13       | S               | Peak             |                           | 45.87      | -12.30       | 33.57                      | 43.50                        | -9.93        |
| 440.31       | S               | Peak             |                           | 36.82      | -10.20       | 26.62                      | 46.00                        | -19.38       |
| 577.08       | S               | Peak             |                           | 39.73      | -8.05        | 31.68                      | 46.00                        | -14.32       |
| 966.05       | S               | Peak             |                           | 35.17      | -2.03        | 33.14                      | 54.00                        | -20.86       |
| 4804.00      | H               | Average          |                           | 24.49      | 9.65         | 34.14                      | 54.00                        | -19.86       |
| 4804.00      | H               | Peak             |                           | 33.52      | 9.65         | 43.17                      | 74.00                        | -30.83       |
| 7206.00      | H               | ---              |                           |            |              |                            |                              |              |
| 9608.00      | H               | ---              |                           |            |              |                            |                              |              |
| 12010.00     | H               | ---              |                           |            |              |                            |                              |              |
| 14412.00     | H               | ---              |                           |            |              |                            |                              |              |
| 16814.00     | H               | ---              |                           |            |              |                            |                              |              |
| 19216.00     | H               | ---              |                           |            |              |                            |                              |              |
| 21618.00     | H               | ---              |                           |            |              |                            |                              |              |
| 24020.00     | H               | ---              |                           |            |              |                            |                              |              |

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|                       |           |                          |                 |
|-----------------------|-----------|--------------------------|-----------------|
| Operation Band        | :BDR      | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2402 MHz | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :TX LOW   | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan   | Measurement Antenna Pol. | :HORIZONTAL     |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|----------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                            |                              |              |
| 138.64       | S               | Peak             | 43.40    | -13.20                      | 30.20        | 43.50                      | -13.30                       |              |
| 271.53       | S               | Peak             | 45.37    | -13.32                      | 32.05        | 46.00                      | -13.95                       |              |
| 335.55       | S               | Peak             | 40.19    | -11.86                      | 28.33        | 46.00                      | -17.67                       |              |
| 577.08       | S               | Peak             | 37.84    | -8.05                       | 29.79        | 46.00                      | -16.21                       |              |
| 799.21       | S               | Peak             | 33.32    | -4.21                       | 29.11        | 46.00                      | -16.89                       |              |
| 962.17       | S               | Peak             | 34.43    | -2.05                       | 32.38        | 54.00                      | -21.62                       |              |
| 4804.00      | H               | Average          | 24.30    | 9.69                        | 33.99        | 54.00                      | -20.01                       |              |
| 4804.00      | H               | Peak             | 34.74    | 9.69                        | 44.43        | 74.00                      | -29.57                       |              |
| 7206.00      | H               | ---              |          |                             |              |                            |                              |              |
| 9608.00      | H               | ---              |          |                             |              |                            |                              |              |
| 12010.00     | H               | ---              |          |                             |              |                            |                              |              |
| 14412.00     | H               | ---              |          |                             |              |                            |                              |              |
| 16814.00     | H               | ---              |          |                             |              |                            |                              |              |
| 19216.00     | H               | ---              |          |                             |              |                            |                              |              |
| 21618.00     | H               | ---              |          |                             |              |                            |                              |              |
| 24020.00     | H               | ---              |          |                             |              |                            |                              |              |

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|                       |           |                          |                 |
|-----------------------|-----------|--------------------------|-----------------|
| Operation Band        | :BDR      | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2441 MHz | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :TX MID   | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan   | Measurement Antenna Pol. | :VERTICAL       |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : "F" : denotes Fundamental Frequency. ; "H" : denotes Harmonic Frequency.

"E" : denotes Band Edge Frequency. ; "S" : denotes Spurious Frequency.

"---" : denotes Noise Floor.

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|------------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                              |                              |              |
| 37.76        | S               | Peak             |          | 44.91                       | -13.72       | 31.19                        | 40.00                        | -8.81        |
| 95.96        | S               | Peak             |          | 50.63                       | -17.13       | 33.50                        | 43.50                        | -10.00       |
| 158.04       | S               | Peak             |          | 40.32                       | -12.30       | 28.02                        | 43.50                        | -15.48       |
| 577.08       | S               | Peak             |          | 40.58                       | -8.05        | 32.53                        | 46.00                        | -13.47       |
| 966.05       | S               | Peak             |          | 36.09                       | -2.03        | 34.06                        | 54.00                        | -19.94       |
| 995.15       | S               | Peak             |          | 40.37                       | -1.87        | 38.50                        | 54.00                        | -15.50       |
| 4882.00      | H               | Average          |          | 23.90                       | 10.17        | 34.07                        | 54.00                        | -19.93       |
| 4882.00      | H               | Peak             |          | 33.56                       | 10.17        | 43.73                        | 74.00                        | -30.27       |
| 7323.00      | H               | ---              |          |                             |              |                              |                              |              |
| 9764.00      | H               | ---              |          |                             |              |                              |                              |              |
| 12205.00     | H               | ---              |          |                             |              |                              |                              |              |
| 14646.00     | H               | ---              |          |                             |              |                              |                              |              |
| 17087.00     | H               | ---              |          |                             |              |                              |                              |              |
| 19528.00     | H               | ---              |          |                             |              |                              |                              |              |
| 21969.00     | H               | ---              |          |                             |              |                              |                              |              |
| 24410.00     | H               | ---              |          |                             |              |                              |                              |              |

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|                       |           |                          |                 |
|-----------------------|-----------|--------------------------|-----------------|
| Operation Band        | :BDR      | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2441 MHz | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :TX MID   | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan   | Measurement Antenna Pol. | :HORIZONTAL     |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|----------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                            |                              |              |
| 138.64       | S               | Peak             | 48.30    | -13.20                      | 35.10        | 43.50                      | -8.40                        |              |
| 288.99       | S               | Peak             | 44.14    | -12.83                      | 31.31        | 46.00                      | -14.69                       |              |
| 398.60       | S               | Peak             | 39.25    | -11.07                      | 28.18        | 46.00                      | -17.82                       |              |
| 577.08       | S               | Peak             | 37.88    | -8.05                       | 29.83        | 46.00                      | -16.17                       |              |
| 966.05       | S               | Peak             | 35.58    | -2.03                       | 33.55        | 54.00                      | -20.45                       |              |
| 995.15       | S               | Peak             | 36.25    | -1.87                       | 34.38        | 54.00                      | -19.62                       |              |
| 4882.00      | H               | Average          | 26.12    | 10.11                       | 36.23        | 54.00                      | -17.77                       |              |
| 4882.00      | H               | Peak             | 34.99    | 10.11                       | 45.10        | 74.00                      | -28.90                       |              |
| 7323.00      | H               | ---              |          |                             |              |                            |                              |              |
| 9764.00      | H               | ---              |          |                             |              |                            |                              |              |
| 12205.00     | H               | ---              |          |                             |              |                            |                              |              |
| 14646.00     | H               | ---              |          |                             |              |                            |                              |              |
| 17087.00     | H               | ---              |          |                             |              |                            |                              |              |
| 19528.00     | H               | ---              |          |                             |              |                            |                              |              |
| 21969.00     | H               | ---              |          |                             |              |                            |                              |              |
| 24410.00     | H               | ---              |          |                             |              |                            |                              |              |

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|                       |           |                          |                 |
|-----------------------|-----------|--------------------------|-----------------|
| Operation Band        | :BDR      | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2480 MHz | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :TX HIGH  | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan   | Measurement Antenna Pol. | :VERTICAL       |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum |                             | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|-----------------|------------------|----------|-----------------------------|--------------|----------------------------|------------------------------|--------------|
|              |                 |                  | PK/QP/AV | Reading Level<br>dB $\mu$ V |              |                            |                              |              |
| 36.79        | S               | Peak             | 47.64    | -13.86                      | 33.78        | 40.00                      | -6.22                        |              |
| 95.96        | S               | Peak             | 50.72    | -17.13                      | 33.59        | 43.50                      | -9.91                        |              |
| 185.20       | S               | Peak             | 47.32    | -15.10                      | 32.22        | 43.50                      | -11.28                       |              |
| 577.08       | S               | Peak             | 40.28    | -8.05                       | 32.23        | 46.00                      | -13.77                       |              |
| 966.05       | S               | Peak             | 35.98    | -2.03                       | 33.95        | 54.00                      | -20.05                       |              |
| 995.15       | S               | Peak             | 39.70    | -1.87                       | 37.83        | 54.00                      | -16.17                       |              |
| 4960.00      | H               | Average          | 25.89    | 10.04                       | 35.93        | 54.00                      | -18.07                       |              |
| 4960.00      | H               | Peak             | 35.08    | 10.04                       | 45.12        | 74.00                      | -28.88                       |              |
| 7440.00      | H               | ---              |          |                             |              |                            |                              |              |
| 9920.00      | H               | ---              |          |                             |              |                            |                              |              |
| 12400.00     | H               | ---              |          |                             |              |                            |                              |              |
| 14880.00     | H               | ---              |          |                             |              |                            |                              |              |
| 17360.00     | H               | ---              |          |                             |              |                            |                              |              |
| 19840.00     | H               | ---              |          |                             |              |                            |                              |              |
| 22320.00     | H               | ---              |          |                             |              |                            |                              |              |
| 24800.00     | H               | ---              |          |                             |              |                            |                              |              |

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|                       |           |                          |                 |
|-----------------------|-----------|--------------------------|-----------------|
| Operation Band        | :BDR      | Test Date                | :2012-10-18     |
| Fundamental Frequency | :2480 MHz | Temp./Humi.              | :25.1deg_C/64RH |
| Operation Mode        | :TX HIGH  | Engineer                 | :Marcus         |
| EUT Pol.              | :H Plan   | Measurement Antenna Pol. | :HORIZONTAL     |

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) - Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

| Freq.<br>MHz | Note<br>F/H/E/S | Detector<br>Mode | Spectrum<br>Reading Level | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m | Margin |
|--------------|-----------------|------------------|---------------------------|--------------|------------------------------|--------------|--------|
|              |                 |                  |                           |              |                              | dB $\mu$ V/m | dB     |
| 139.61       | S               | Peak             | 45.26                     | -13.13       | 32.13                        | 43.50        | -11.37 |
| 288.99       | S               | Peak             | 44.39                     | -12.83       | 31.56                        | 46.00        | -14.44 |
| 399.57       | S               | Peak             | 38.84                     | -11.06       | 27.78                        | 46.00        | -18.22 |
| 577.08       | S               | Peak             | 38.61                     | -8.05        | 30.56                        | 46.00        | -15.44 |
| 966.05       | S               | Peak             | 34.98                     | -2.03        | 32.95                        | 54.00        | -21.05 |
| 995.15       | S               | Peak             | 37.29                     | -1.87        | 35.42                        | 54.00        | -18.58 |
| 4960.00      | H               | Average          | 28.91                     | 9.89         | 38.80                        | 54.00        | -15.20 |
| 4960.00      | H               | Peak             | 36.34                     | 9.89         | 46.23                        | 74.00        | -27.77 |
| 7440.00      | H               | ---              |                           |              |                              |              |        |
| 9920.00      | H               | ---              |                           |              |                              |              |        |
| 12400.00     | H               | ---              |                           |              |                              |              |        |
| 14880.00     | H               | ---              |                           |              |                              |              |        |
| 17360.00     | H               | ---              |                           |              |                              |              |        |
| 19840.00     | H               | ---              |                           |              |                              |              |        |
| 22320.00     | H               | ---              |                           |              |                              |              |        |
| 24800.00     | H               | ---              |                           |              |                              |              |        |

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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 20dB bandwidth of the hopping channel, whichever is greater.

According to RSS 210 issue 8, A8.1(b), 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.

### 10.2. Measurement Equipment Used:

Refer to section 7.2 for details.

### 10.3. Test Set-up:

Refer to section 7.3 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:

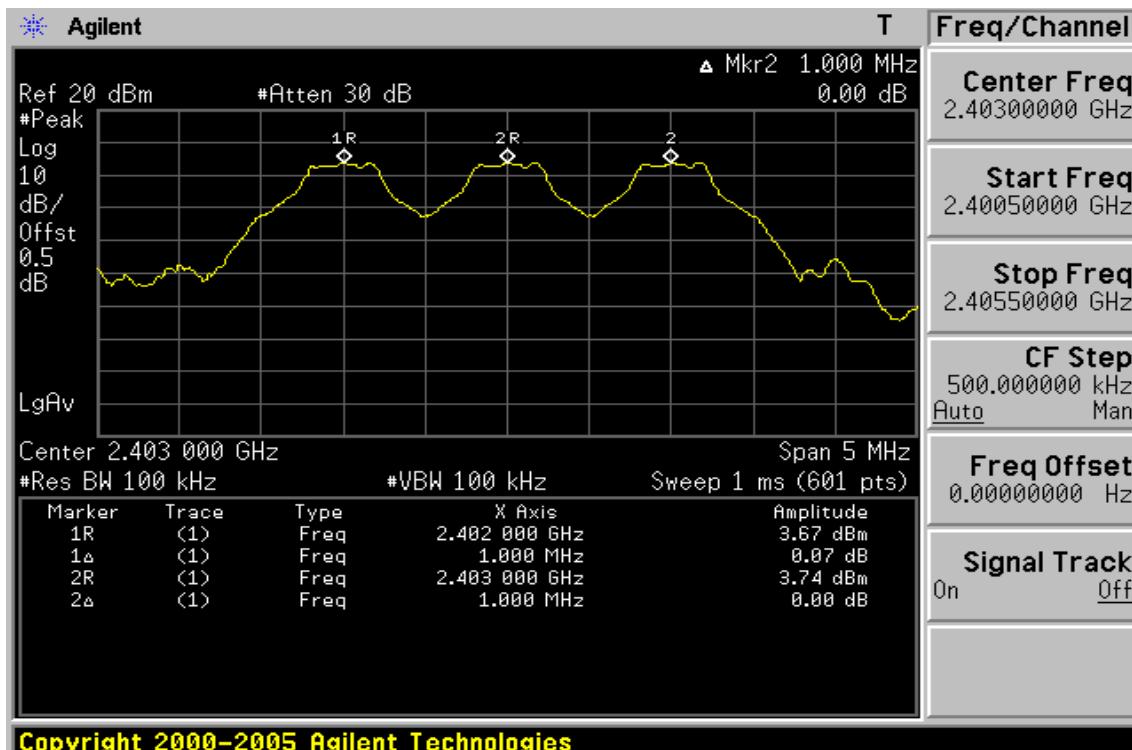
| Channel separation<br>(MHz) | Limit                                  | Result |
|-----------------------------|--|--------|
| 1                           | >=25KHz or<br>2/3 times 20dB bandwidth | PASS   |

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.

According to RSS-210 issue 8, §A8.1(d), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

### 11.2. Measurement Equipment Used:

Refer to section 7.2 for details.

### 11.3. Test Set-up:

Refer to section 7.3 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=1.3MHz,
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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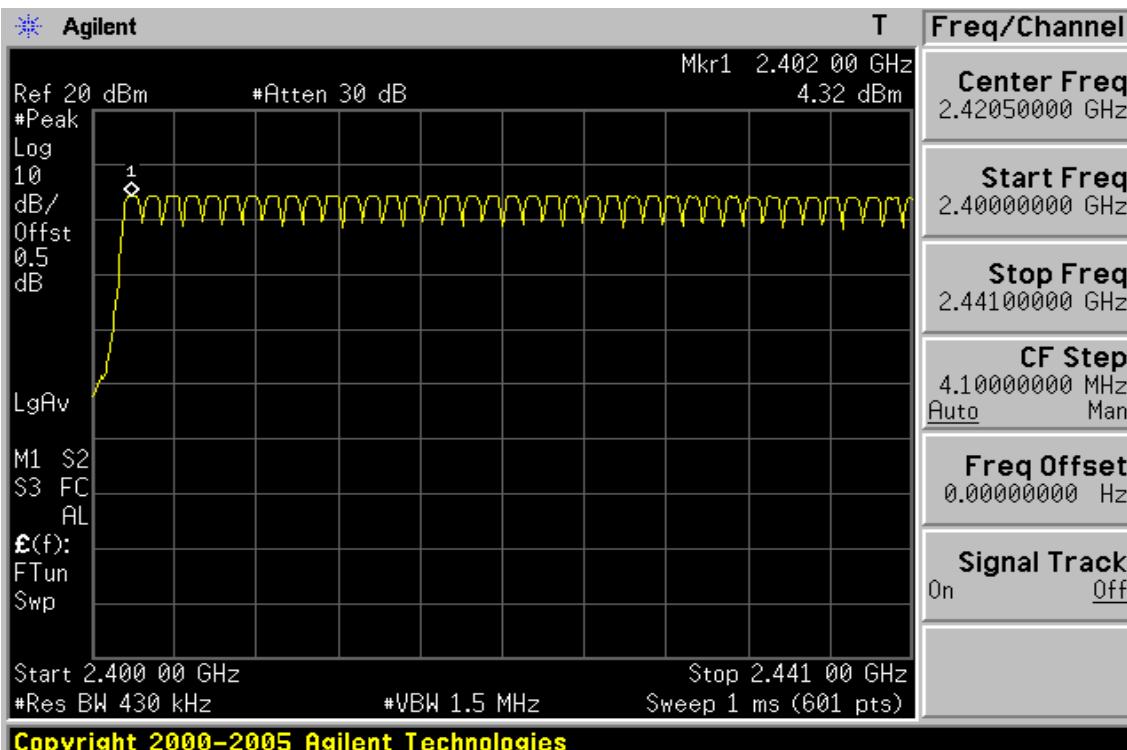
t (886-2) 2299-3279

f (886-2) 2298-0488

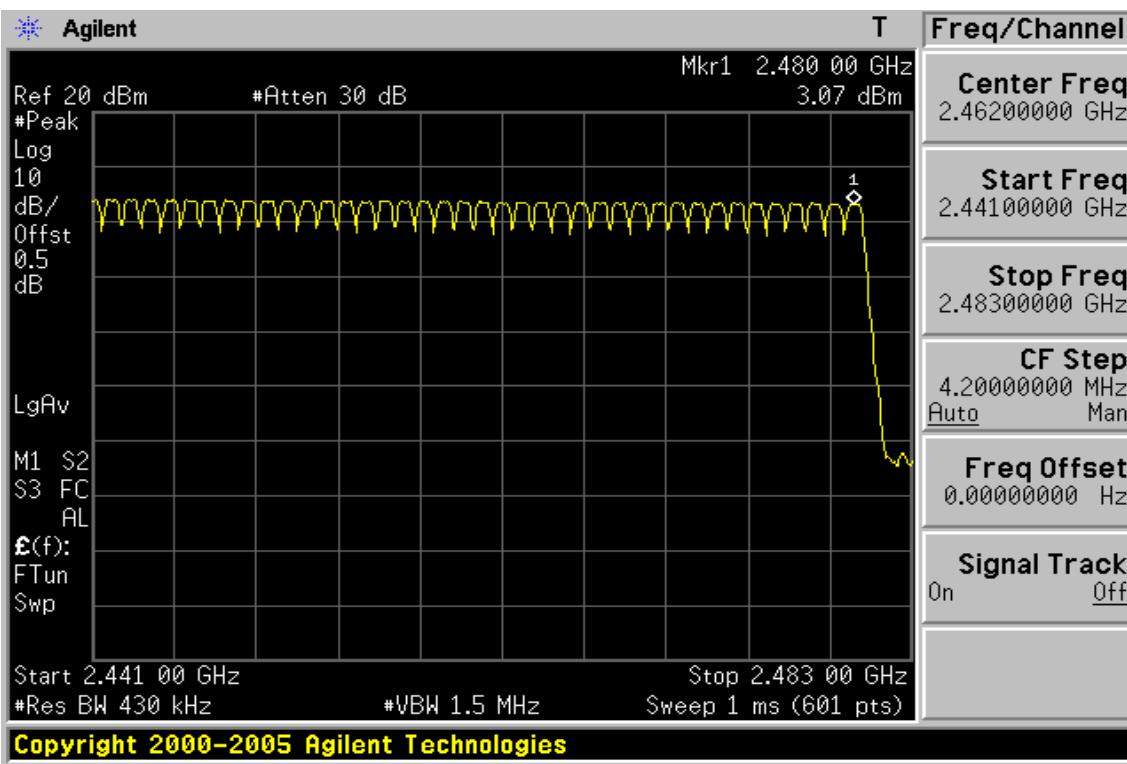
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Member of SGS Group

**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.

According to RSS-210 issue 8,§A8.1(d), Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

### 12.2. Measurement Equipment Used:

Refer to section 7.2 for details.

### 12.3. Test Set-up:

Refer to section 7.3 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=1MHz, VBW=3MHz, Span = 0Hz , Adjust Sweep = 15ms.
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 =  $0.393 \text{ (ms)} * (1600/(2*79)) * 31.6 = 125.76 \text{ (ms)}$

DH3 time slot =  $1.65 \text{ (ms)} * (1600/(4*79)) * 31.6 = 264.00 \text{ (ms)}$

DH5 time slot =  $2.883 \text{ (ms)} * (1600/(6*79)) * 31.6 = 307.52 \text{ (ms)}$

CH Mid: DH1 time slot =  $0.393 \text{ (ms)} * (1600/(2*79)) * 31.6 = 125.76 \text{ (ms)}$

DH3 time slot =  $1.65 \text{ (ms)} * (1600/(4*79)) * 31.6 = 264.00 \text{ (ms)}$

DH5 time slot =  $2.883 \text{ (ms)} * (1600/(6*79)) * 31.6 = 307.52 \text{ (ms)}$

CH High: DH1 time slot =  $0.393 \text{ (ms)} * (1600/(2*79)) * 31.6 = 125.76 \text{ (ms)}$

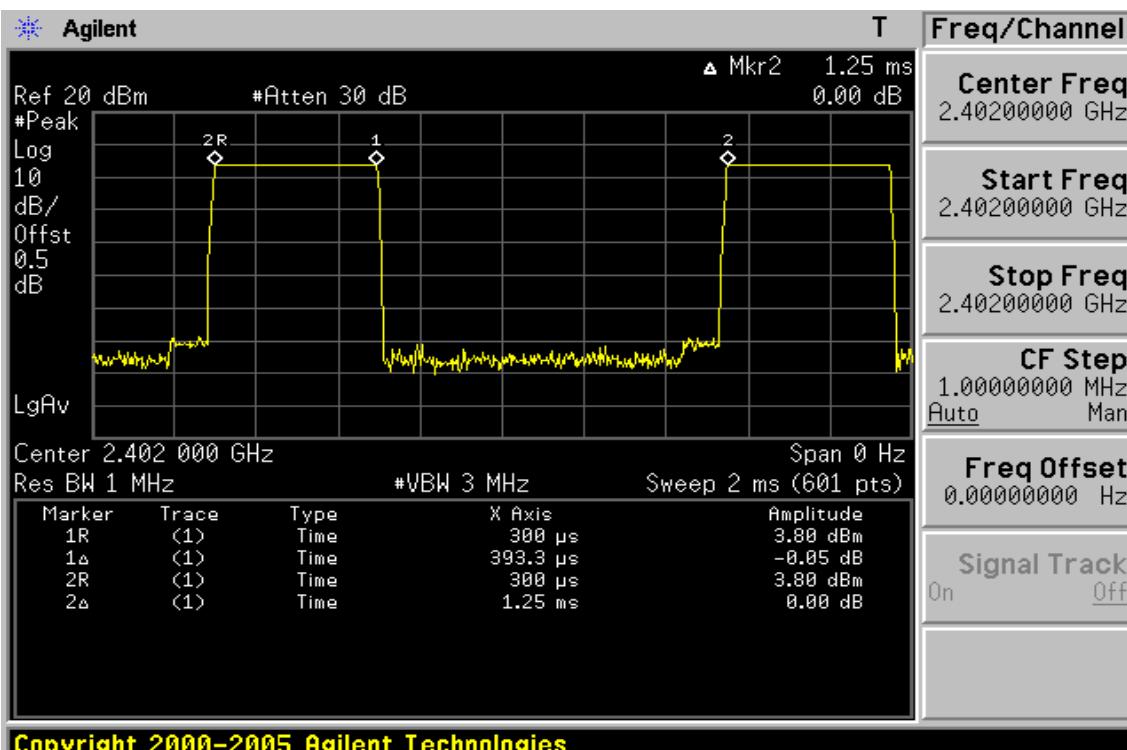
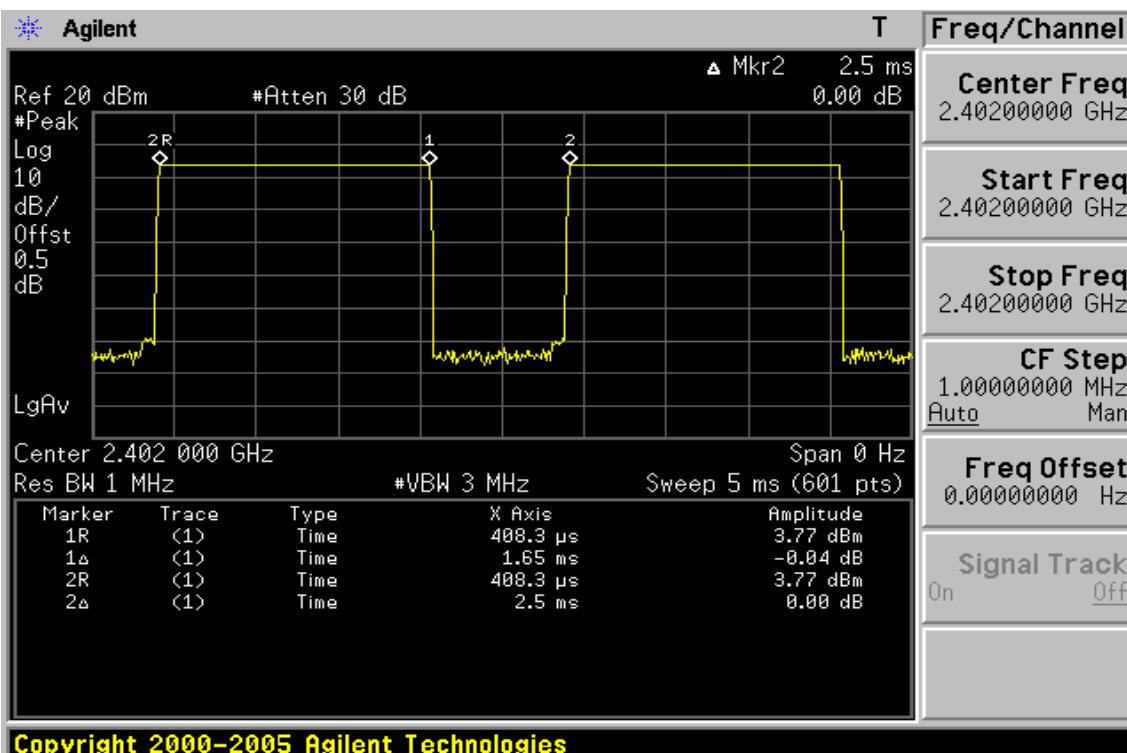
DH3 time slot =  $1.65 \text{ (ms)} * (1600/(4*79)) * 31.6 = 264.00 \text{ (ms)}$

DH5 time slot =  $2.883 \text{ (ms)} * (1600/(6*79)) * 31.6 = 307.52 \text{ (ms)}$

Note: Refer to next page for plots.

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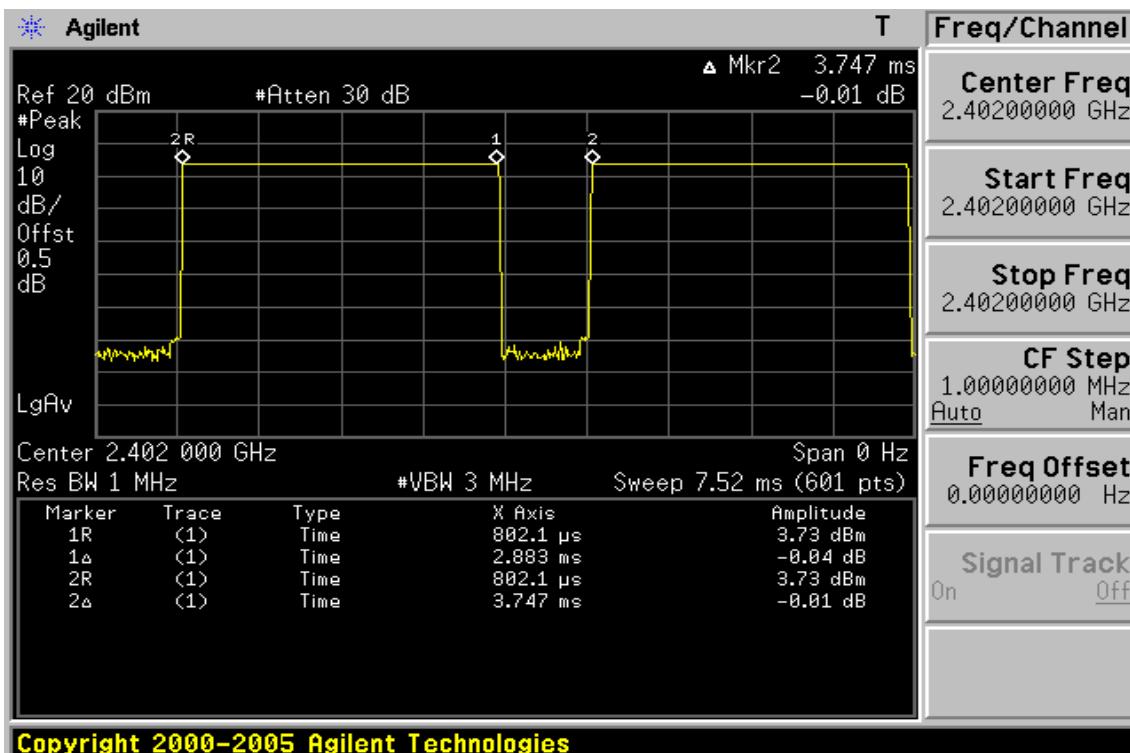
**CH-Low**  
**DH1**

**DH3**


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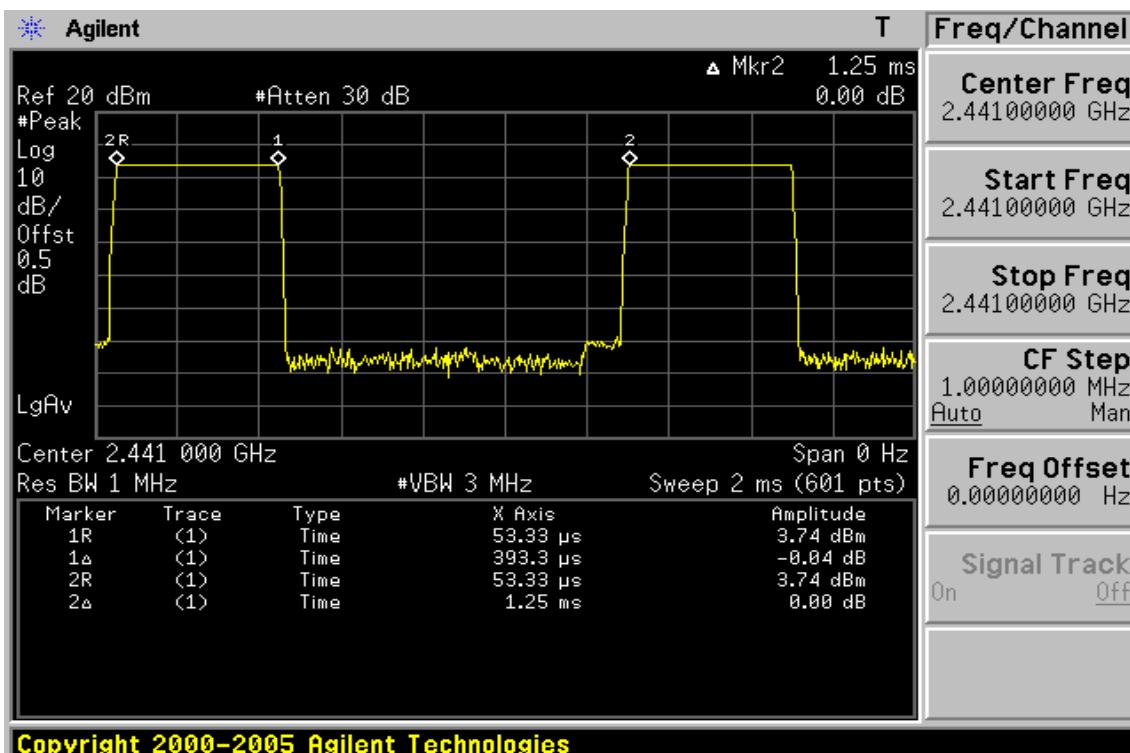
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## DH5



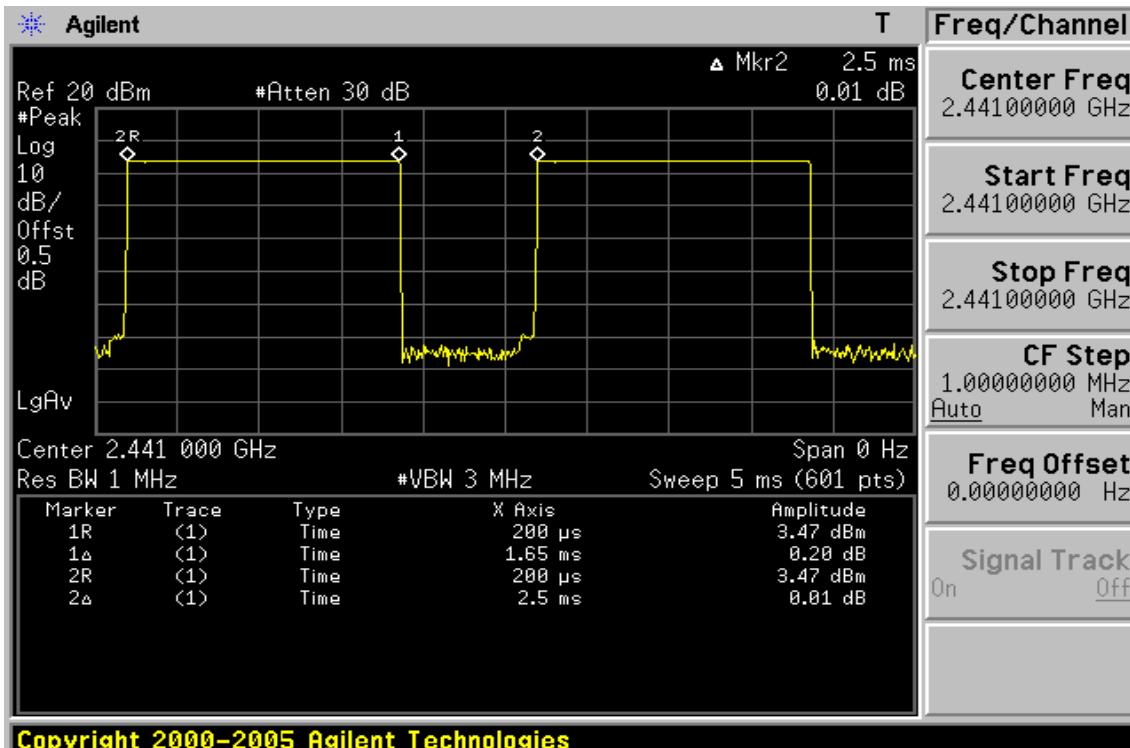
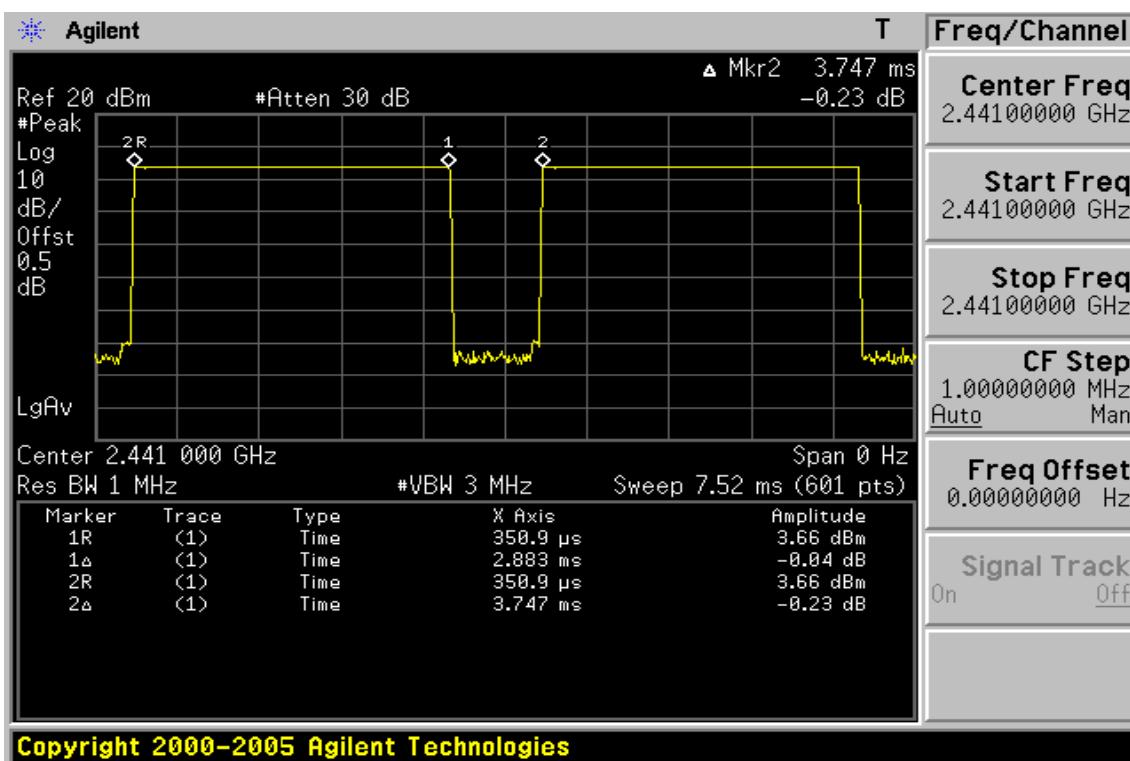
## CH-Mid DH1



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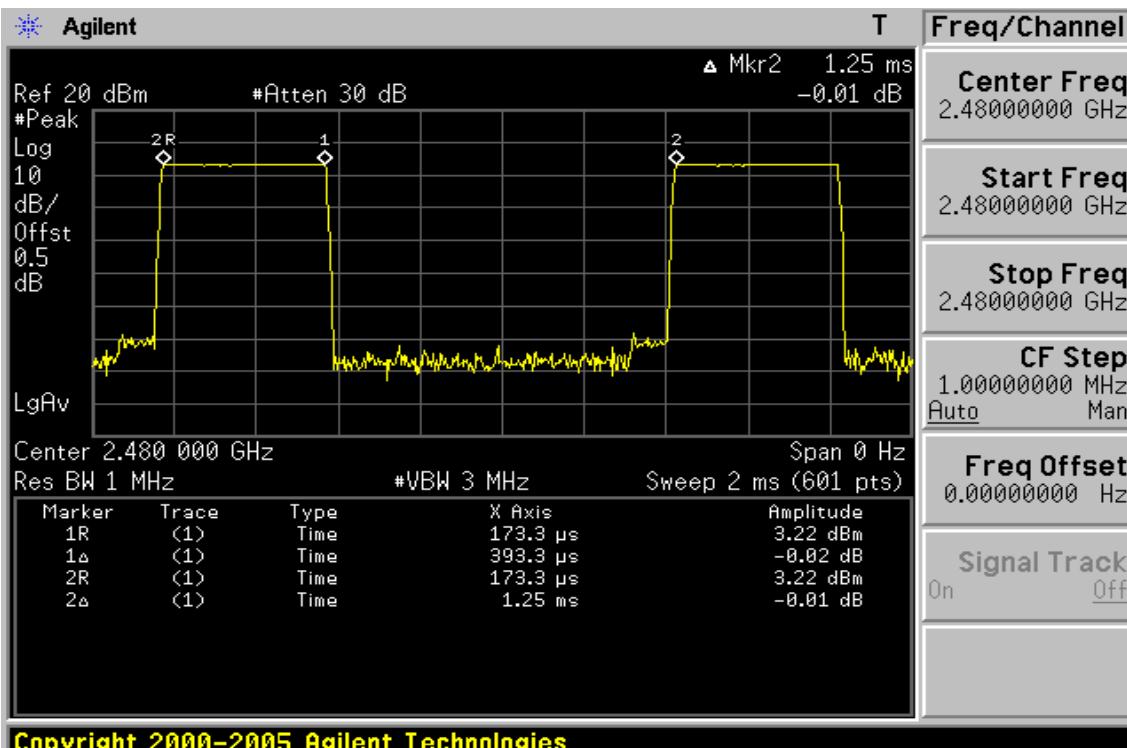
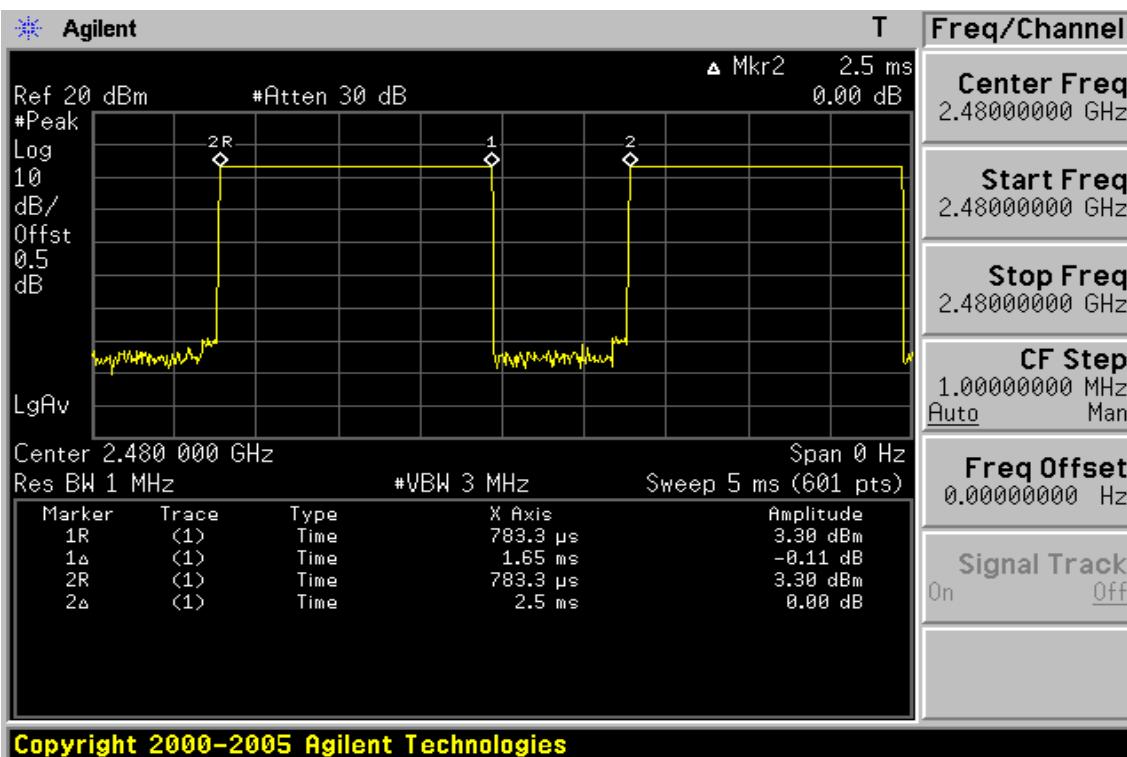
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**DH3**

**DH5**


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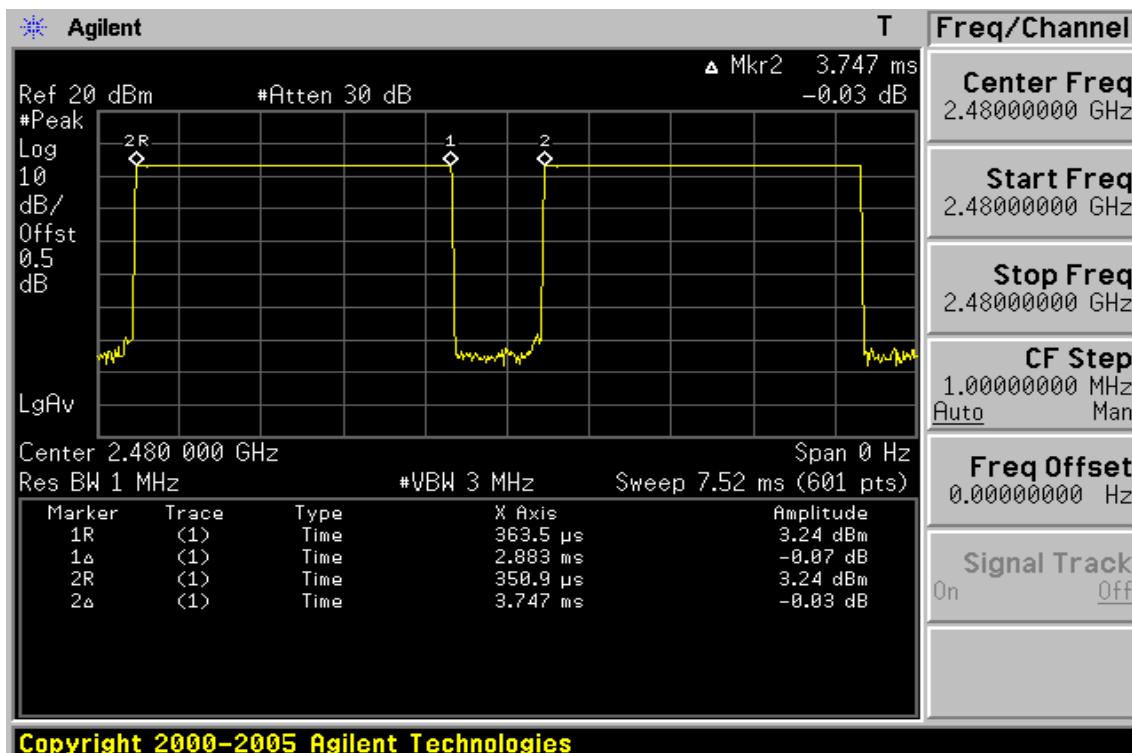
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**CH-High**  
**DH1**

**DH3**


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**DH5**


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## 13. 20dB Bandwidth & 99% Bandwidth

### 13.1. Standard Applicable:

For 20dB Bandwidth

According to §15.247(a)(1) and RSS210 A8.1(b), for frequency hopping systems operating in the 2400MHz-2483.5 MHz, there is no limit for 20dB bandwidth.

For 99% Bandwidth

RSS-Gen §4.6.1, the transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth..

### 13.2. Measurement Equipment Used:

Refer to section 7.2 for details.

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### 13.3. Test Set-up:

Refer to section 7.3 for details.

### 13.4. 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 for 20dB Bandwidth test.
4. Mark the peak frequency and -20dB (upper and lower) frequency and Turn on the 99% bandwidth function, max reading.
5. Repeat above procedures until all frequency measured were complete.

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### 13.5. Measurement Result:

#### 20dB Bandwidth : BDR mode (GFSK)

| CH     | Bandwidth<br>(kHz) |
|--------|--------------------|
| Lower  | 932.296            |
| Mid    | 930.873            |
| Higher | 932.382            |

#### 20dB Bandwidth : EDR mode ( $\pi/4$ DQPSK)

| CH     | Bandwidth<br>(MHz) | 2/3 Bandwidth<br>(MHz) |
|--------|--------------------|------------------------|
| Lower  | 1.219              | 0.813                  |
| Mid    | 1.216              | 0.811                  |
| Higher | 1.216              | 0.811                  |

#### 20dB Bandwidth : EDR mode (8DPSK)

| CH     | Bandwidth<br>(MHz) | 2/3 Bandwidth<br>(MHz) |
|--------|--------------------|------------------------|
| Lower  | 1.235              | 0.823                  |
| Mid    | 1.233              | 0.822                  |
| Higher | 1.237              | 0.825                  |

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**99% Bandwidth : BDR mode (GFSK):**

| CH     | Bandwidth (kHz) |
|--------|-----------------|
| Lower  | 871.7358        |
| Mid    | 867.8109        |
| Higher | 867.2966        |

**99% Bandwidth : EDR mode ( $\pi/4$ DQPSK)**

| CH     | Bandwidth (MHz) |
|--------|-----------------|
| Lower  | 1.1702          |
| Mid    | 1.1682          |
| Higher | 1.1665          |

**99% Bandwidth : EDR mode (8DPSK)**

| CH     | Bandwidth (MHz) |
|--------|-----------------|
| Lower  | 1.1830          |
| Mid    | 1.1755          |
| Higher | 1.1740          |

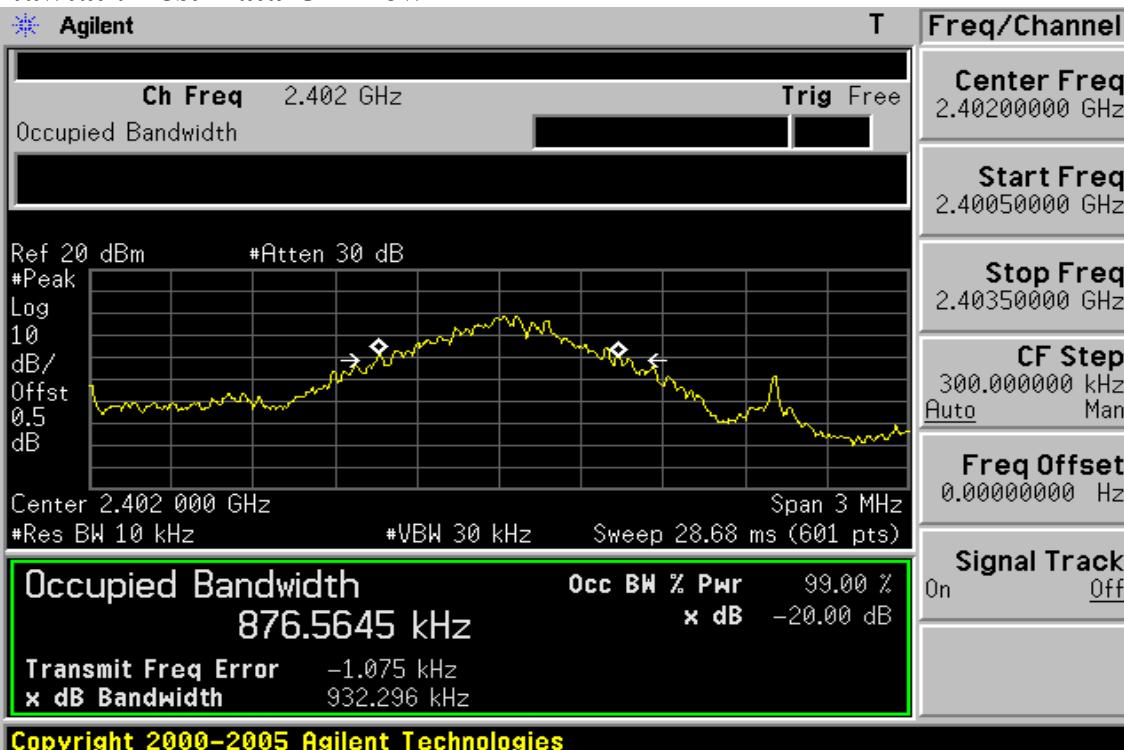
Note: Refer to next page for plots.

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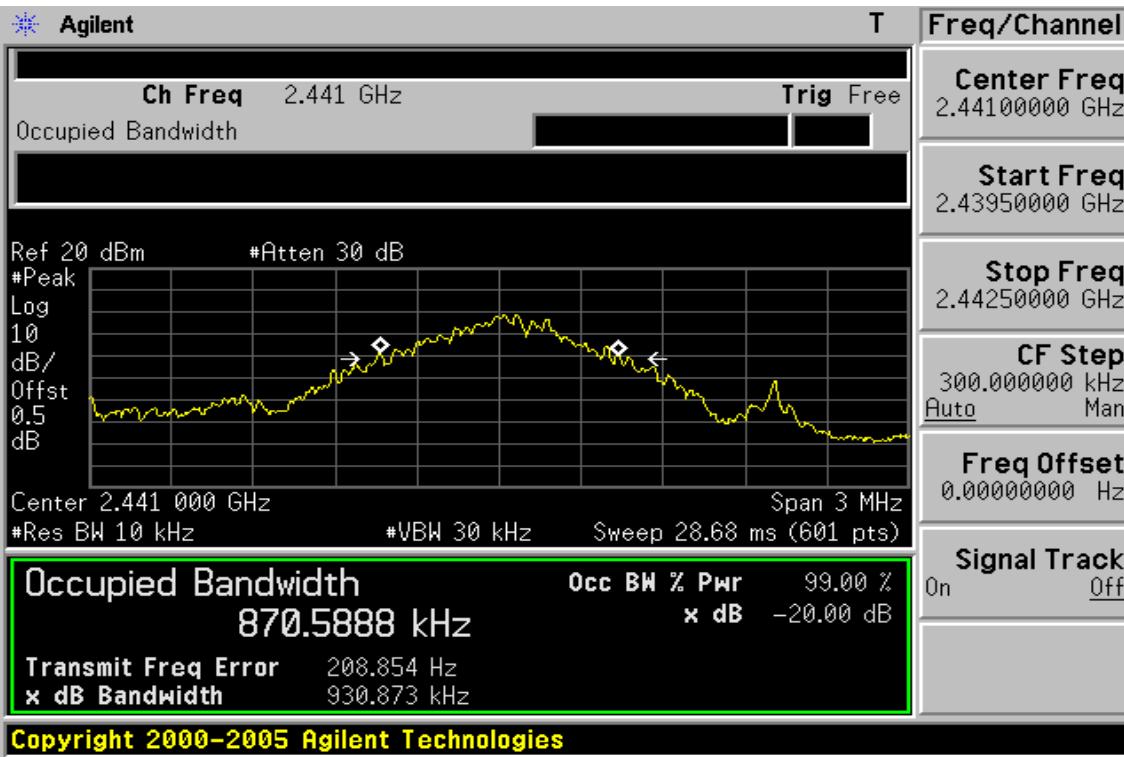
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**BDR Mode (GFSK)**

**20dB Bandwidth Test Data CH-Low**



**20dB Bandwidth Test Data CH-Mid**

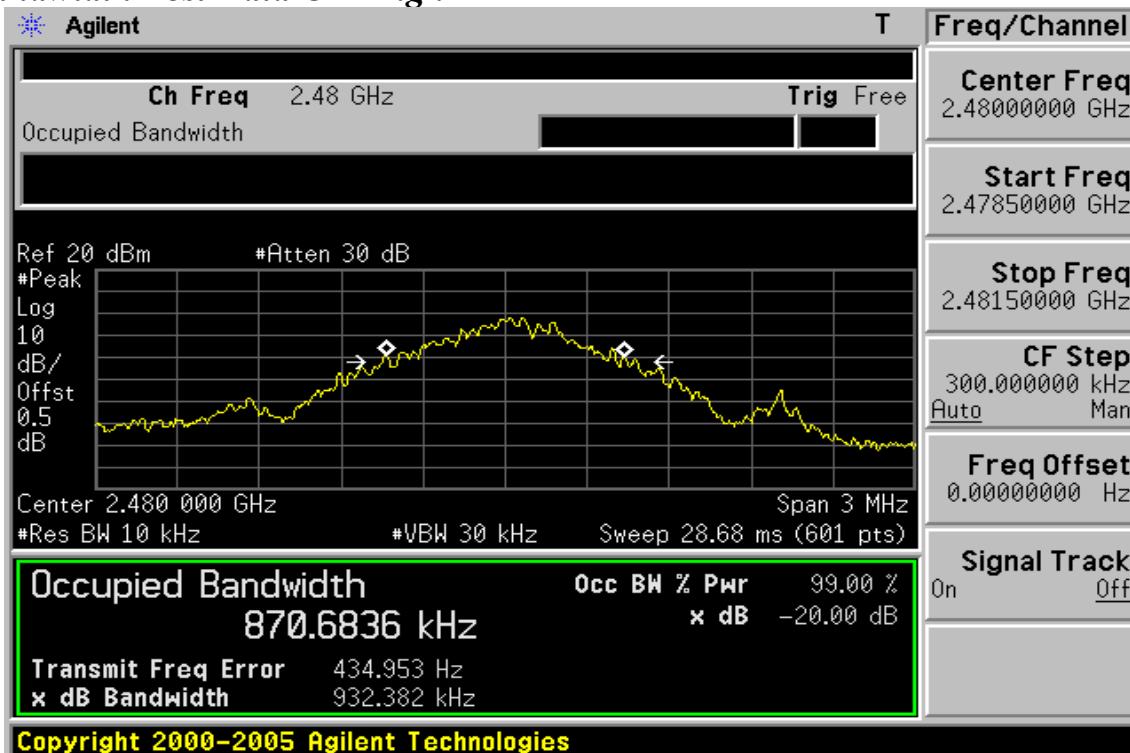


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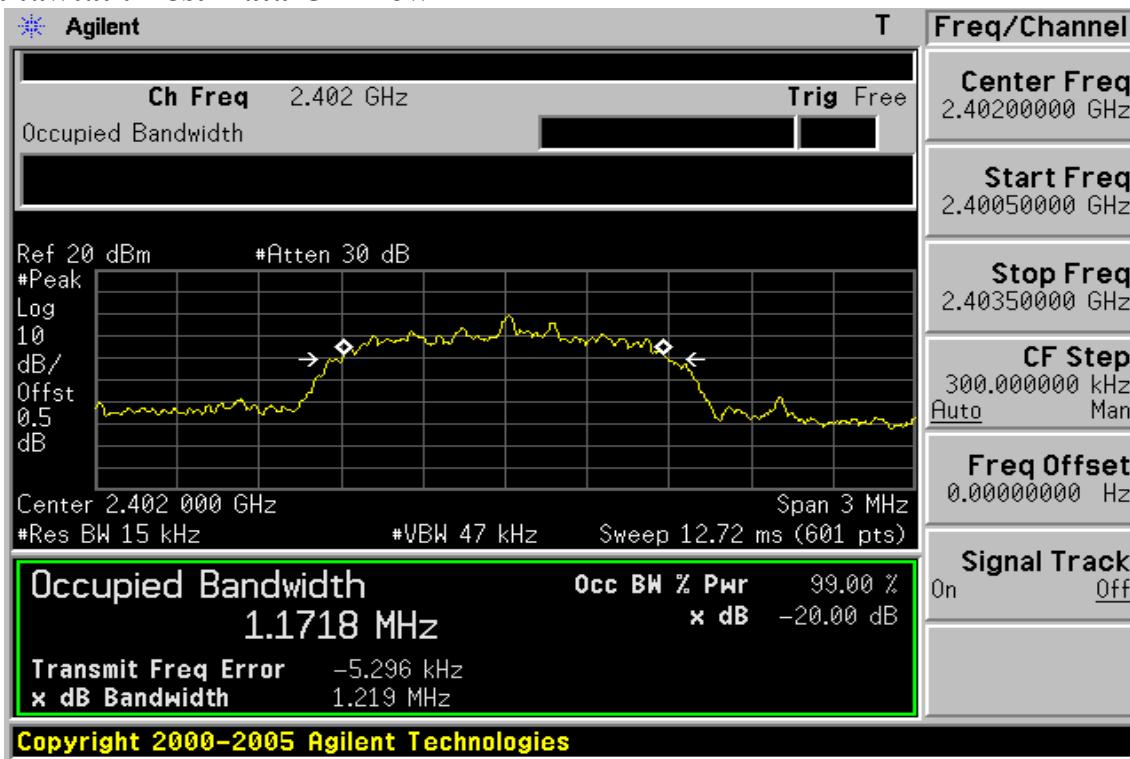
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### 20dB Bandwidth Test Data CH-High



### EDR Mode ( $\pi/4$ DQPSK)

### 20dB Bandwidth Test Data CH-Low

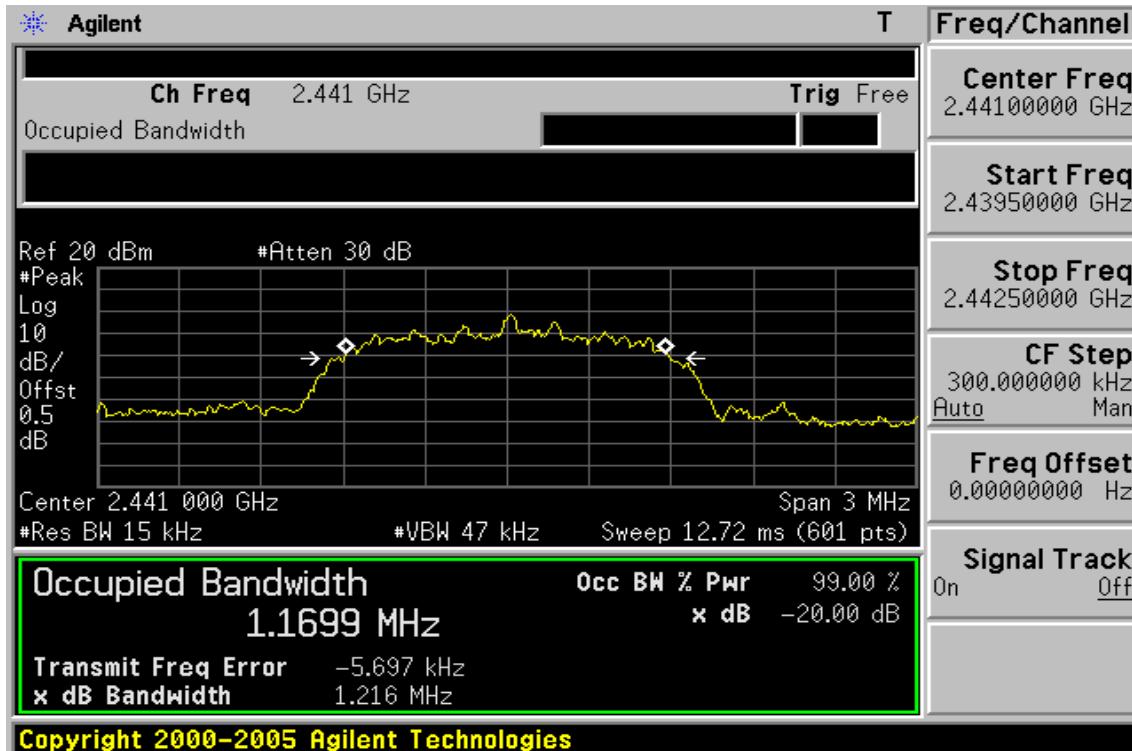


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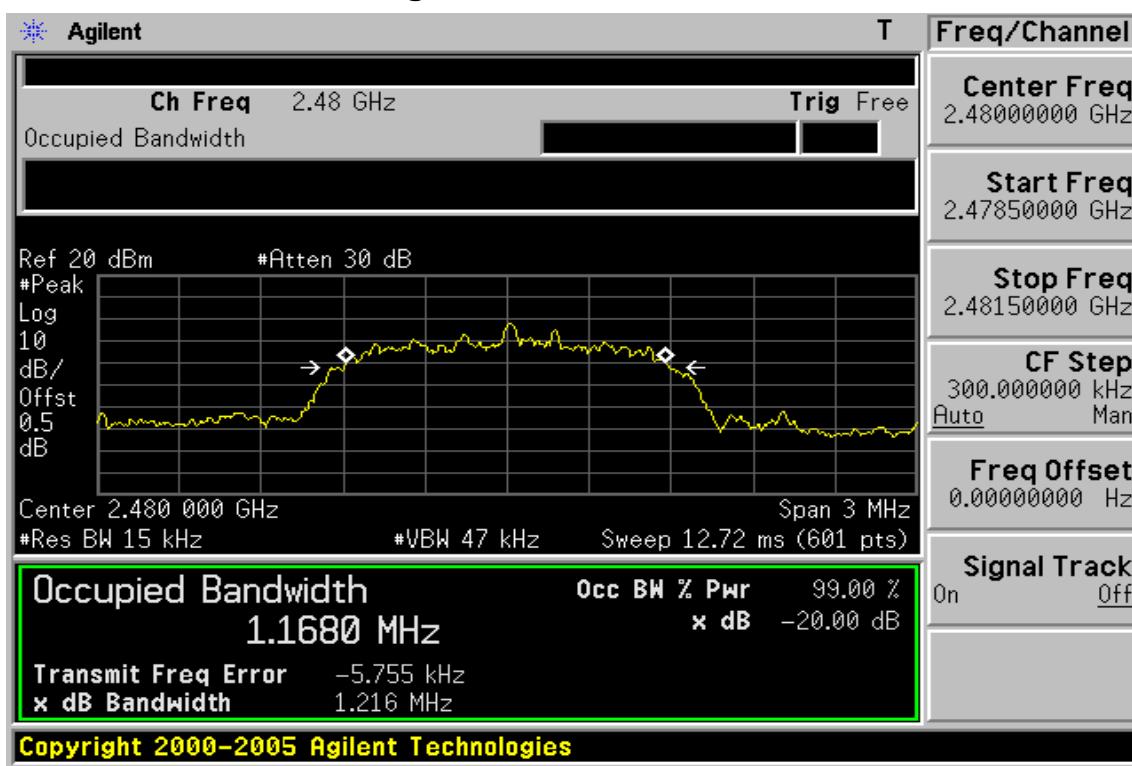
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### 20dB Bandwidth Test Data CH-Mid



### 20dB Bandwidth Test Data CH-High



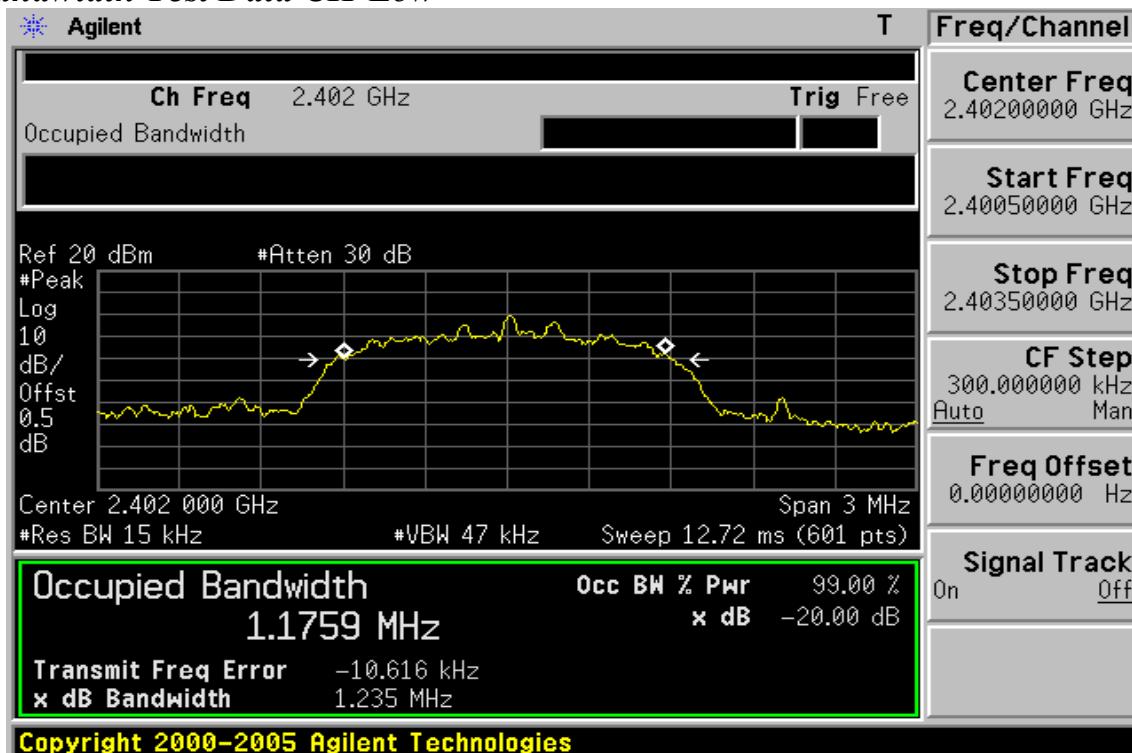
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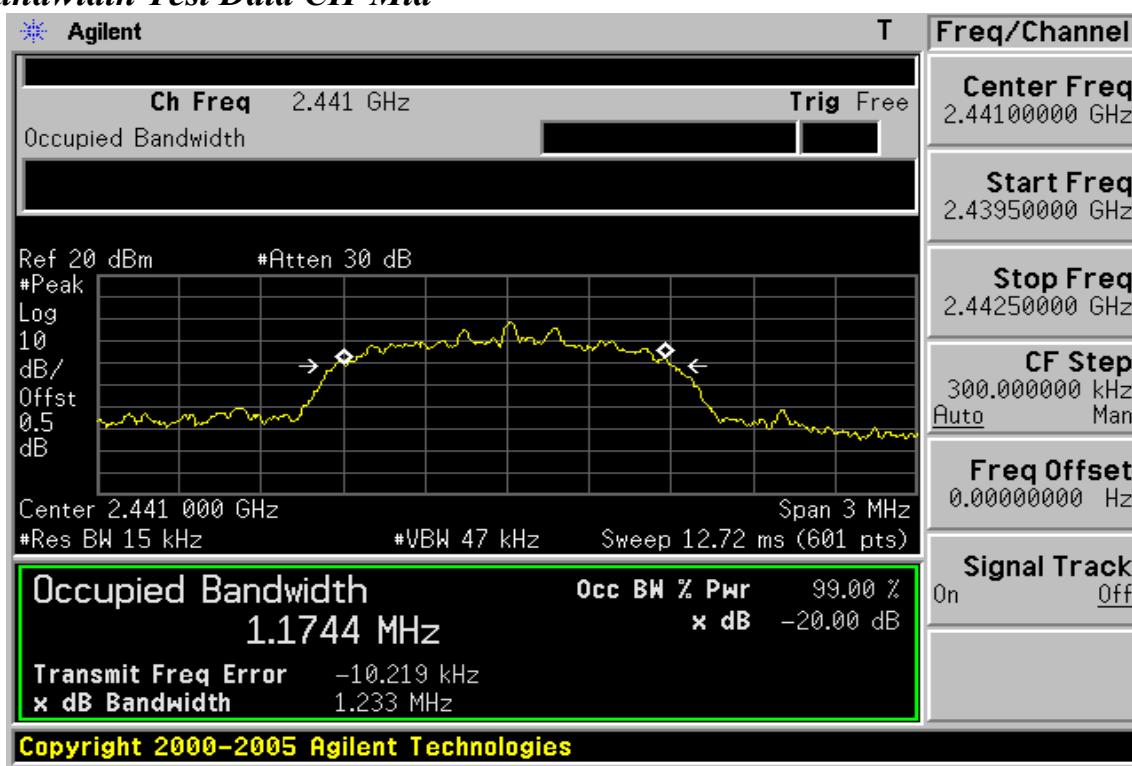
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### EDR Mode (8DPSK)

#### 20dB Bandwidth Test Data CH-Low



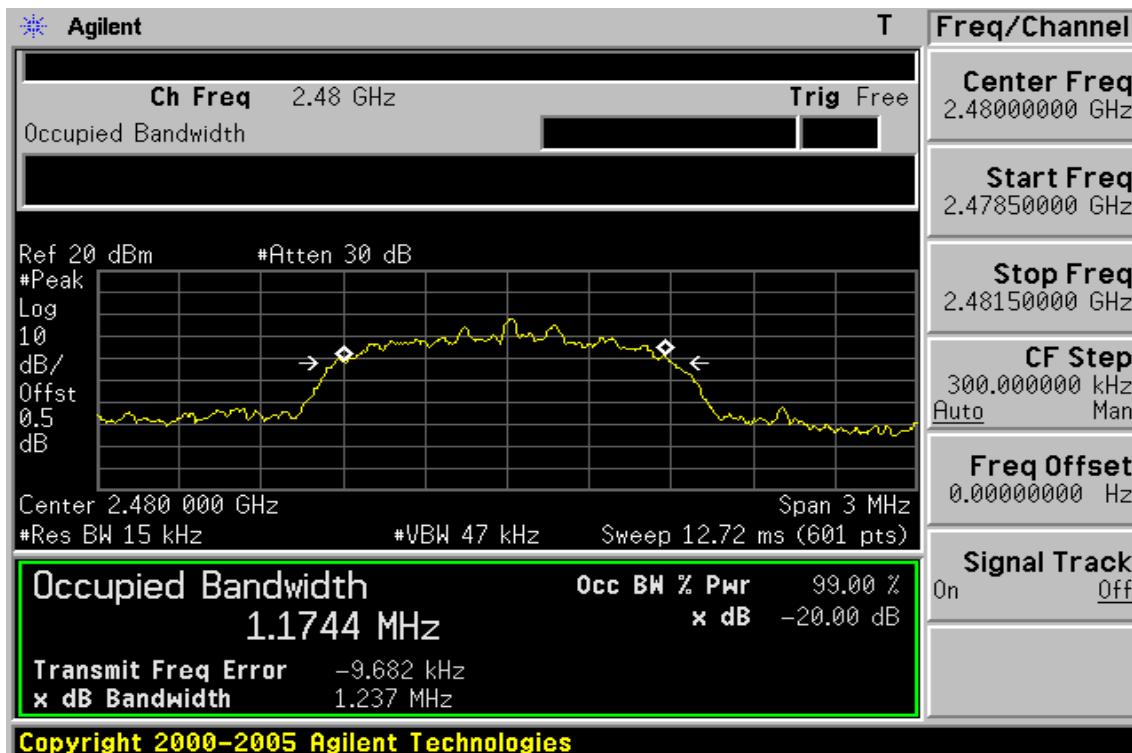
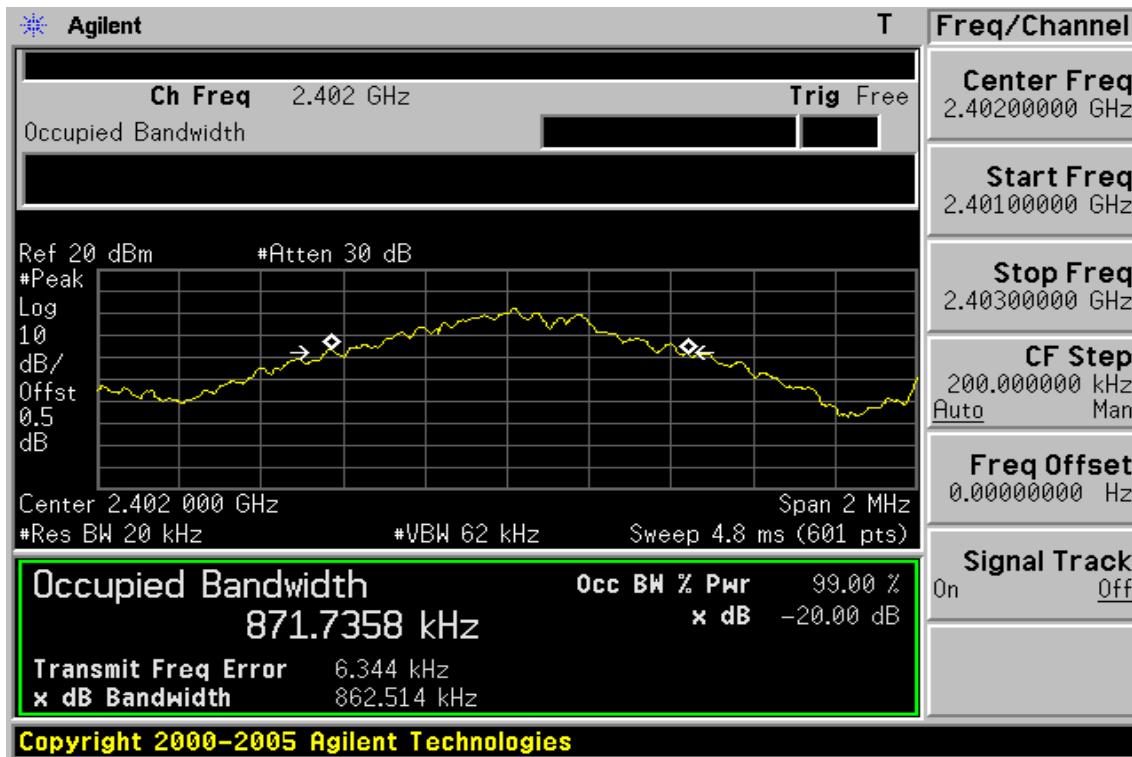
#### 20dB Bandwidth Test Data CH-Mid



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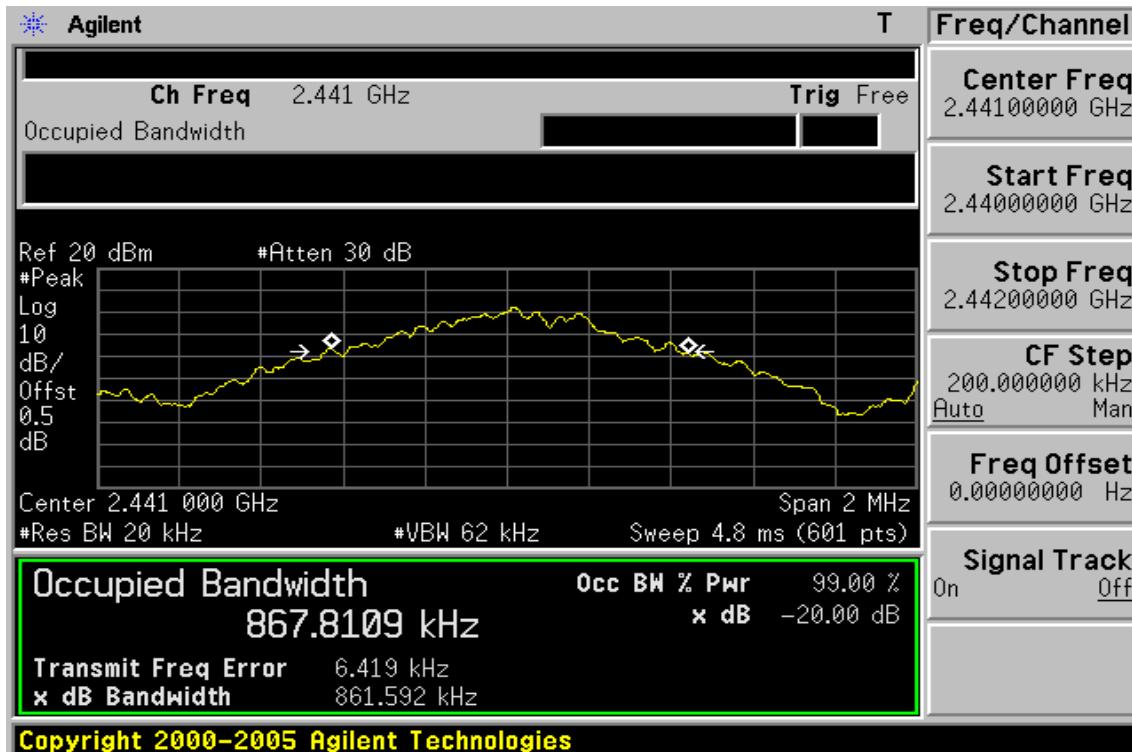
**20dB Bandwidth Test Data CH-High**

**BDR Mode (GFSK)**
**99% Band Width Test Data CH-Low**


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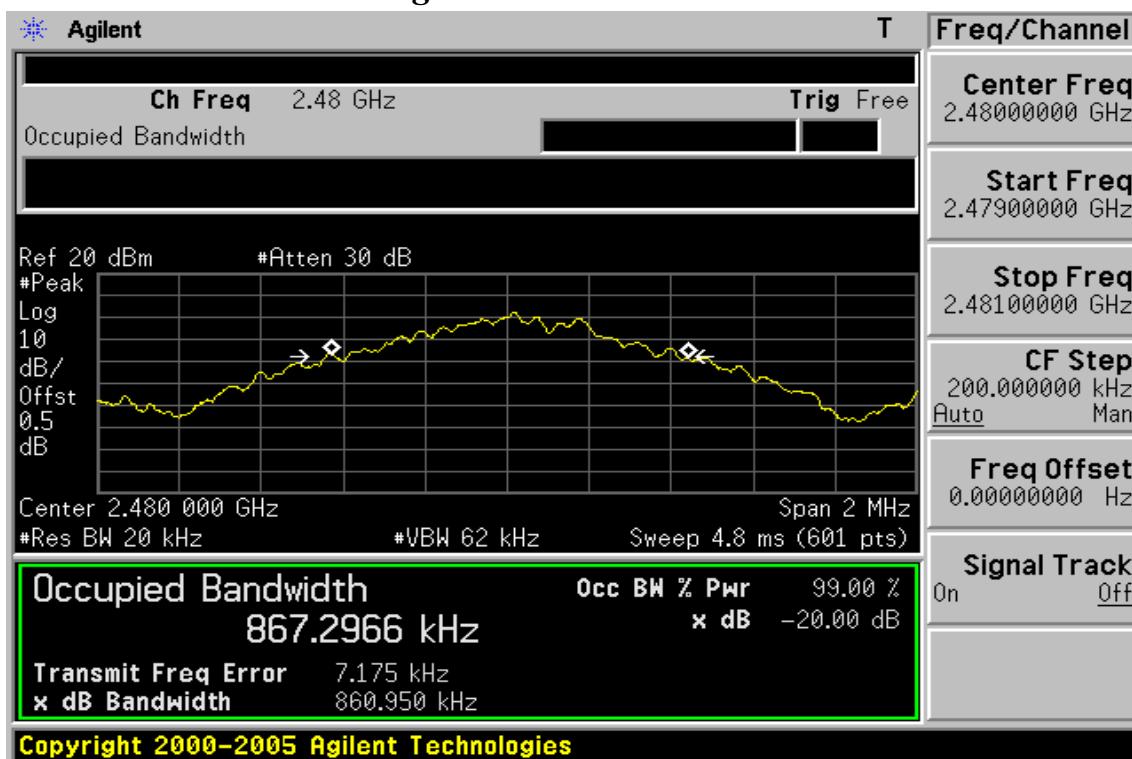
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### 99% Band Width Test Data CH-Mid



### 99% Band Width Test Data CH-High

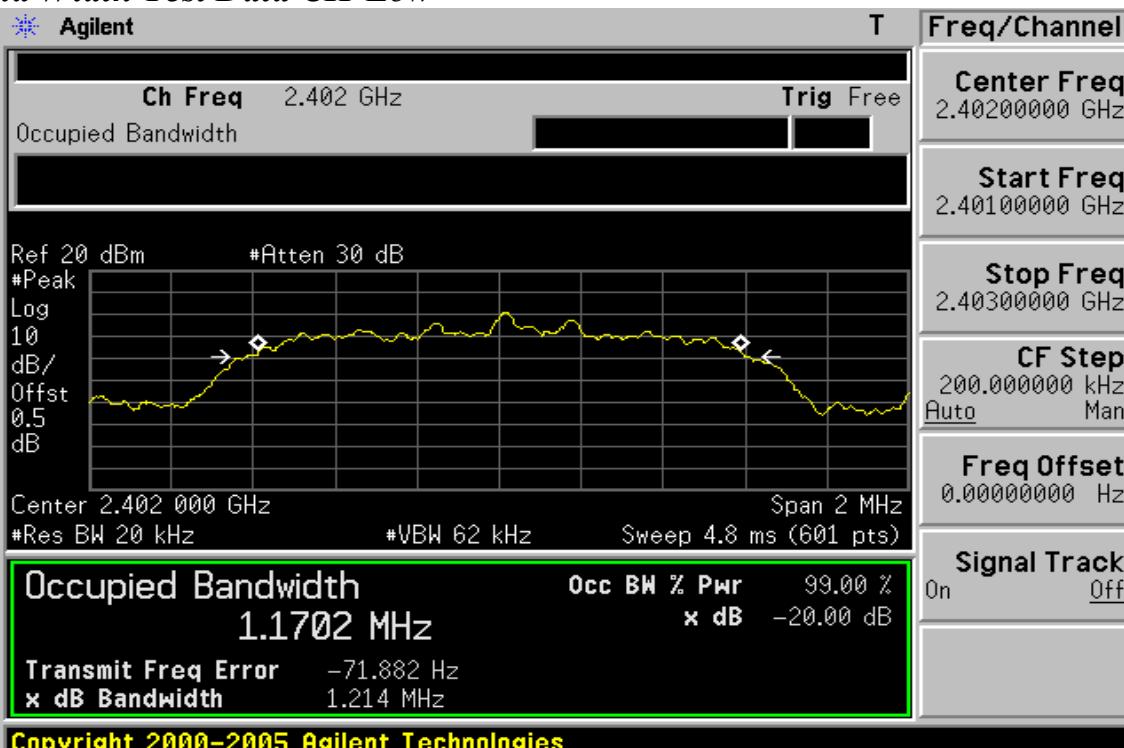


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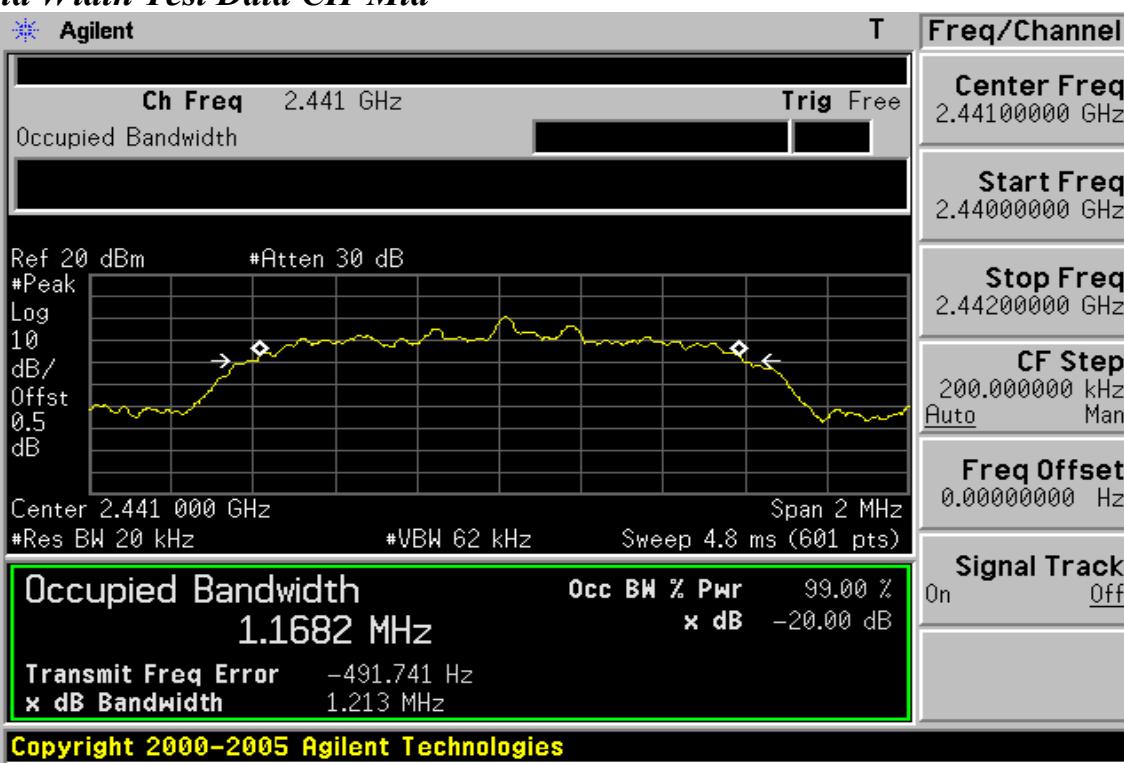
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**EDR Mode ( $\pi/4$ DQPSK)**  
**99% Band Width Test Data CH-Low**



**99% Band Width Test Data CH-Mid**

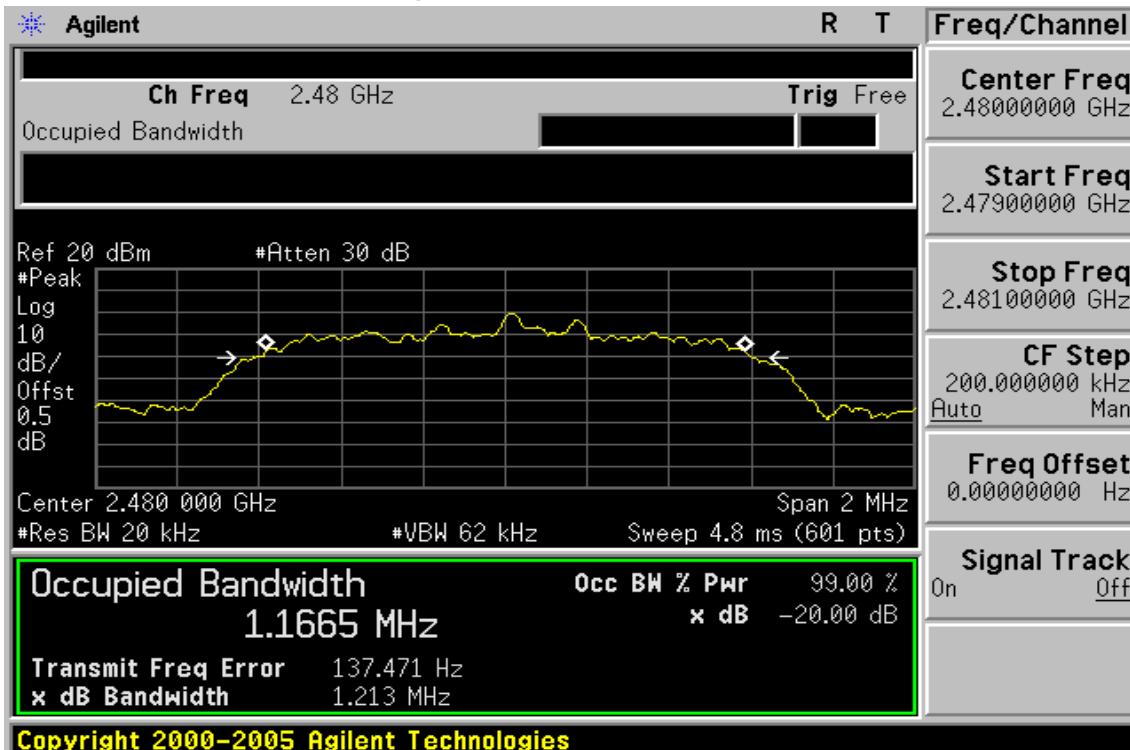


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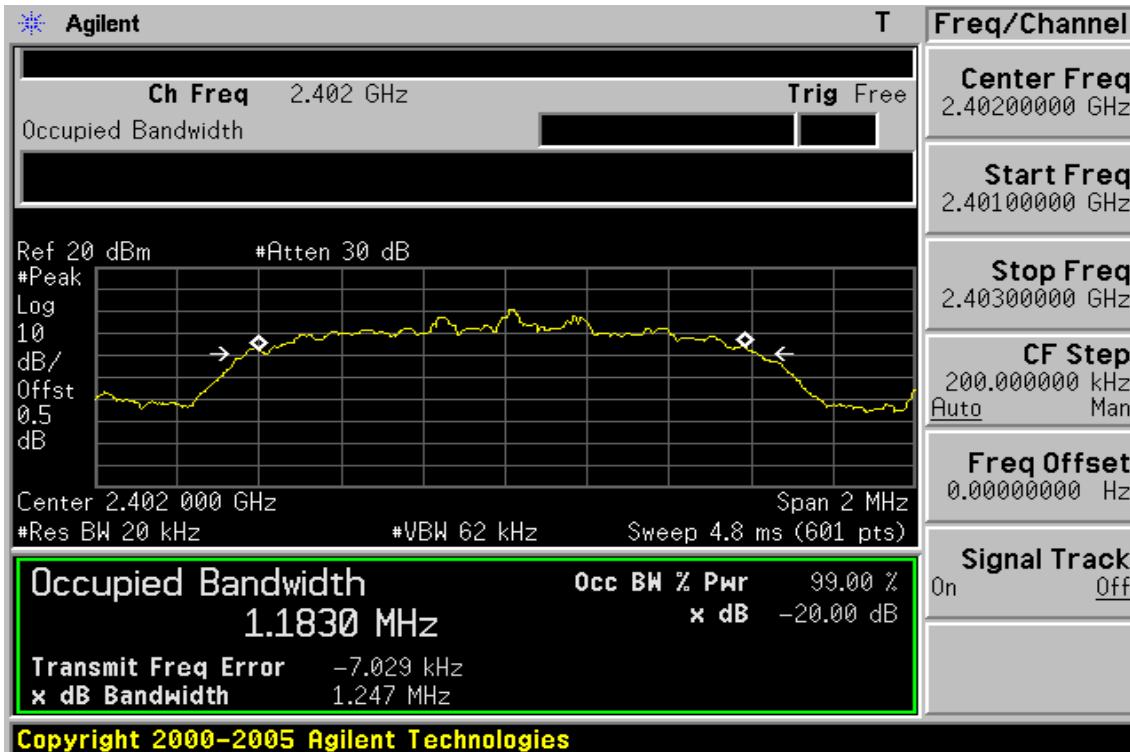
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### 99% Band Width Test Data CH-High



### EDR Mode (8DPSK)

### 99% Band Width Test Data CH-Low

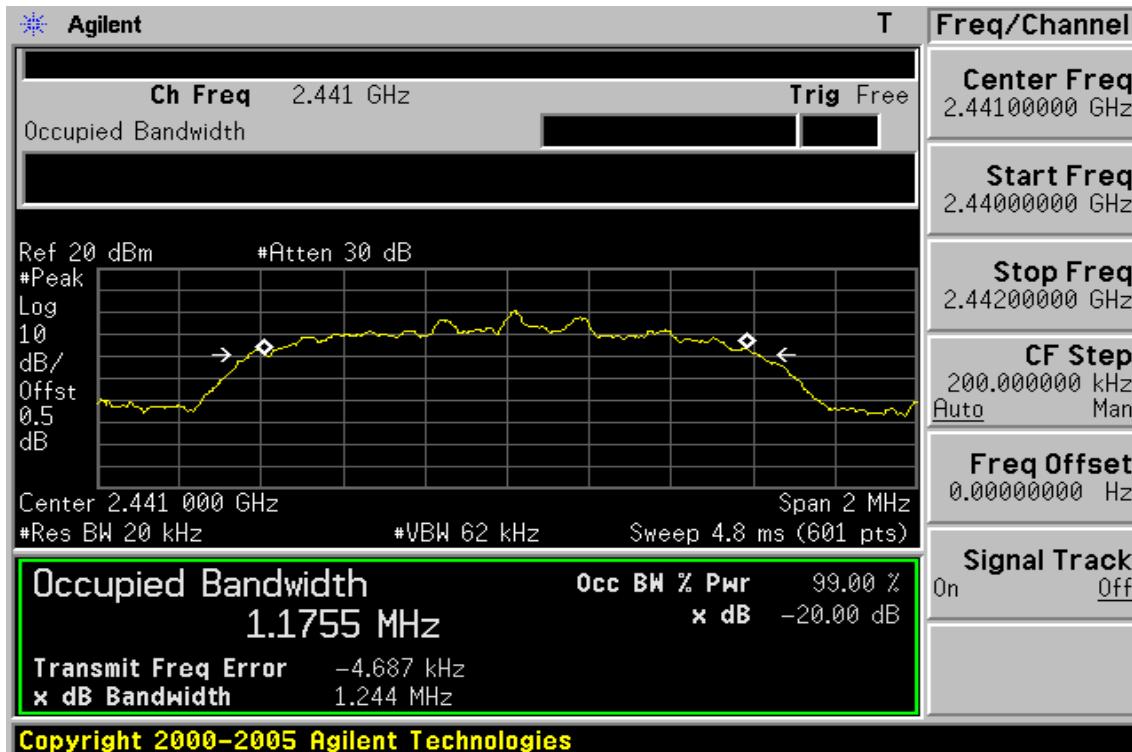


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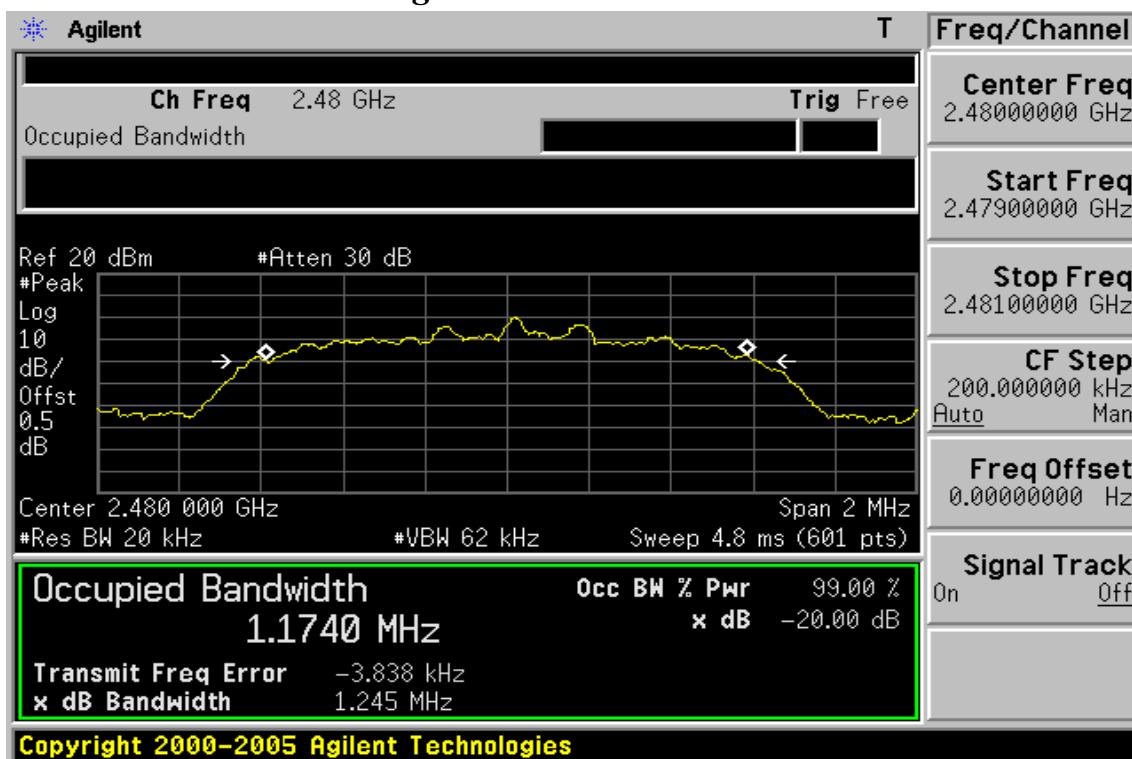
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### 99% Band Width Test Data CH-Mid



### 99% Band Width Test Data CH-High



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## 14. ANTENNA REQUIREMENT

### 14.1. Standard Applicable:

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 §15.246(1), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-GEN 7.1.2, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

### 14.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is -1.20dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

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## 15. Maximum Permissible Exposure (MPE)

### 15.1. Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

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

F = frequency in MHz

\* = Plane-wave equipment power density

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## 15.2. Maximum Permissible Exposure (MPE) Evaluation:

### BDR mode (GFSK):

| Frequency (MHz) | Reading Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|--------------------|------------------|-----------|
| 2402.00         | 3.80                | 3.80               | 0.00240          | 1         |
| 2441.00         | 3.76                | 3.76               | 0.00238          | 1         |
| 2480.00         | 3.46                | 3.46               | 0.00222          | 1         |

### EDR mode ( $\pi/4$ DQPSK):

| Frequency (MHz) | Reading Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|--------------------|------------------|-----------|
| 2402.00         | 2.38                | 2.38               | 0.00173          | 0.125     |
| 2441.00         | 1.92                | 1.92               | 0.00156          | 0.125     |
| 2480.00         | 1.21                | 1.21               | 0.00132          | 0.125     |

### EDR mode (8DPSK):

| Frequency (MHz) | Reading Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|-----------------|---------------------|--------------------|------------------|-----------|
| 2402.00         | 2.74                | 2.74               | 0.00188          | 0.125     |
| 2441.00         | 2.26                | 2.26               | 0.00168          | 0.125     |
| 2480.00         | 1.64                | 1.64               | 0.00146          | 0.125     |

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### 15.3. MPE Prediction (BDR Mode)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

|  |             |                       |
|--|-------------|-----------------------|
| Maximum peak output power at antenna input terminal: | 3.8         | (dBm)                 |
| Maximum peak output power at antenna input terminal: | 2.398832919 | (mW)                  |
| Duty cycle:  | 77          | (%)                   |
| Maximum Pav :  | 1.847101348 | (mW)                  |
| Antenna gain (typical):                              | -1.2        | (dBi)                 |
| Maximum antenna gain:                                | 0.758577575 | (numeric)             |
| Prediction distance:                                 | 20          | (cm)                  |
| Prediction frequency:                                | 2402        | (MHz)                 |
|  |             |                       |
| MPE limit for uncontrolled exposure at prediction:   | 1           | (mW/cm <sup>2</sup> ) |
| Power density at predication frequency at 20 (cm)    | 0.0002789   | (mW/cm <sup>2</sup> ) |

### Measurement Result

The predicted power density level at 20 cm is 0.00028 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1 mW/cm<sup>2</sup> at 2402MHz.

*Note: In comparison with BDR, and EDR, BDR results highest emission of power, and further produces higher value of Maximum Permissible Exposure at 20cm. Hence, only the derivation of MPR on the basis of BDR mode is present in this given test report.*

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