0513
ILAC MRA

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

*OF*

| | |
|---|---|
| **Product Name:** | **Bluetooth Headset** |
| **Brand Name:** | **G-Tek** |
| **Model Name:** | **BTH-1XX, BTHS-706X** |
| **Model Differences:** | **Variant in exterior looks** |
| **FCC ID:** | **Q3M-BTH** |
| **Report No.:** | **EF/2005/10005** |
| **Issue Date:** | **Jan. 20, 2005** |
| **FCC Rule Part:** | **§15.247** |
| **Prepared for:** | **G-TEK Electronics Corporation**<br>**16F, 106 Sec 1, Hsin Tai 5th Road, Hsichih Taipei Taiwan** |
| **Prepared by:** | **SGS Taiwan Ltd.**<br>**No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei County, Taiwan.** |

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# VERIFICATION OF COMPLIANCE

| | |
|---|---|
| **Applicant:** | G-TEK Electronics Corporation |
| | 16F, 106 Sec 1, Hsin Tai 5th Road, Hsichih Taipei Taiwan |
| **Equipment Under Test:** | Bluetooth Headset |
| **Brand Name:** | G-Tek |
| **FCC ID Number:** | Q3M-BTH |
| **Model No.:** | BTH-1XX, BTHX-706X |
| **Model Difference:** | Variant in exterior looks |
| **File Number:** | EF/2005/10005 |
| **Date of test:** | Jan. 3, 2005 ~ Jan. 10, 2005 |
| **Date of EUT Received:** | Jan. 11, 2005 |

## We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247

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

| | | | |
|---|---|---|---|
| ***Test By:*** | Sky Wang | ***Date*** | Jan. 20, 2005 |
| | ***Sky Wang*** | | |
| ***Approved By*** | Vincent Su | ***Date*** | Jan. 20, 2005 |
| | ***Vincent Su*** | | |

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# 1. GENERAL INFORMATION

## 1.1. Product Description

The G-TEK Electronics Corporation., Model: BTH-1XX, BTHS-706X is a Bluetooth Head-set.

The EUT is compliance with Bluetooth Standard.

A major technical descriptions of EUT is described as following:

A). Operation Frequency: 2402 – 2480Hz, 79 channels

B). Rated output power: 2 dBm

C). Modulation type: Frequency Hopping Spread Spectrum (FHSS)

D). Antenna Designation: Chip Antenna, 2 dBi, Non-User Replaceable (Fixed)

E). Battery Charge: 5V DC by AC/DC Power Adapter

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

This submittal(s) (test report) is intended for **FCC ID: Q3M-BTH** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (receiver) is compliance with Subpart B is authorized under a Doc procedure.

## 1.3. Test Methodology

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

## 1.4. Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the address of SGS Taiwan Ltd. No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan. The Open Area Test Sites and the Line Conducted labs are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003 and CISPR 22/EN 55022 requirements. Site No. 1(3 &10 meters) Registration Number: 94644, Anechoic chamber (3 meters) Registration Number: 573967

## 1.5. Special Accessories

Not available for this EUT intended for grant.

## 1.6. Equipment Modifications

Not available for this EUT intended for grant.

# 2. SYSTEM TEST CONFIGURATION

## 2.1. EUT Configuration

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

## 2.2. EUT Exercise

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

## 2.3. Test Procedure

### 2.3.1 Conducted Emissions

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

### 2.3.2 Radiated Emissions

The EUT is 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 according to the requirements in Section 8 and 13 of ANSI C63.4-2003.

## 2.4. Configuration of Tested System

**Fig. 2-1 Configuration of Tested System (Fixed channel)**

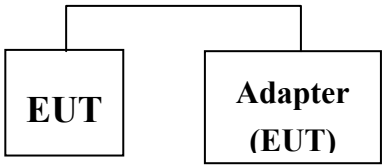



**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/ Type No. | FCC ID | Series No. | Data Cable | Power Cord |
|---|---|---|---|---|---|---|---|
| 1. | N/A | | | | | | |

## 3. SUMMARY OF TEST RESULTS

| FCC Rules | Description Of Test | Result |
|---|---|---|
| §15.207(a) | Conducted Emission | Compliant |
| §15.247(b)(1) | Peak Output Power | Compliant |
| §15.247(a) | 20dB Bandwidth | Compliant |
| §15.247(c) | 100 KHz Bandwidth Of Frequency Band Edges | Compliant |
| §15.209(a) (f) | Spurious Emission | Compliant |
| §15.247(a)(1) | Frequency Separation | Compliant |
| §15.247(a)(1)(iii) | Number of hopping frequency | Compliant |
| §15.247(a)(1)(iii) | Time of Occupancy | Compliant |
| §15.247 | Peak Power Density | Compliant |
| §15.203, §15.247(b)(4)(i) | Antenna Requirement | Compliant |
| §1.1310 | RF Exposure | 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 741k highest data rate are chosen for full testing.

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.

# 5. CONDUCTED EMISSION TEST

## 5.1. Standard Applicable

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

| Frequency range MHz | Limits 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<br>1.The lower limit shall apply at the transition frequencies<br>2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

## 5.2. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2003.
2. The EUT was plug-in the AC/DC Power adapter. The host system was placed on the center of the back edge on the test table. The peripherals was placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host system was connected with 110Vac/60Hz power source.

## 5.3. Measurement Procedure

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

## 5.4. Measurement Equipment Used:

| Conducted Emission Test Site | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT TYPE** | **MFR** | **MODEL NUMBER** | **SERIAL NUMBER** | **LAST CAL.** | **CAL DUE.** |
| EMC Analyzer | HP | 8594EM | 3624A00203 | 12/31/2004 | 12/30/2005 |
| EMI Test Receiver | R&S | ESCS30 | 828985/004 | 01/15/2004 | 01/14/2005 |
| LISN | Rolf-Heine | NNB-2/16Z | 99012 | 12/30/2004 | 12/29/2005 |
| LISN | Rolf-Heine | NNB-2/16Z | 99013 | 11/06/2004 | 11/05/2005 |

## 5.5. Measurement Result

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

# AC POWER LINE CONDUCTED EMISSION TEST DATA

| Operation Mode: | Normal Operating | | | Test Date: | Jan. 21, 2005 |
|---|---|---|---|---|---|
| Temperature: | 20 ℃ | Humidity: | 55 % | Test By: | Sky |

| FREQ MHz | Q.P. Raw dBuV | AVG Raw dBuV | Q.P. Limit dBuV | AVG Limit dBuV | Q.P. Margin dB | AVG Margin dB | NOTE |
|---|---|---|---|---|---|---|---|
| 0.166 | 30.54 | -- | 65.18 | 50.29 | -34.64 | -- | L1 |
| 0.365 | 45.22 | -- | 58.62 | 46.00 | -13.40 | -- | L1 |
| 0.384 | 40.99 | -- | 58.18 | 46.00 | -17.19 | -- | L1 |
| 0.525 | 29.27 | -- | 56.00 | 46.00 | -26.73 | -- | L1 |
| 2.904 | 20.35 | --- | 56.00 | 46.00 | -35.65 | --- | L1 |
| 6.263 | 22.22 | --- | 60.00 | 46.00 | -37.78 | --- | L1 |
| | | | | | | | |
| 0.166 | 32.20 | --- | 65.18 | 50.29 | -32.98 | --- | L2 |
| 0.349 | 34.88 | --- | 58.98 | 46.00 | -24.10 | --- | L2 |
| 0.381 | 35.56 | --- | 58.27 | 46.00 | -22.71 | --- | L2 |
| 0.500 | 23.81 | --- | 56.00 | 46.00 | -32.19 | --- | L2 |
| 1.060 | 17.41 | --- | 56.00 | 46.00 | -38.59 | --- | L2 |
| 6.412 | 19.42 | --- | 60.00 | 46.00 | -40.58 | --- | L2 |

Remark：

(1) Measuring frequencies from 0.15 MHz to 30MHz。

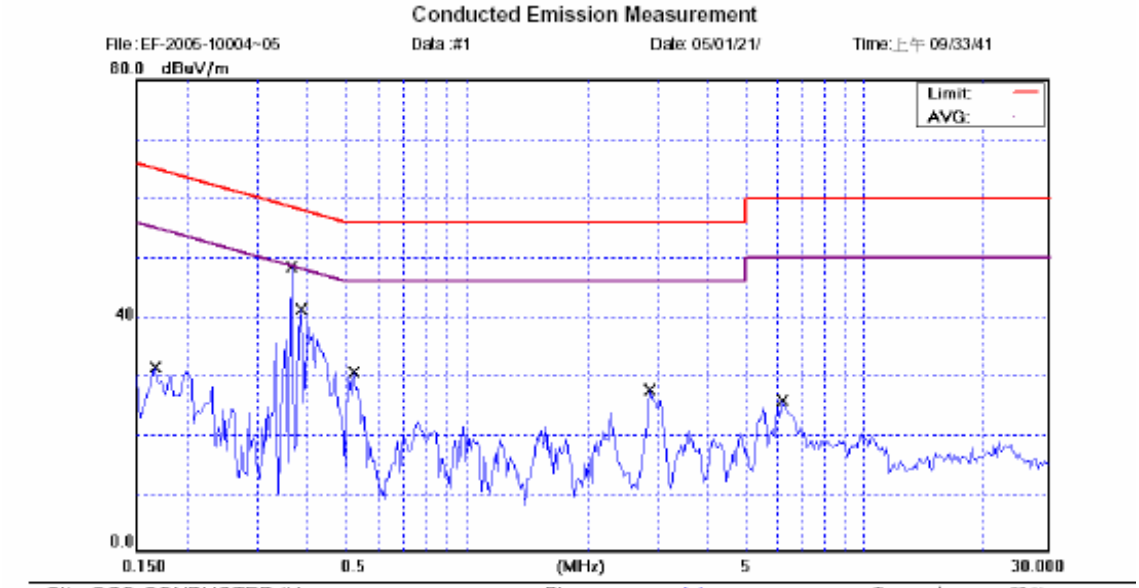
(2) The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Qusia-Peak detector and Average detector.

(3) "---" denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.

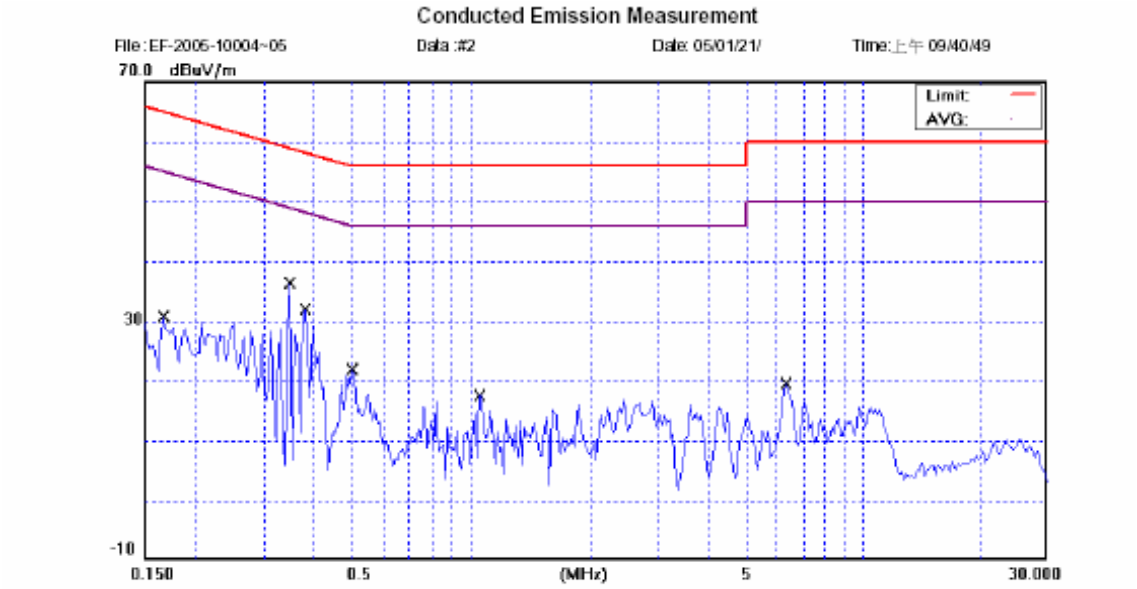
(4) The IF bandwidth of SPA between 0.15MHz to 30MHz was 10KHz;
The IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9KHz;

(5) L1 = Line One (Hot side) / L2 = Line Two (Neutral side)

# Conducted Emission Test Plot




Site SGS CONDUCTED #1 | Phase: L1 | Temperature: 20 ℃
Limit: EN55022 Class B Conduction(QP) | Power: AC 120V/60Hz | Humidity: 55 %
EUT: BLUETOOTH HEADSET | Distance: | Air Pressure: hpa
M/N: BTH-1XX
Note: CHARGE




Site SGS CONDUCTED #1 | Phase: N | Temperature: 20 ℃
Limit: EN55022 Class B Conduction(QP) | Power: AC 120V/60Hz | Humidity: 55 %
EUT: BLUETOOTH HEADSET | Distance: | Air Pressure: hpa
M/N: BTH-1XX
Note: CHARGE

# 6. PEAK OUTPUT POWER MEASUREMENT

## 6.1. Standard Applicable

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

## 6.2. Measurement 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. (Channel power function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

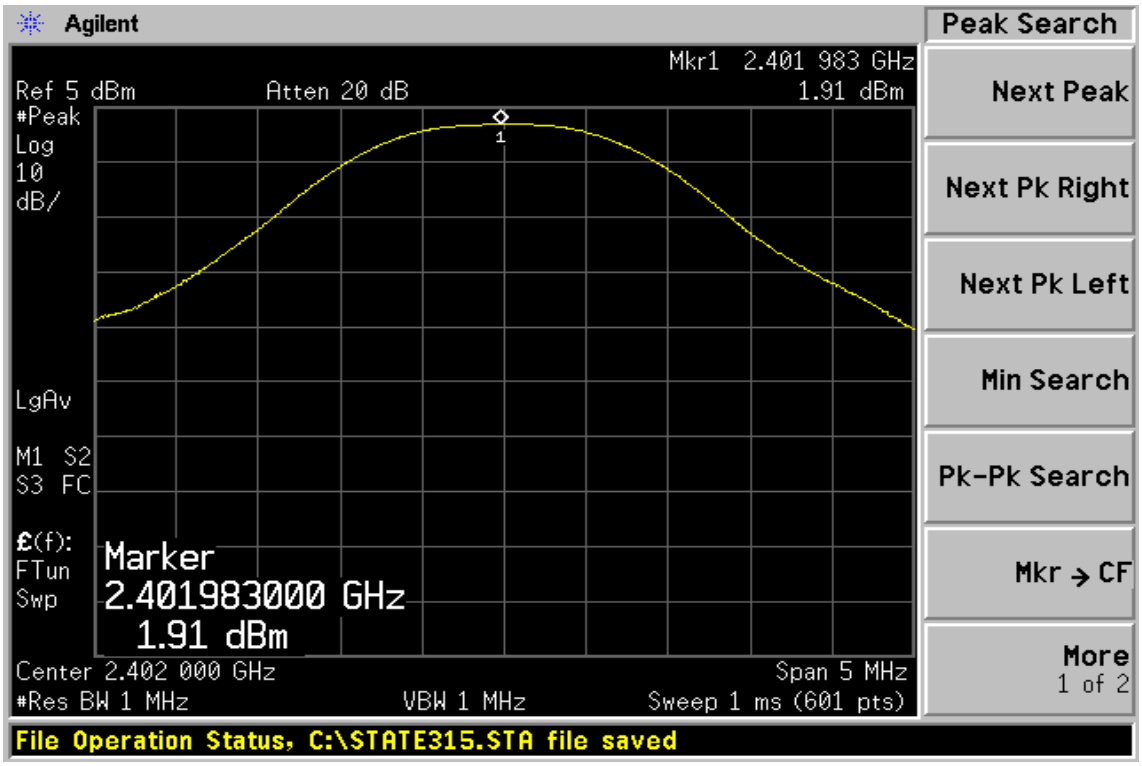
## 6.3. Measurement Result

| CH | Frequency (MHz) | Reading Power dBm | Cable Loss | Output Power dBm | Output Power W | Limit (W) |
|---|---|---|---|---|---|---|
| LOW | 2402.0 | 1.91 | 0.20 | 2.11 | 0.00163 | 1 |
| MID | 2441.0 | 1.13 | 0.20 | 1.33 | 0.00136 | 1 |
| HIGH | 2480.0 | 1.23 | 0.20 | 1.43 | 0.00139 | 1 |

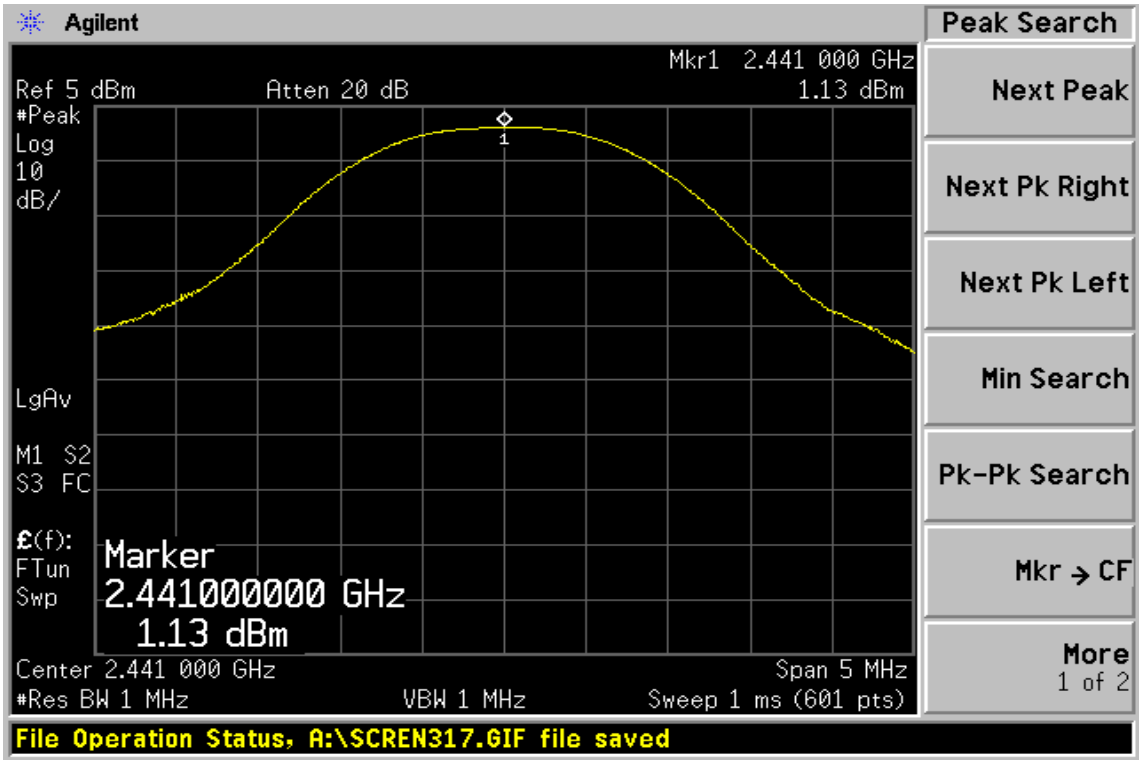
## 6.4. Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/27/2005 |
| Spectrum Analyzer | Agilent | E4446A | MY43360126 | 01/22/2005 | 01/21/2006 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

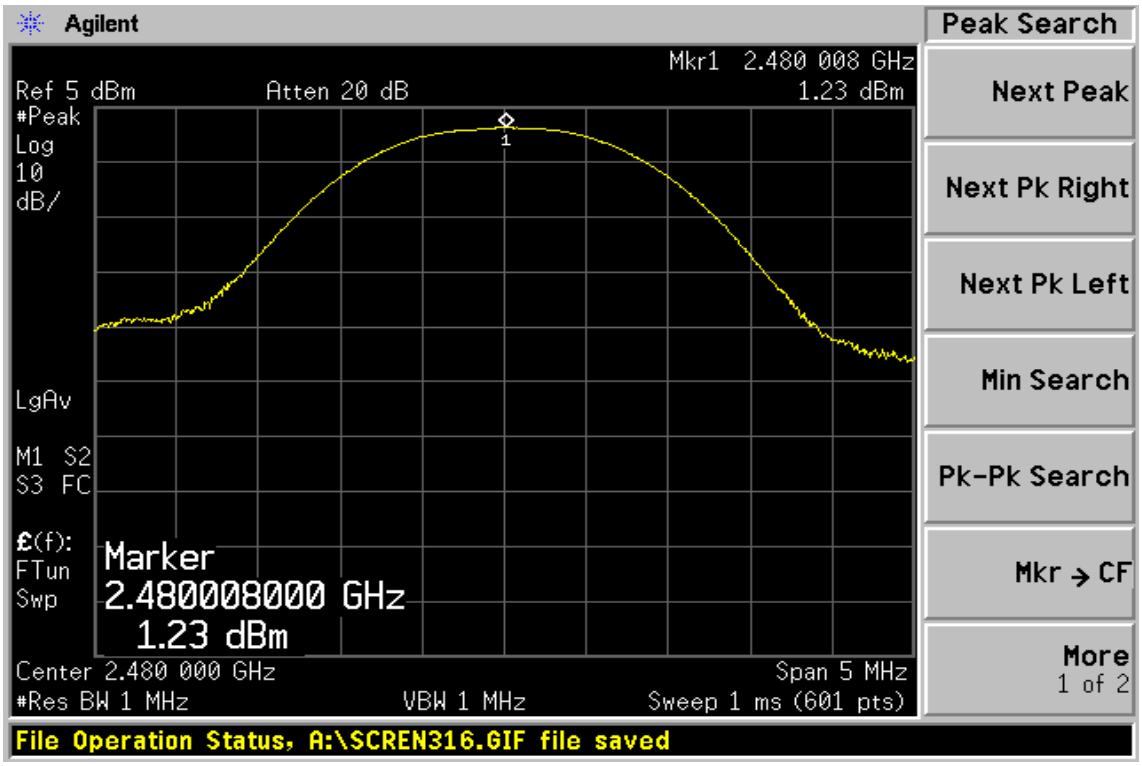
## Peak Power Output Data Plot (CH Low)




## Peak Power Output Data Plot (CH Mid)



## Peak Power Output Data Plot (CH High)



# 7. 20dB BAND WIDTH

## 7.1. Standard Applicable

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

## 7.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

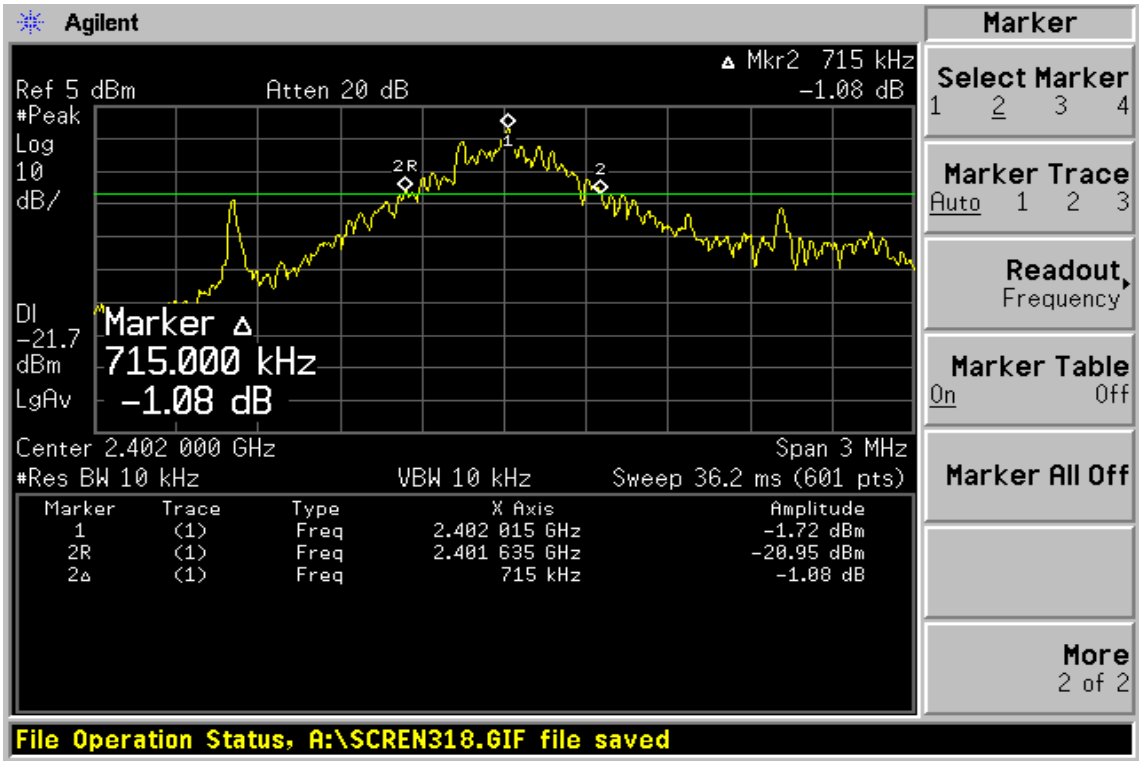
## 7.3. Measurement Result

| CH | Bandwidth (MHz) |
|---|---|
| Lower | 0.715 |
| Mid | 0.715 |
| Higher | 0.715 |

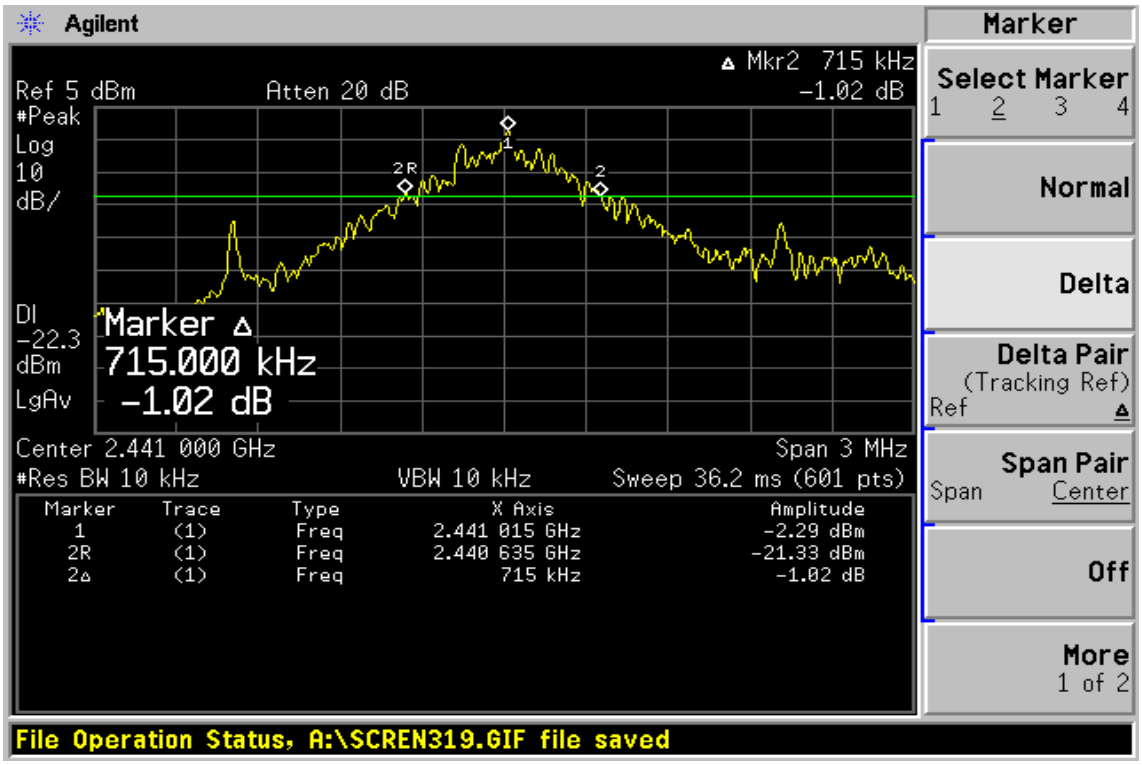
## 7.4. Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/27/2005 |
| Spectrum Analyzer | Agilent | E4446A | MY43360126 | 01/22/2005 | 01/21/2006 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

## 20dB Band Width Test Data CH-Low




## 20dB Band Width Test Data CH-Mid



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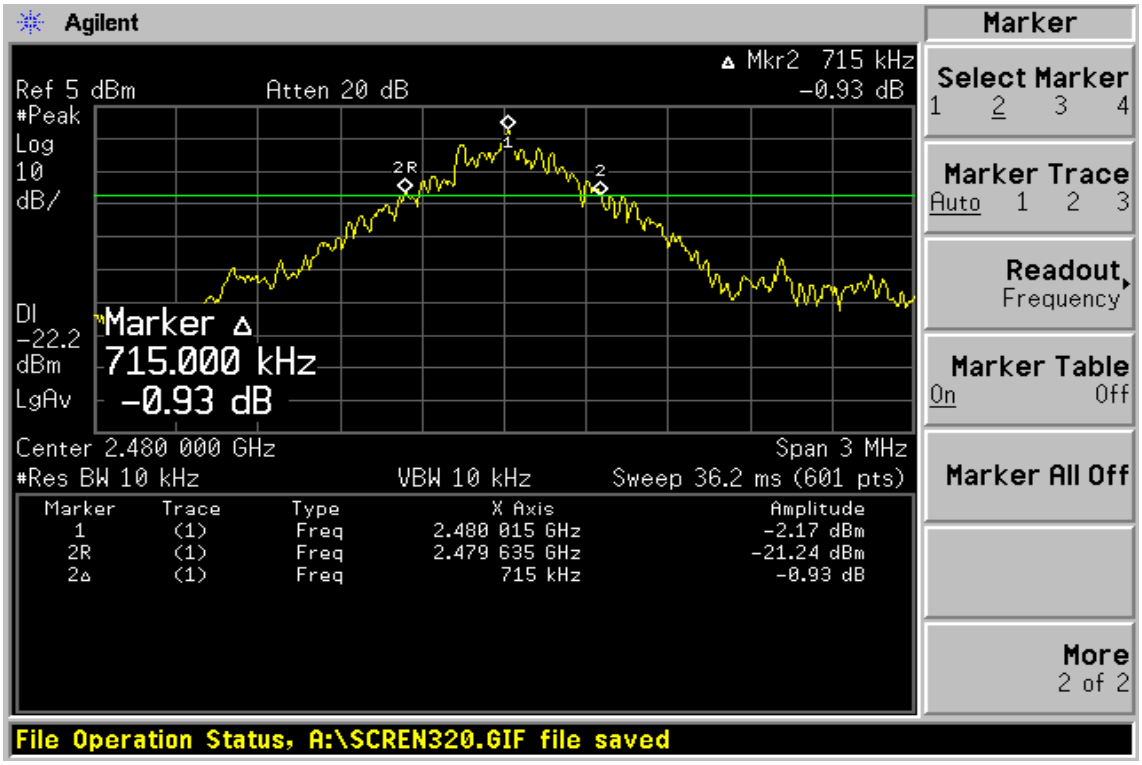
## 20dB Band Width Test Data CH-High



# 8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

## 8.1. Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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 in15.209(a).

## 8.2. 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 2.488GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.
7. Radiated Emission refer to section 9.

## 8.3. Measurement Result

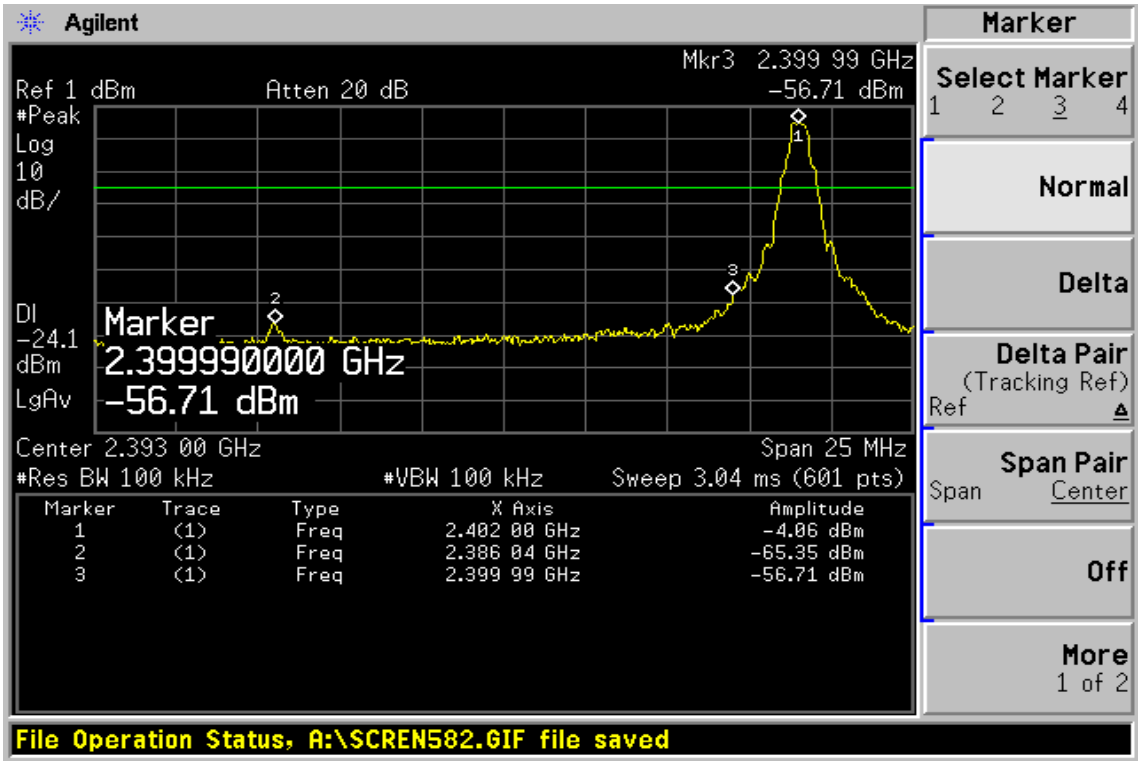
Refer to attach spectrum analyzer data chart.

## 8.4. Measurement Equipment Used:

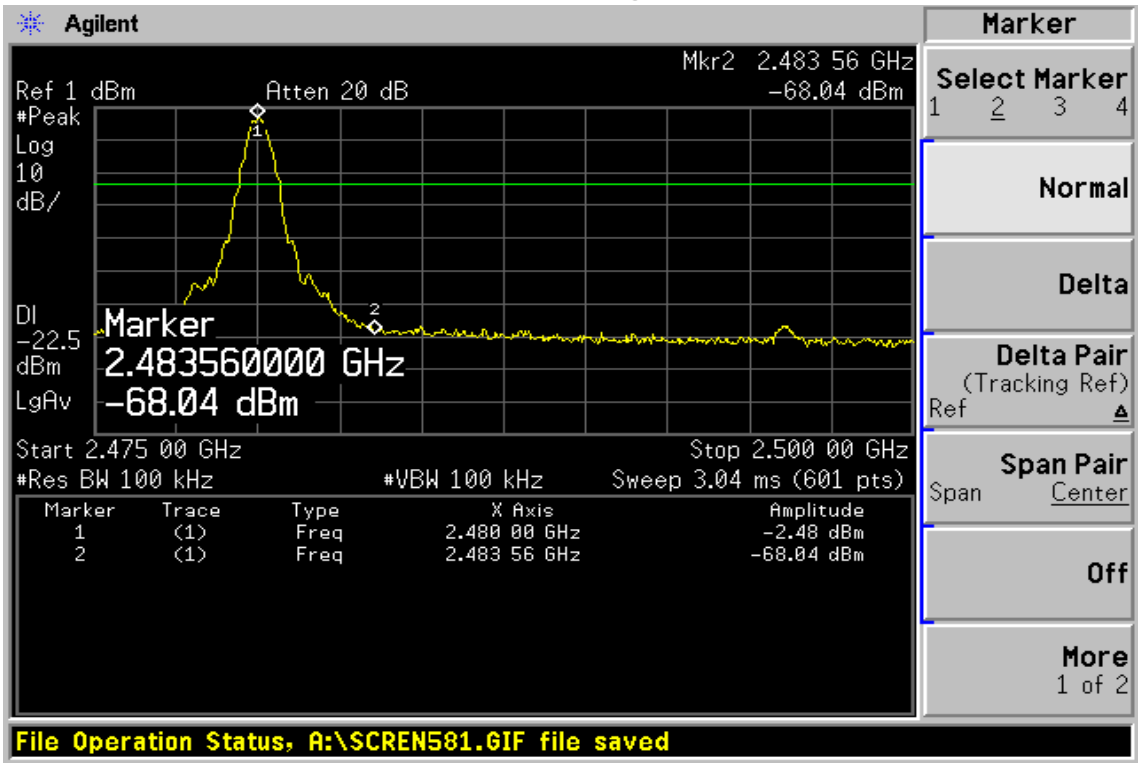
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/26/2005 |
| Spectrum Analyzer | Agilent | E4446A | MY43360126 | 01/22/2005 | 01/21/2006 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

Note: Measurement Equipment for radiated emission refers to section 9.

## Conducted Emission: Test Data CH-Low




## Conducted Emission: Test Data CH-High



**Radiated Emission:**

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Low | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2402 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver. |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 2386.0 | --- | | | | | 74.00 | 54.00 | | Peak |

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Low | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2402 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Hor. |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 2386.0 | --- | | | | | 74.00 | 54.00 | | Peak |

Remark：

(1) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Emission:**

| | | | |
|---|---|---|---|
| Operation Mode | TX CH High | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2480 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver. |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 2483.5 | --- | | --- | --- | | 74.00 | 54.00 | --- | Peak |

| | | | |
|---|---|---|---|
| Operation Mode | TX CH High | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2480 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Hor. |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 2483.5 | --- | | --- | --- | | 74.00 | 54.00 | --- | Peak |

Remark：

(1) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

# 9. SPURIOUS RADIATED EMISSION TEST

## 9.1. Standard Applicable

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

## 9.2. EUT Setup

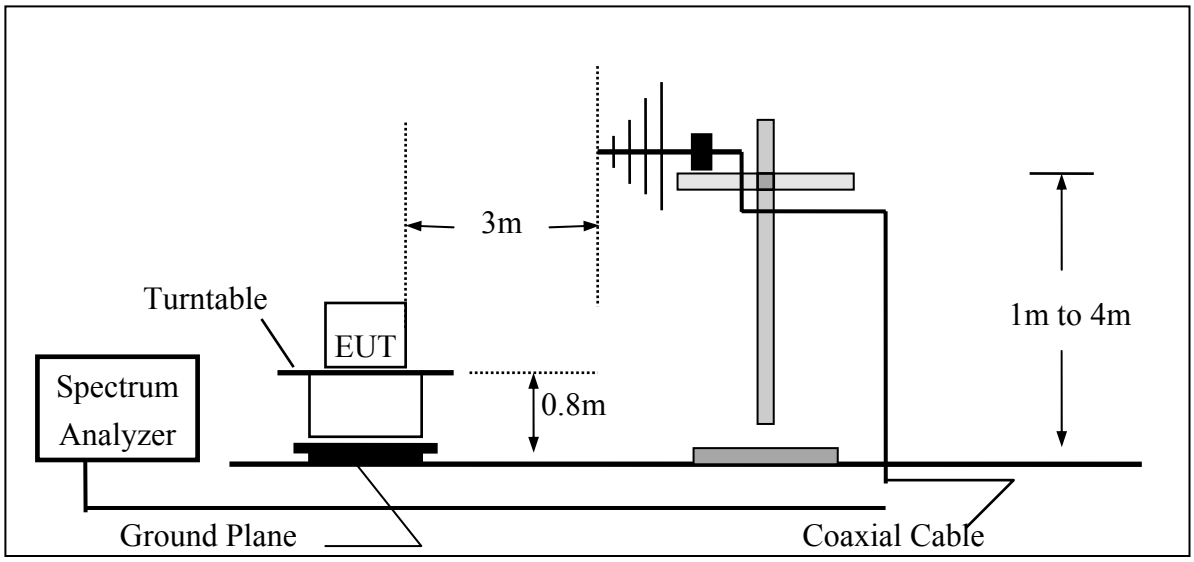
1. The radiated emission tests were performed in the 3 meter open-test site, using the setup in accordance with the ANSI C63.4-2003.
2. The EUT was put in the front of the test table. The peripherals was placed on the side of the host system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host PC system was connected with 110Vac/60Hz power source.

## 9.3. Measurement Procedure

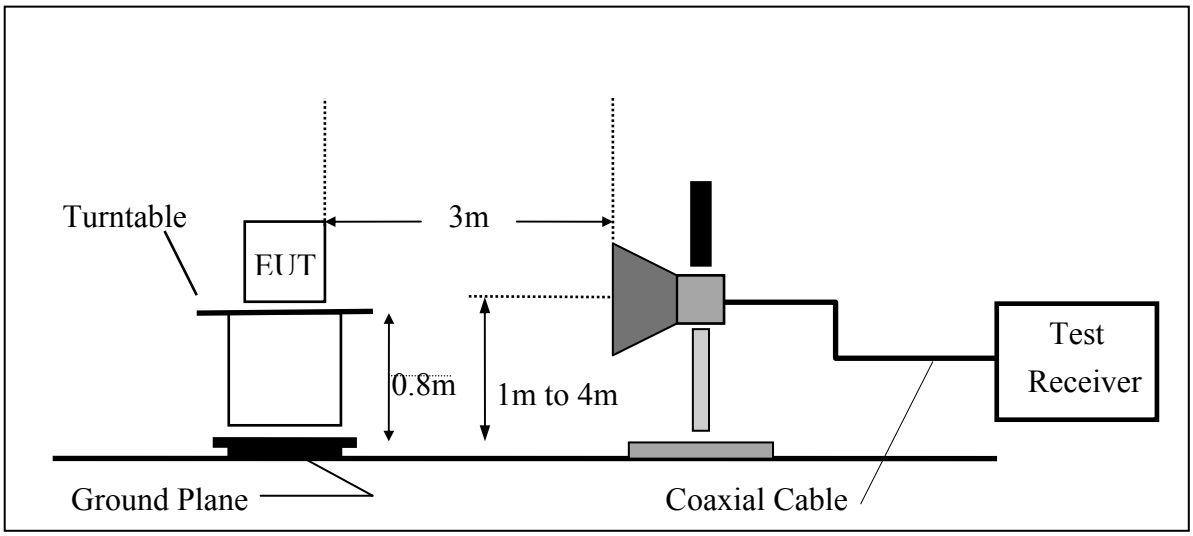
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until all frequency measured were complete.

## 9.4. Test SET-UP (Block Diagram of Configuration)

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




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



## 9.5. Measurement Equipment Used:

| 966 Chamber | | | | | |
|---|---|---|---|---|---|
| **EQUIPMENT TYPE** | **MFR** | **MODEL NUMBER** | **SERIAL NUMBER** | **LAST CAL.** | **CAL DUE.** |
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/26/2005 |
| Bilog Antenna | SCHWAZBECK | VULB9163 | 152 | 06/03/2004 | 06/02/2005 |
| Horn antenna | Schwarzbeck | BBHA 9120D | 309/320 | 08/16/2004 | 08/15/2005 |
| Horn antenna | Schwarzbeck | BBHA 9170 | 184/185 | 07/04/2004 | 07/03/2005 |
| Pre-Amplifier | HP | 8447D | 2944A09469 | 07/19/2004 | 07/18/2005 |
| Pre-Amplifier | HP | 8494B | 3008A00578 | 02/26/2004 | 02/25/2005 |
| Turn Table | HD | DT420 | N/A | N.C.R | N.C.R |
| Antenna Tower | HD | MA240-N | 240/657 | N.C.R | N.C.R |
| Controller | HD | HD100 | N/A | N.C.R | N.C.R |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA-10M | 10m | 10/09/2004 | 10/08/2005 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA-3M | 3m | 10/09/2004 | 10/08/2005 |
| Site NSA | SGS | 966 chamber | N/A | 11/17/2004 | 11/16/2005 |

## 9.6. 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:

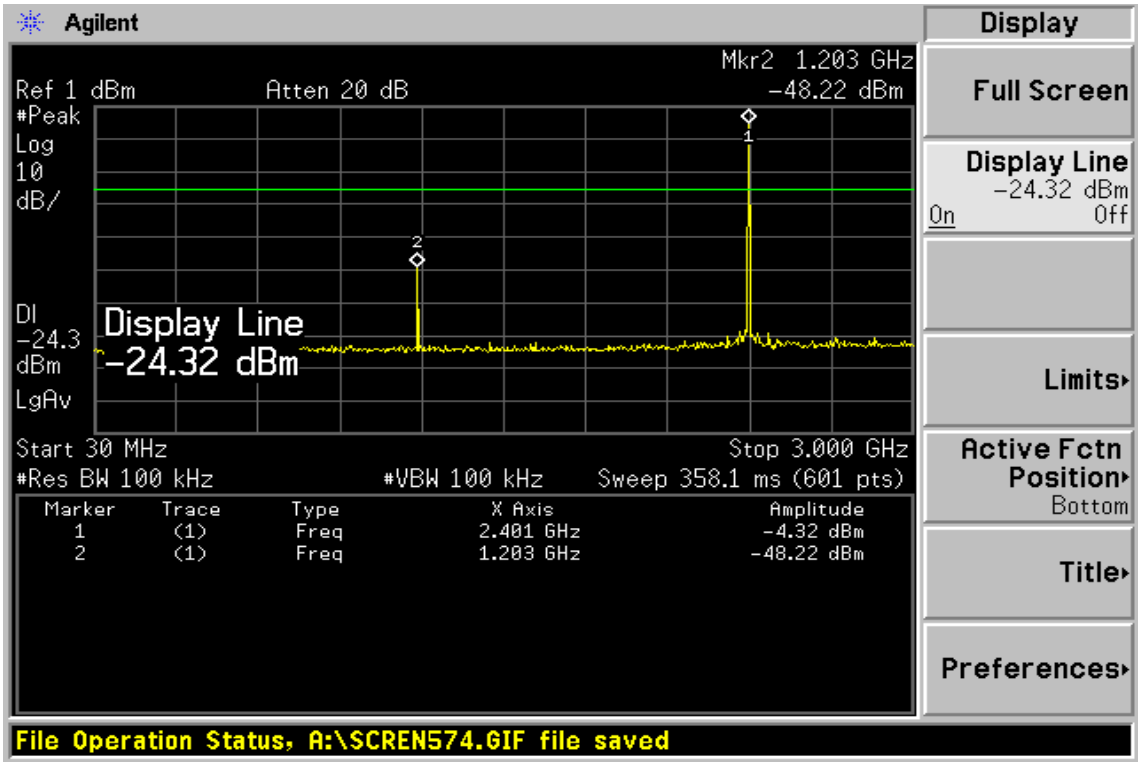
**FS = RA + AF + CL - AG**

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

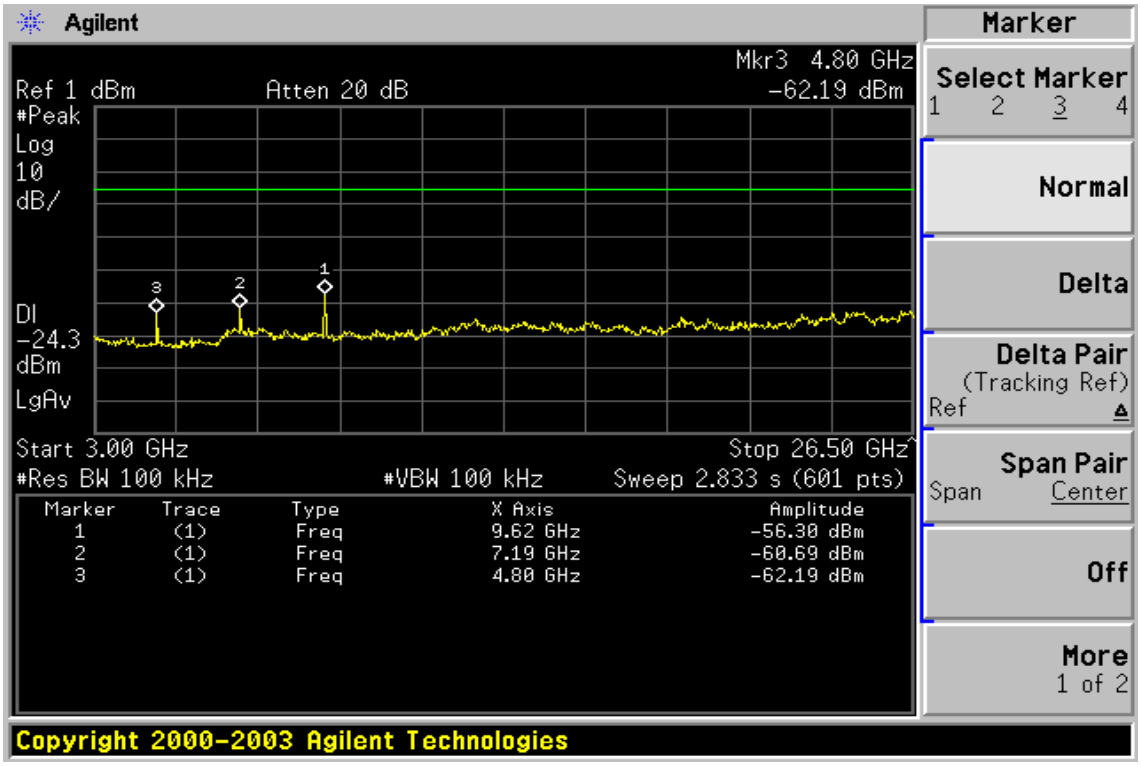
## 9.7. Measurement Result

Refer to attach tabular data sheets.

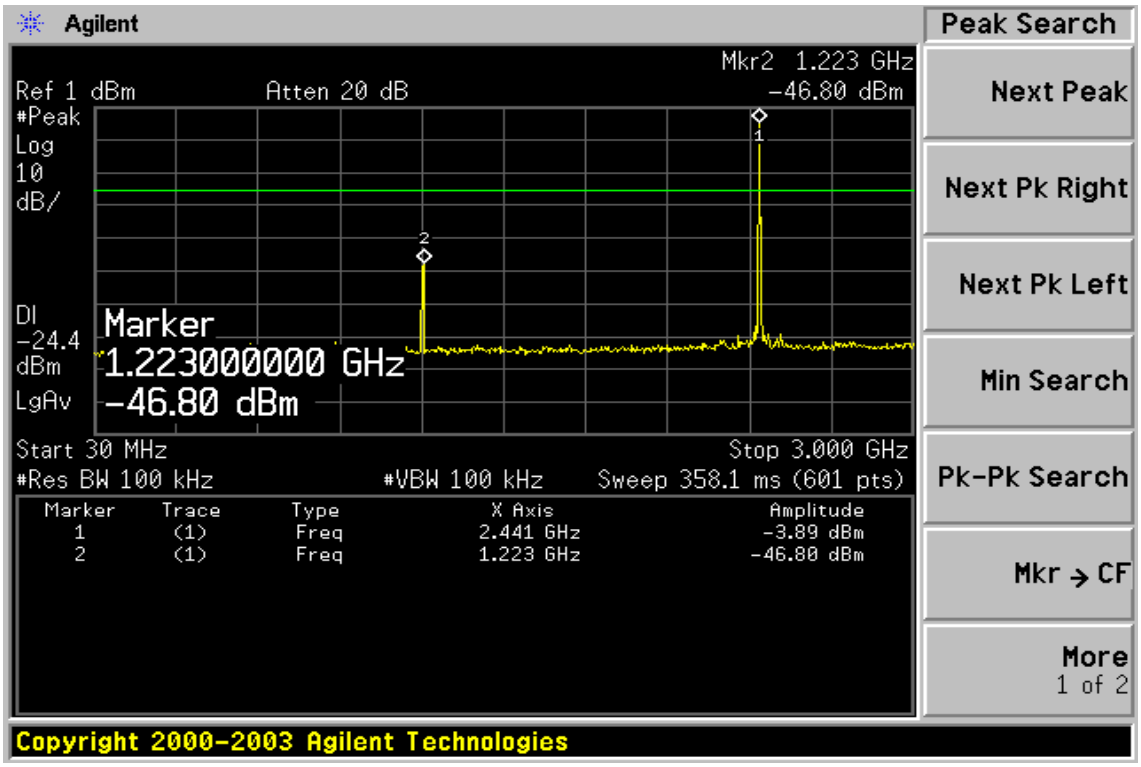
## Conducted Spurious Emission Measurement Result
## Ch Low 30MHz – 3GHz



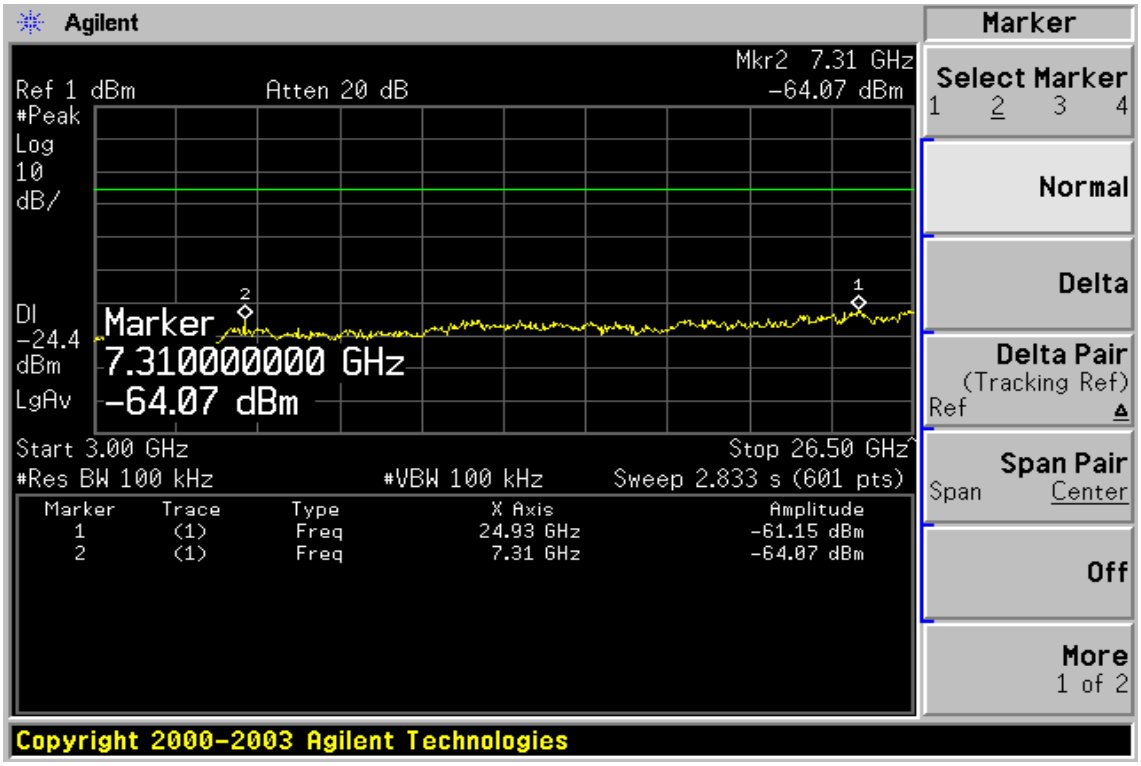

## Ch Low 3GHz – 26.5GHz



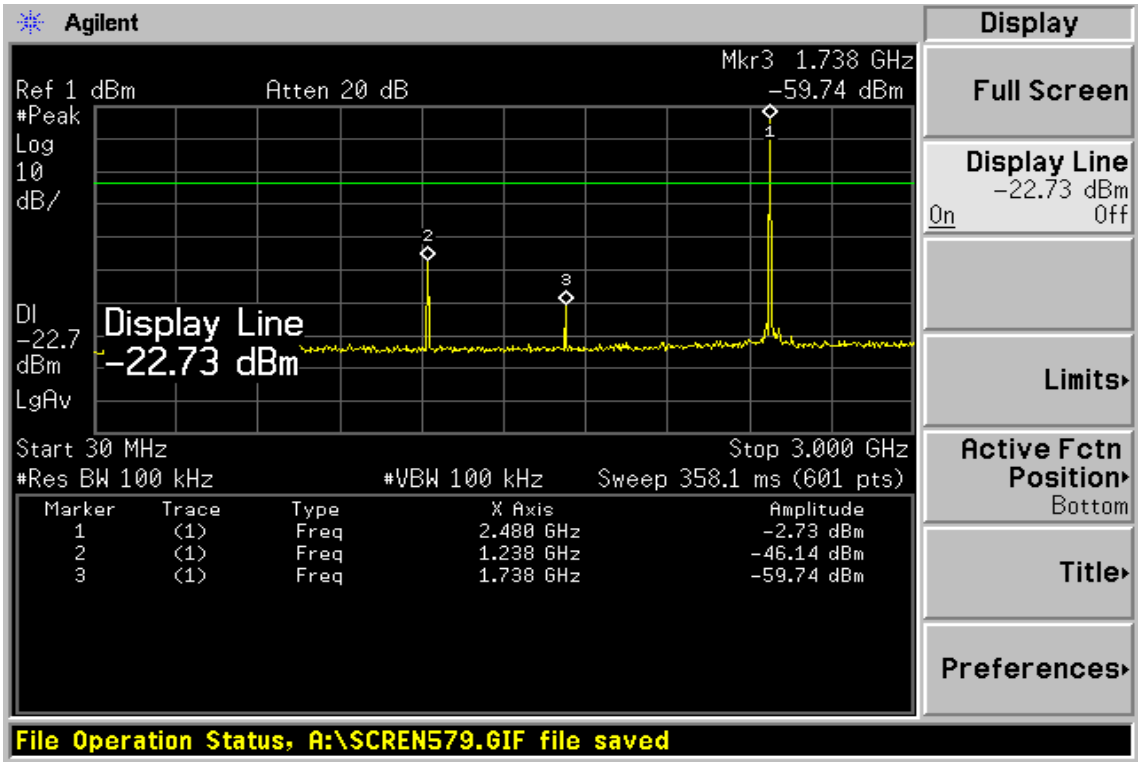
## Ch Mid 30MHz – 3GHz



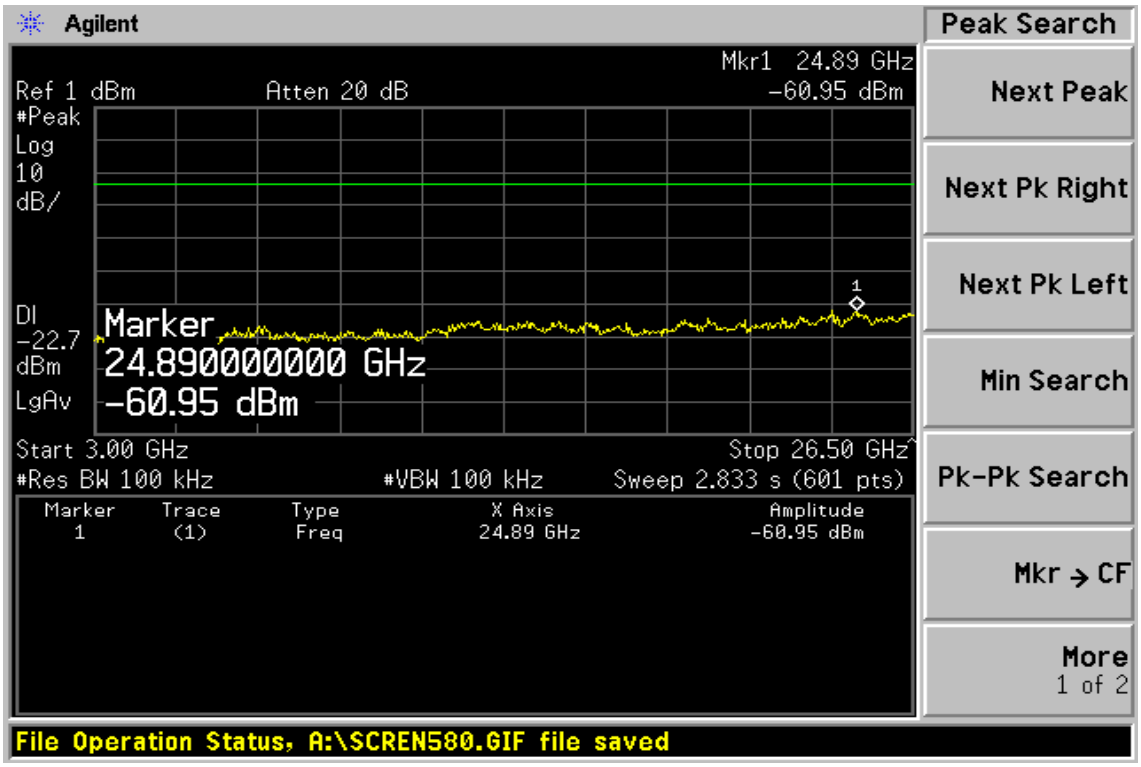

## Ch Mid 3GHz – 26.5GHz



## Ch High 30MHz – 3GHz




## Ch High 3GHz – 26.5GHz



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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Low | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2402MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver./Hor |
| Humidity | 65 % | | |

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 56.19 | V | Peak | 42.03 | -14.95 | 27.08 | 40.00 | -12.92 |
| 75.59 | V | Peak | 44.07 | -17.66 | 26.41 | 40.00 | -13.59 |
| 135.73 | V | Peak | 40.43 | -14.23 | 26.2 | 43.50 | -17.30 |
| 259.89 | V | Peak | 42.34 | -14.96 | 27.38 | 46.00 | -18.62 |
| 300.63 | V | Peak | 40.78 | -13.37 | 27.41 | 46.00 | -18.59 |
| 623.64 | V | Peak | 35.78 | -7.1 | 28.68 | 46.00 | -17.32 |
| 153.19 | H | Peak | 41.60 | -13.67 | 27.93 | 43.50 | -15.57 |
| 198.78 | H | Peak | 45.41 | -16.60 | 28.81 | 43.50 | -14.69 |
| 301.60 | H | Peak | 48.4 | -13.35 | 35.05 | 46.00 | -10.95 |
| 601.33 | H | Peak | 38.67 | -7.6 | 31.07 | 46.00 | -14.93 |
| 623.64 | H | Peak | 43.54 | -7.1 | 36.44 | 46.00 | -9.56 |
| 749.74 | H | Peak | 33.88 | -4.46 | 29.42 | 46.00 | -16.58 |

Remark：

(1) Measuring frequencies from 30 MHz to the 1GHz。

(2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.

(3) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Mid | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2441MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver./Hor |
| Humidity | 65 % | | |

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 31.94 | V | Peak | 47.69 | -15.21 | 32.48 | 40.00 | -7.52 |
| 75.59 | V | Peak | 43.14 | -17.66 | 25.48 | 40.00 | -14.52 |
| 135.73 | V | Peak | 40.66 | -14.23 | 26.43 | 43.50 | -17.07 |
| 259.89 | V | Peak | 41.46 | -14.96 | 26.50 | 46.00 | -19.50 |
| 623.64 | V | Peak | 34.92 | -7.10 | 27.82 | 46.00 | -18.18 |
| 909.79 | V | Peak | 32.96 | -2.09 | 30.87 | 46.00 | -15.13 |
| 159.98 | H | Peak | 47.40 | -14.28 | 33.12 | 43.50 | -10.38 |
| 203.63 | H | Peak | 45.30 | -16.57 | 28.73 | 43.50 | -14.77 |
| 300.63 | H | Peak | 48.07 | -13.37 | 34.70 | 46.00 | -11.30 |
| 623.64 | H | Peak | 43.79 | -7.10 | 36.69 | 46.00 | -9.31 |
| 640.13 | H | Peak | 40.02 | -6.73 | 33.29 | 46.00 | -12.71 |
| 812.79 | H | Peak | 33.85 | -3.33 | 30.52 | 46.00 | -15.48 |

Remark：

(1) Measuring frequencies from 30 MHz to the 1GHz。

(2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.

(3) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH High | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2480MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver./Hor |
| Humidity | 65 % | | |

| Freq. (MHz) | Ant.Pol. H/V | Detector Mode (PK/QP) | Reading (dBuV) | Factor (dB) | Actual FS (dBuV/m) | Limit3m (dBuV/m) | Safe Margin (dB) |
|---|---|---|---|---|---|---|---|
| 31.94 | V | Peak | 42.76 | -15.21 | 27.55 | 40.00 | -12.45 |
| 75.59 | V | Peak | 43.06 | -17.66 | 25.4 | 40.00 | -14.60 |
| 130.88 | V | Peak | 40.89 | -14.63 | 26.26 | 43.50 | -17.24 |
| 259.89 | V | Peak | 41.4 | -14.96 | 26.44 | 46.00 | -19.56 |
| 601.33 | V | Peak | 33.2 | -7.60 | 25.6 | 46.00 | -20.40 |
| 822.49 | V | Peak | 31.83 | -7.60 | 24.23 | 46.00 | -21.77 |
| 159.99 | H | Peak | 43.7 | -14.28 | 29.42 | 43.50 | -14.08 |
| 206.54 | H | Peak | 44.99 | -16.49 | 28.5 | 43.50 | -15.00 |
| 300.63 | H | Peak | 50.18 | -13.37 | 36.81 | 46.00 | -9.19 |
| 623.64 | H | Peak | 40.68 | -7.10 | 33.58 | 46.00 | -12.42 |
| 732.28 | H | Peak | 35.20 | -4.79 | 30.41 | 46.00 | -15.59 |
| 960.23 | H | Peak | 33.14 | -1.70 | 31.44 | 54.00 | -22.56 |

Remark：

(1) Measuring frequencies from 30 MHz to the 1GHz。

(2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.

(3) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Low | Test Date | Jan. 03, 2005 |
| Fundamental Frequency | 2402 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver. |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1188.5 | 47.90 | -- | -7.17 | 40.73 | -- | 74.00 | 54.00 | -13.27 |
| 1500.5 | 41.84 | -- | -7.17 | 34.67 | -- | 74.00 | 54.00 | -19.33 |
| 2391.0 | 91.86 | -- | -3.40 | 88.46 | -- | -- | -- | -- |
| 4804.0 | ---- | | | | | | | |
| 7206.0 | ---- | | | | | | | |
| 9608.0 | ---- | | | | | | | |
| 12010.0 | ---- | | | | | | | |
| 14412.0 | ---- | | | | | | | |
| 16814.0 | ---- | | | | | | | |
| 19216.0 | ---- | | | | | | | |
| 21618.0 | ---- | | | | | | | |
| 24020.0 | ---- | | | | | | | |

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Low | Test Date | Jan. 14. 2005 |
| Fundamental Frequency | 2402 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Hor |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1188.5 | 50.88 | -- | -8.65 | 42.23 | -- | 74.00 | 54.00 | -11.77 |
| 1500.5 | 46.68 | -- | -7.17 | 39.51 | -- | 74.00 | 54.00 | -14.49 |
| 2397.5 | 97.10 | -- | -3.40 | 93.70 | -- | -- | -- | -- |
| 4804.0 | ---- | | | | | | | |
| 7206.0 | ---- | | | | | | | |
| 9608.0 | ---- | | | | | | | |
| 12010.0 | ---- | | | | | | | |
| 14412.0 | ---- | | | | | | | |
| 16814.0 | ---- | | | | | | | |
| 19216.0 | ---- | | | | | | | |
| 21618.0 | ---- | | | | | | | |
| 24020.0 | ---- | | | | | | | |

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Mid | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2441 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1221.0 | 47.23 | -- | -8.44 | 38.79 | -- | 74.00 | 54.00 | -15.21 |
| 1500.5 | 41.89 | -- | -7.17 | 34.72 | -- | 74.00 | 54.00 | -19.28 |
| 2443.0 | 93.76 | -- | -3.18 | 90.58 | -- | -- | -- | -- |
| 4882.0 | ---- | | | | | | | |
| 7323.0 | ---- | | | | | | | |
| 9764.0 | ---- | | | | | | | |
| 12205.0 | ---- | | | | | | | |
| 14646.0 | ---- | | | | | | | |
| 17087.0 | ---- | | | | | | | |
| 19528.0 | ---- | | | | | | | |
| 21969.0 | ---- | | | | | | | |
| 24410.0 | ---- | | | | | | | |

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH Mid | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2441 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Hor |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1221.0 | 49.14 | -- | -8.44 | 40.70 | -- | 74.00 | 54.00 | -13.30 |
| 1500.5 | 46.92 | -- | -7.17 | 39.75 | -- | 74.00 | 54.00 | -14.25 |
| 2443.0 | 98.12 | -- | -3.18 | 94.94 | -- | -- | -- | -- |
| 4882.0 | ---- | | | | | | | |
| 7323.0 | ---- | | | | | | | |
| 9764.0 | ---- | | | | | | | |
| 12205.0 | ---- | | | | | | | |
| 14646.0 | ---- | | | | | | | |
| 17087.0 | ---- | | | | | | | |
| 19528.0 | ---- | | | | | | | |
| 21969.0 | ---- | | | | | | | |
| 24410.0 | ---- | | | | | | | |

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH High | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2480 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Ver |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1240.5 | 51.03 | -- | -8.42 | 42.61 | -- | 74.00 | 54.00 | -11.39 |
| 1500.5 | 42.20 | -- | -7.17 | 35.03 | -- | 74.00 | 54.00 | -18.97 |
| 2475.5 | 95.64 | -- | -3.04 | 92.60 | -- | -- | -- | -- |
| 4960.0 | ---- | | | | | | | |
| 7440.0 | ---- | | | | | | | |
| 9920.0 | ---- | | | | | | | |
| 12400.0 | ---- | | | | | | | |
| 14880.0 | ---- | | | | | | | |
| 17360.0 | ---- | | | | | | | |
| 19840.0 | ---- | | | | | | | |
| 22320.0 | ---- | | | | | | | |
| 24800.0 | ---- | | | | | | | |

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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

| | | | |
|---|---|---|---|
| Operation Mode | TX CH High | Test Date | Jan. 14, 2005 |
| Fundamental Frequency | 2480 MHz | Test By | Sky |
| Temperature | 25 ℃ | Pol | Hor |
| Humidity | 65 % | | |

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL CF(dB) | Actual FS Peak (dBuV/m) | Actual FS AV (dBuV/m) | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| 1240.5 | 49.21 | -- | -8.42 | 40.79 | -- | 74.00 | 54.00 | -13.21 |
| 1500.5 | 47.04 | -- | -7.17 | 39.87 | -- | 74.00 | 54.00 | -14.13 |
| 2475.5 | 97.40 | -- | -3.04 | 94.36 | -- | -- | -- | -- |
| 7440.0 | ---- | | | | | | | |
| 9920.0 | ---- | | | | | | | |
| 12400.0 | ---- | | | | | | | |
| 14880.0 | ---- | | | | | | | |
| 17360.0 | ---- | | | | | | | |
| 19840.0 | ---- | | | | | | | |
| 22320.0 | ---- | | | | | | | |
| 24800.0 | ---- | | | | | | | |

Remark：

(1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency。

(2) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。

(4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.

(5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

# 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.

## 10.2. 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 5 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

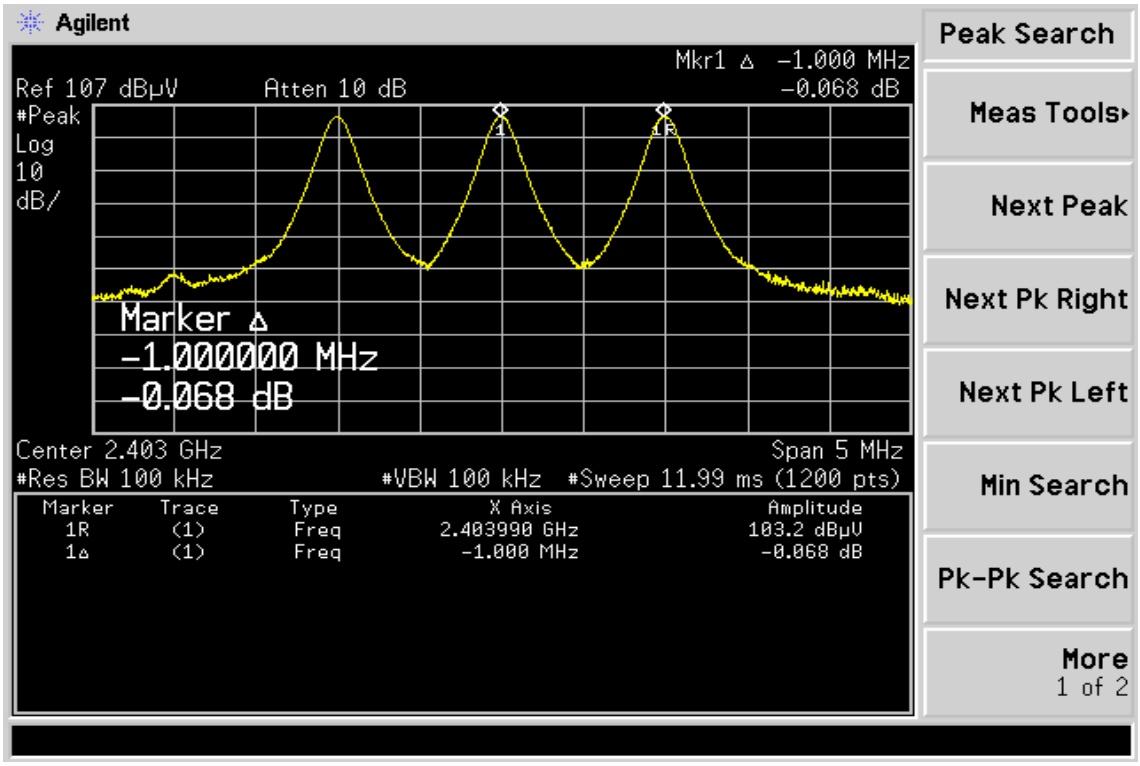
## 10.3. Measurement Result

| Channel separation | Limit | Result |
|---|---|---|
| MHz | kHz | |
| 1 | >=25KHz/ 20 dB bandwidth | PASS |

## 10.4. Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/26/2005 |
| Spectrum Analyzer | Agilent | E4446A | MY43360126 | 01/22/2005 | 01/21/2006 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

## Frequency Separation Test Data



# 11. NUMBER OF HOPPING FREQUENCY

## 11.1. Standard Applicable

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

## 11.2. Measurement 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,VBW=100KHz,
5. Max hold, view and count how many channel in the band.

## 11.3. Measurement Result

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.

The maximum “initial carrier frequency tolerance” which is allowed for Bluetooth is fcenter = 75 kHz.

This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

Additionally an example for the channel separation is given in the test report

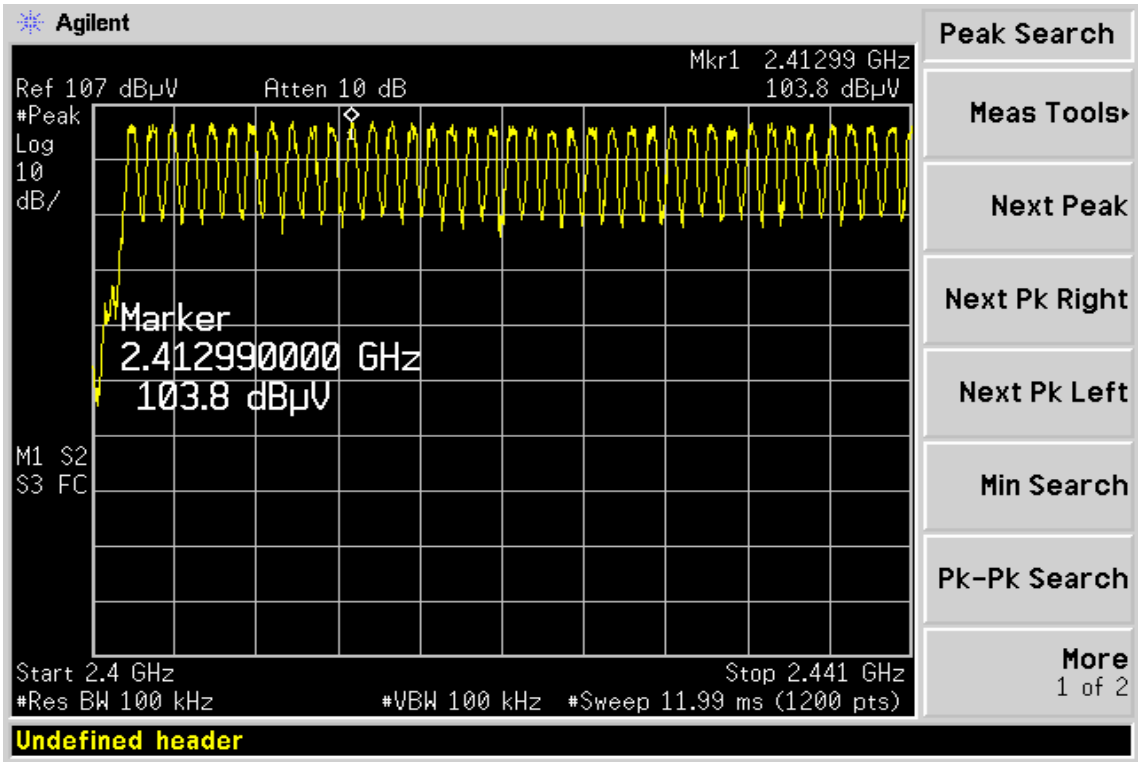
| | Limit (CH) | Measurement result (CH) | Result |
|---|---|---|---|
| Total No of hopping channel | 15 | 79 | Pass |

## 11.4. Measurement Equipment Used:

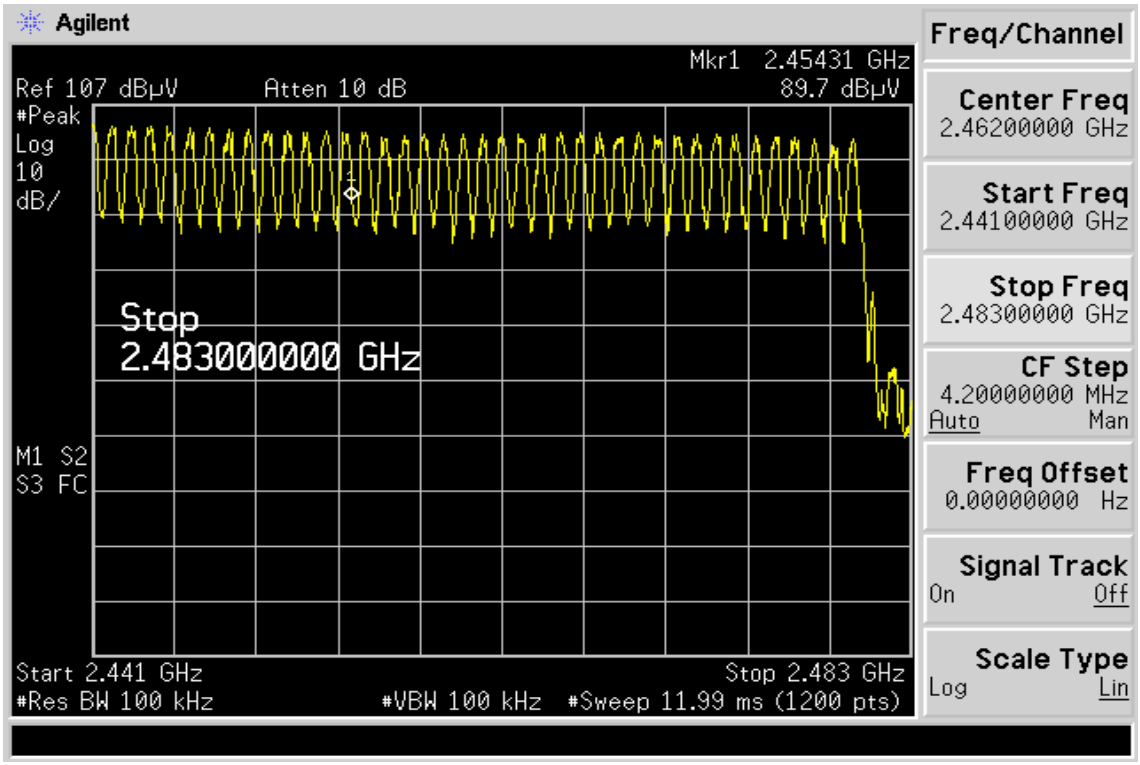
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/26/2005 |
| Spectrum Analyzer | Agilent | E4446A | MY43360126 | 01/22/2005 | 01/21/2006 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

## Channel Number

*2.4 GHz – 2.441GHz*




*2.441 GHz – 2.4835GHz*



# 12. TIME OF OCCUPANCY (DWELL TIME)

## 12.1. Standard Applicable

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

## 12.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW,VBW=100KHz, Span = 0Hz , Adjust Sweep = 30s.
5. Repeat above procedures until all frequency measured were complete.

## 12.3. Measurement Result

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:

Dwell time = time slot length * hop rate / number of hopping channels *30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multislot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. There for all Bluetooth devices comply with the FCC dwell time requirement in data mode.

This was checked during the Bluetooth Qualification tests.

The Dwell time in hybrid mode is measured and stated in the test report.

A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low: DH1 time slot = 0.405 (ms) * (1600/(2*79)) * 31.6 = 129.6 (ms)
DH3 time slot = 1.675 (ms) * (1600/(4*79)) * 31.6 = 268 (ms)
DH5 time slot = 2.295 (ms) * (1600/(6*79)) * 31.6 = 312 (ms)

CH Mid: DH1 time slot = 0.405 (ms) * (1600/(2*79)) * 31.6 = 129.6 (ms)
DH3 time slot = 1.675 (ms) * (1600/(4*79)) * 31.6 = 268 (ms)
DH5 time slot = 2.906 (ms) * (1600/(6*79)) * 31.6 = 309.97 (ms)

CH High: DH1 time slot = 0.416 (ms) * (1600/(2*79)) * 31.6 = 129.6 (ms)
DH3 time slot = 1.662 (ms) * (1600/(4*79)) * 31.6 = 265.92 (ms)
DH5 time slot = 2.906 (ms) * (1600/(6*79)) * 31.6 = 309.97 (ms)

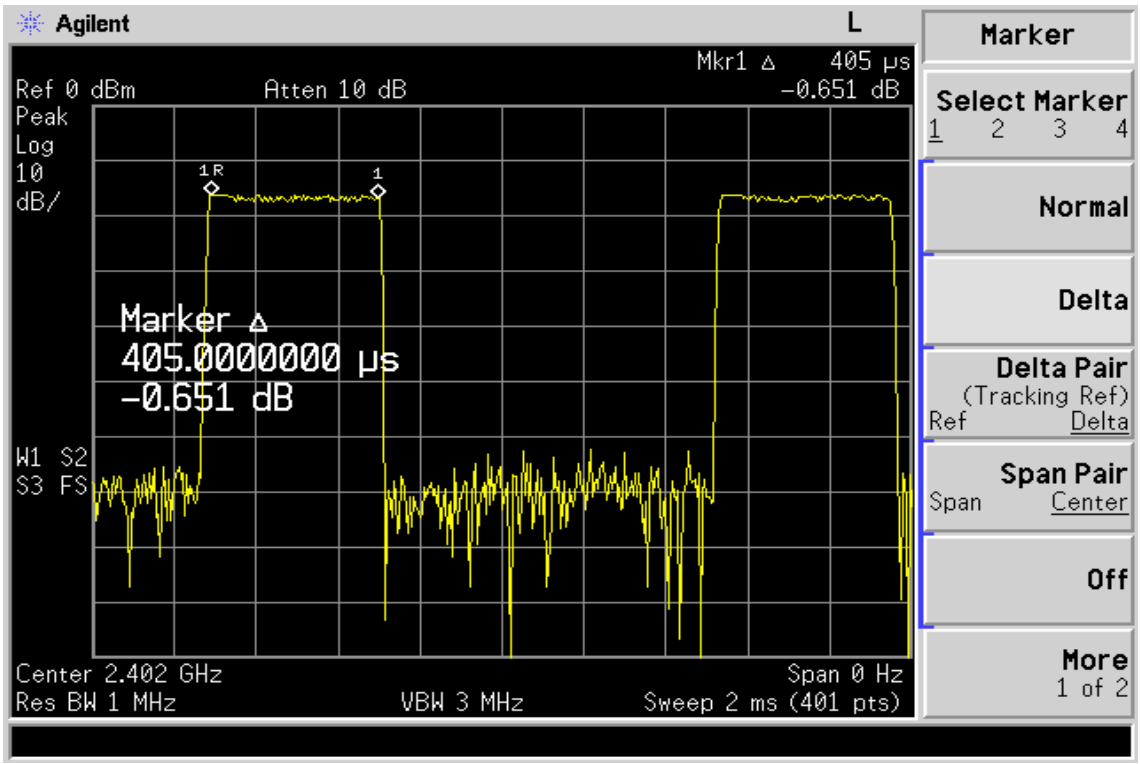
## 12.4. Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/26/2005 |
| Spectrum Analyzer | Agilent | E4446A | MY43360126 | 01/22/2005 | 01/21/2006 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

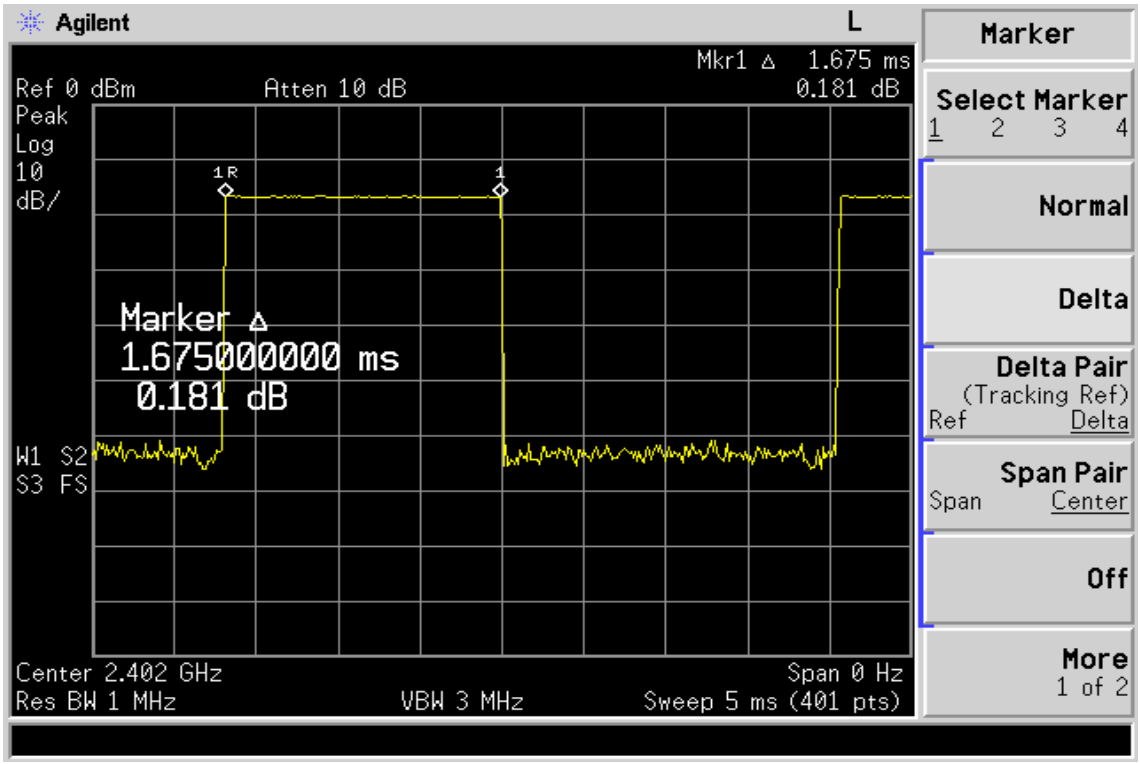
# Dwell Time Test Data

## *CH-Low*

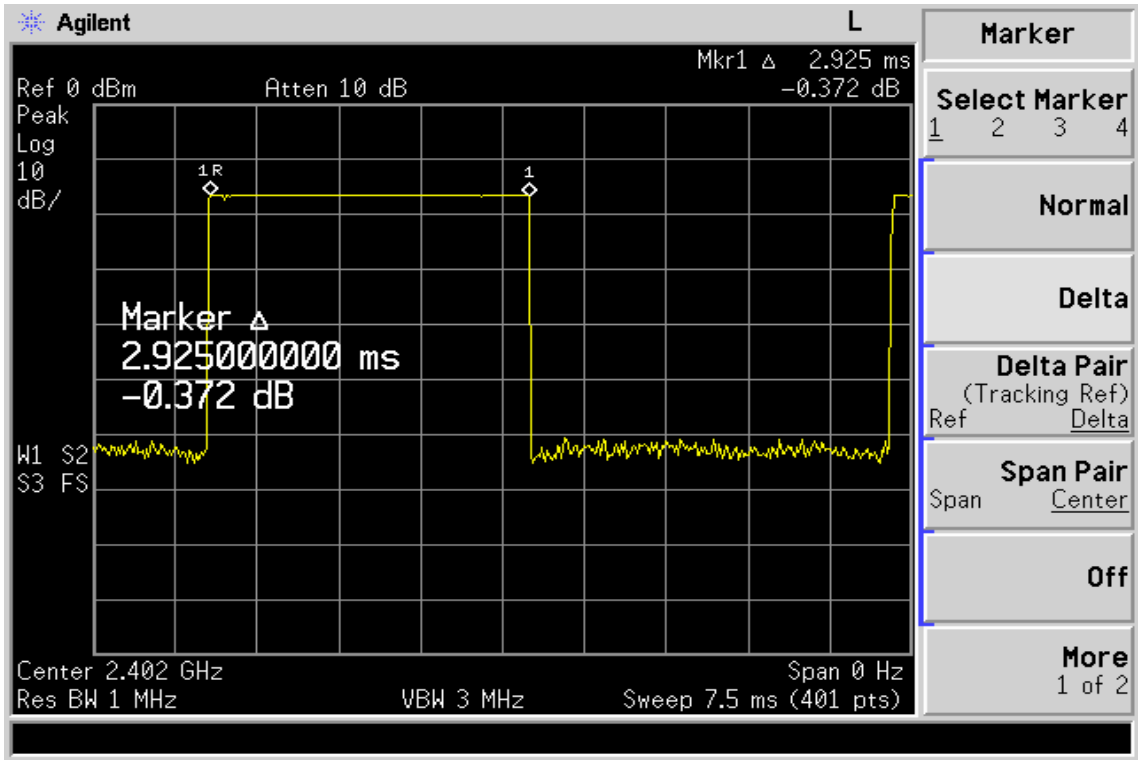
### *DH1*



***DH3***

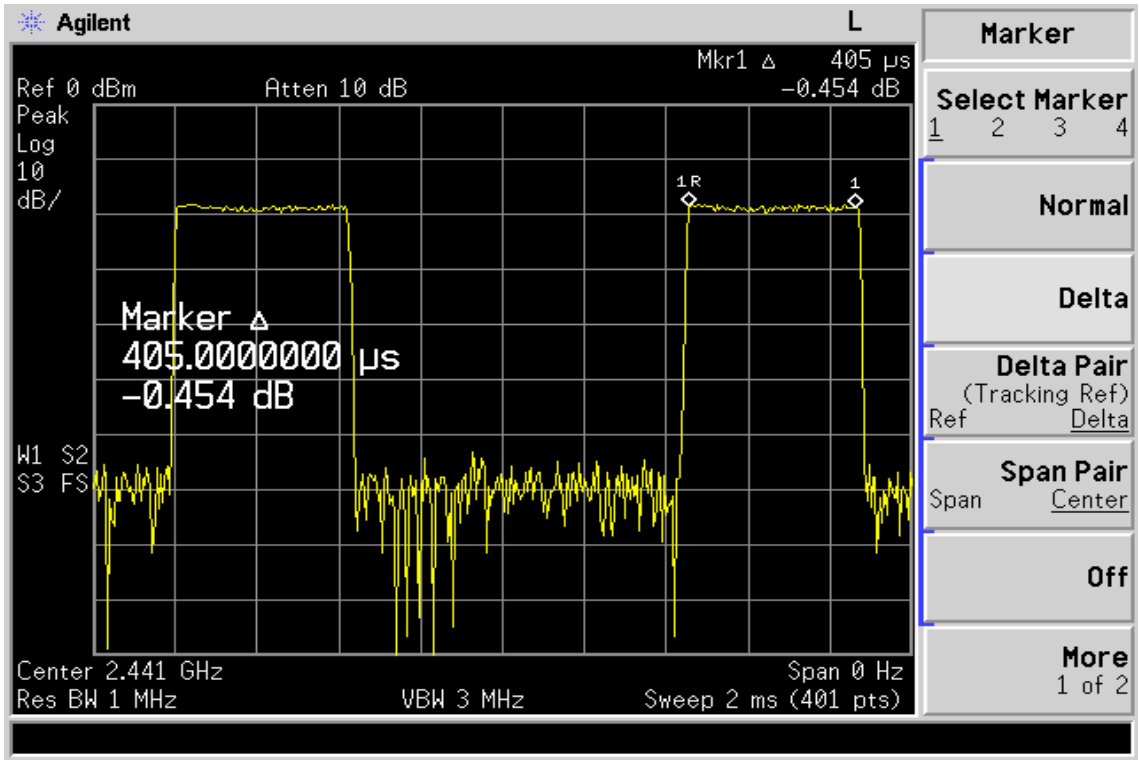



***DH5***

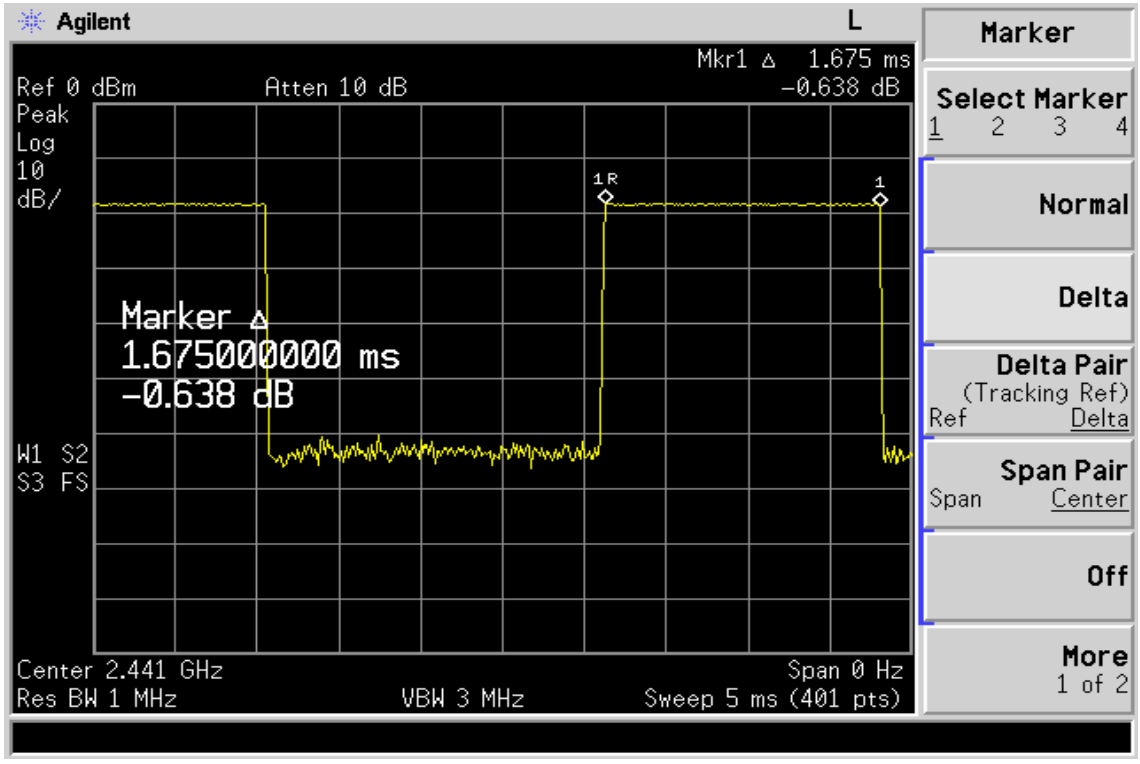


*CH-Mid*

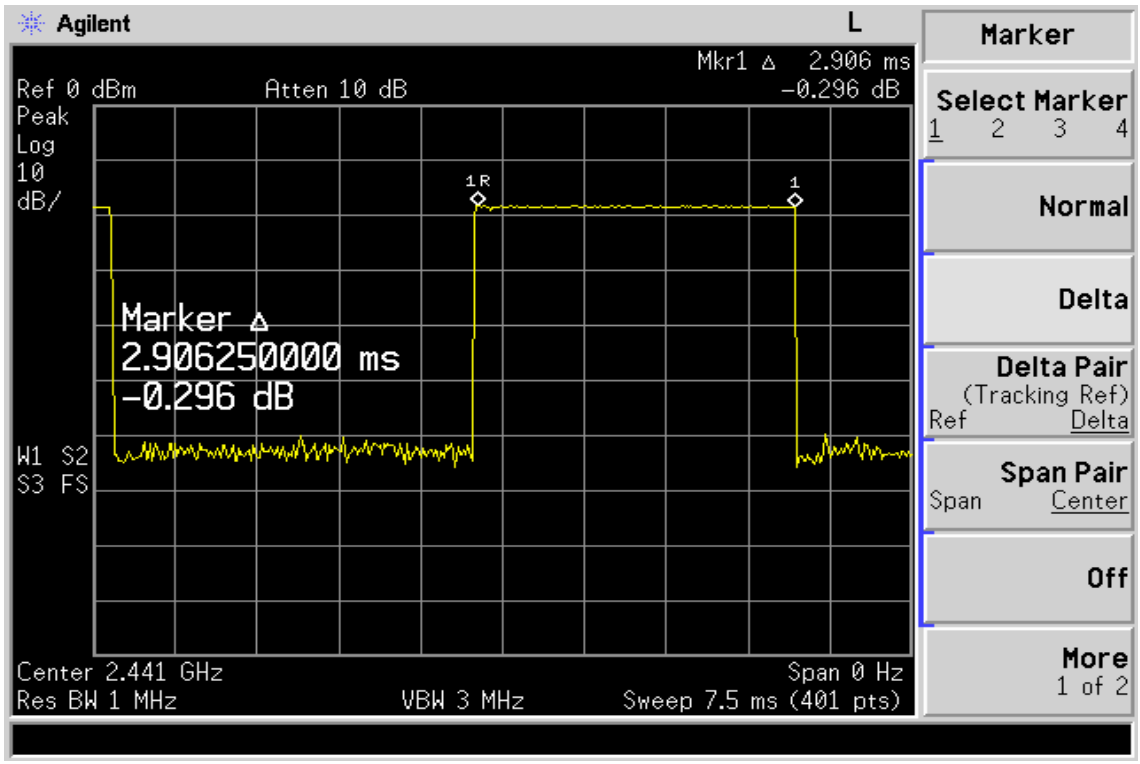
*DH1*




*DH3*

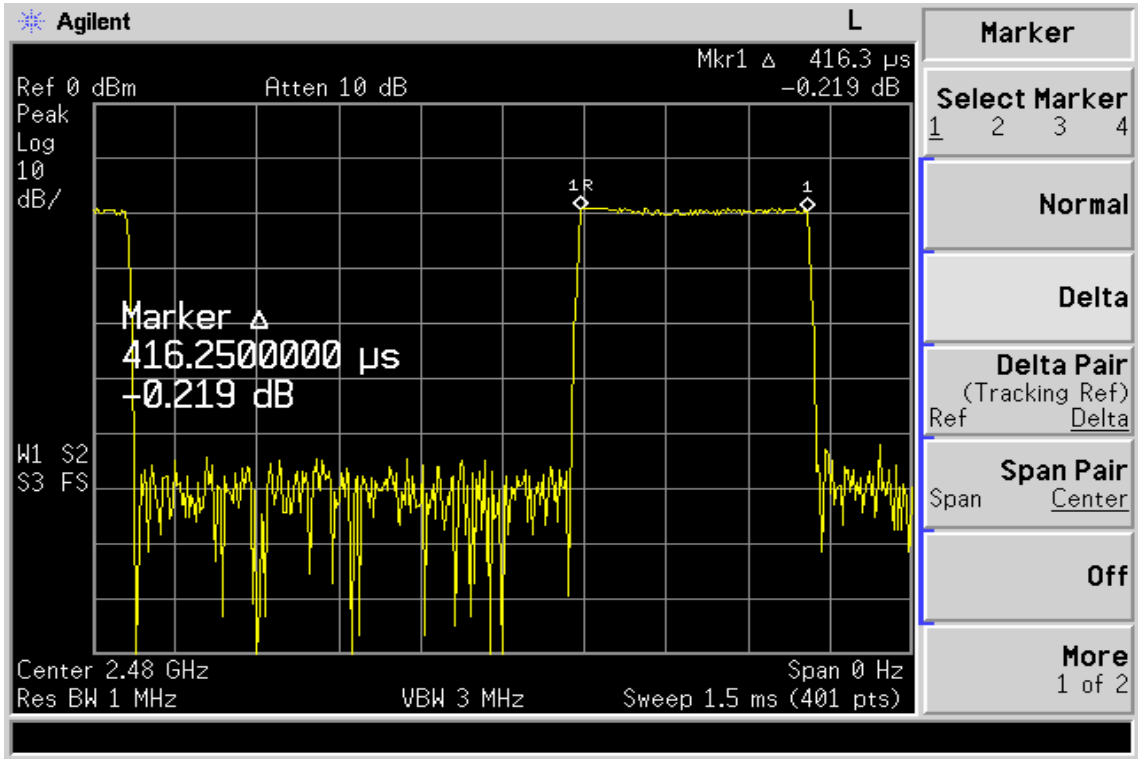


*DH5*

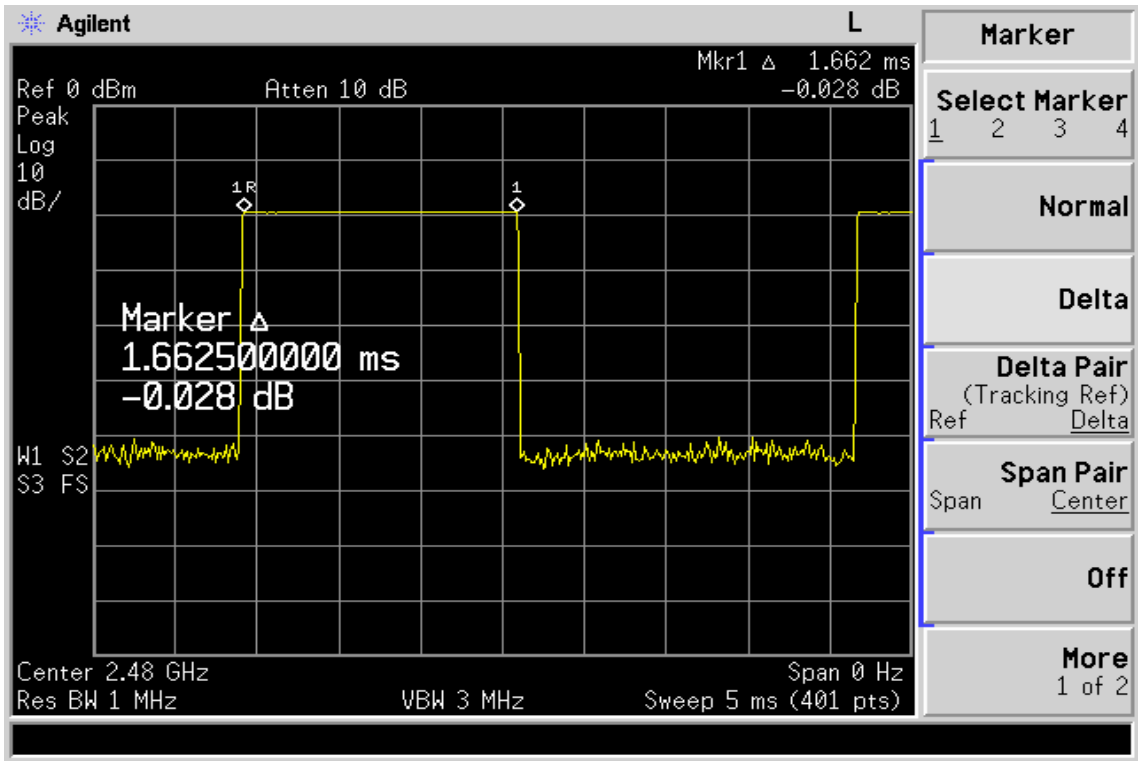



*CH-High*

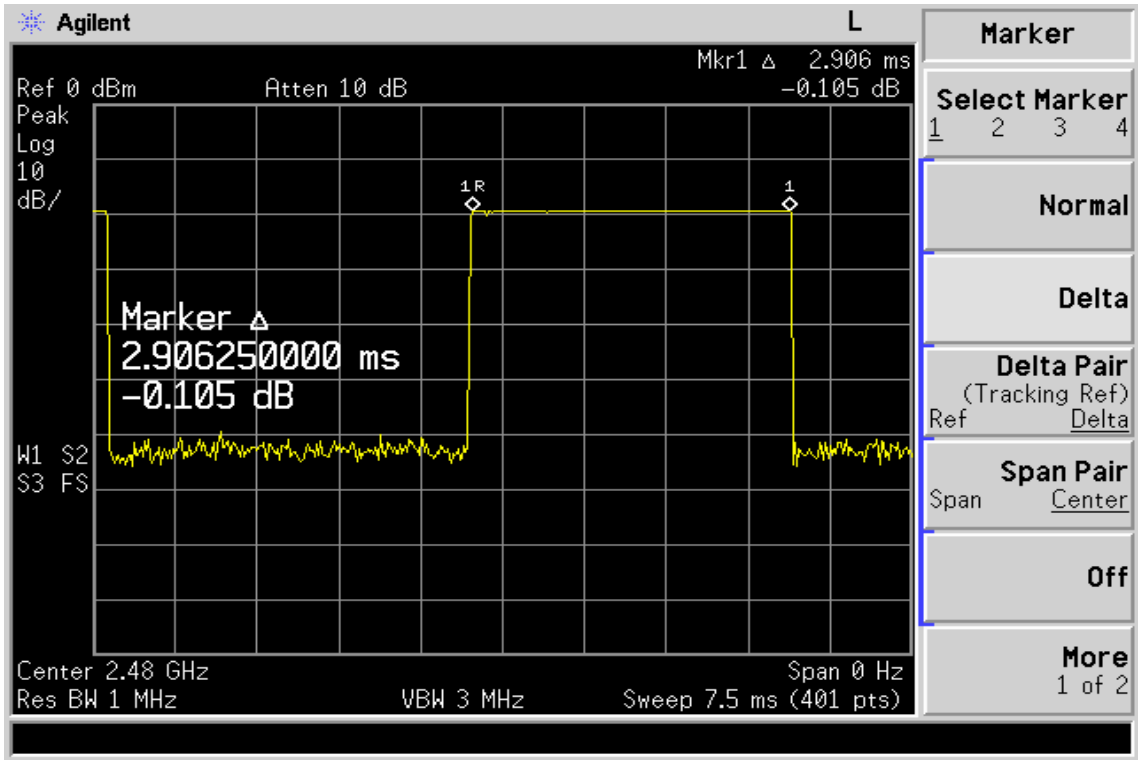
*DH1*



*DH3*




*DH5*



# 13. Peak Power Spectral Density

## 13.1. Standard Applicable

According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3kHz band during any time interval of continuous transmission.

## 13.2. 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 = 3KHz, VBW = 10KHz, Span = 300KHz, Sweep=100s
4. Record the max. reading.
5. Repeat above procedures until all frequency measured were complete.

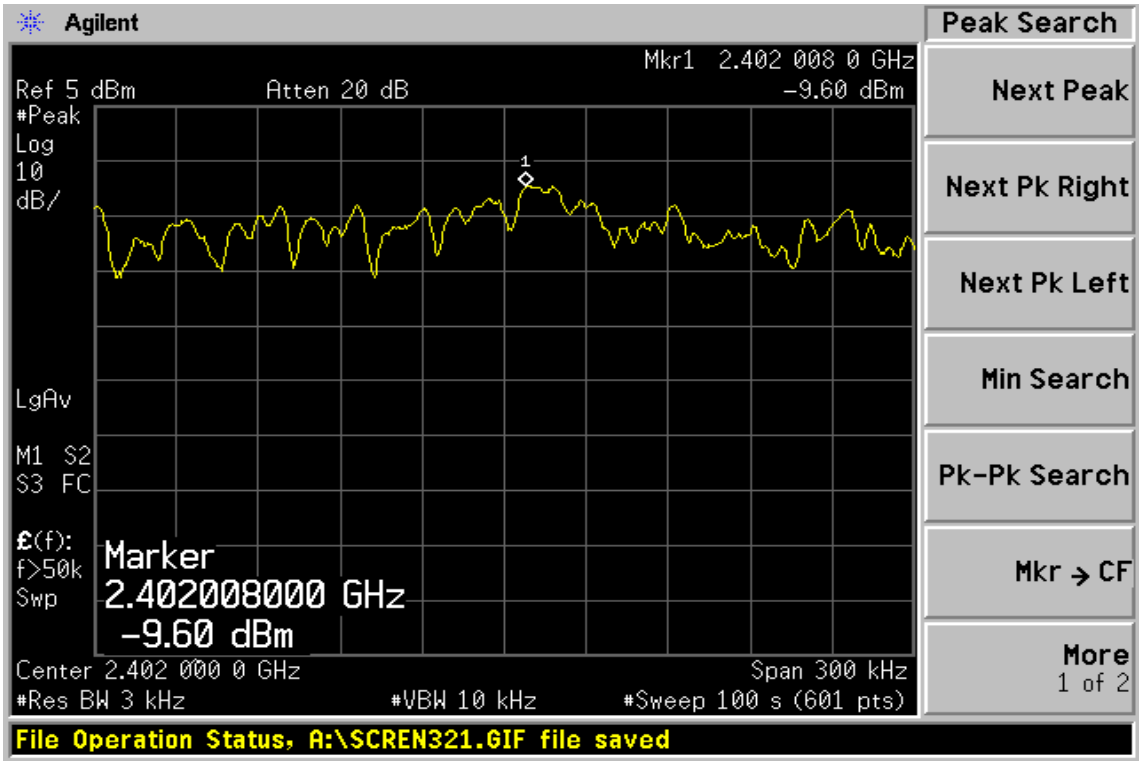
## 13.3. Measurement Result

| CH | RF Power Density Reading (dBm) | Cable loss (dB) | RF Power Density Level (dBm) | Maximum Limit (dBm) |
|---|---|---|---|---|
| Low | -9.60 | 0.20 | -9.40 | 8 |
| Mid | -9.87 | 0.20 | -9.67 | 8 |
| High | -10.16 | 0.20 | -9.96 | 8 |

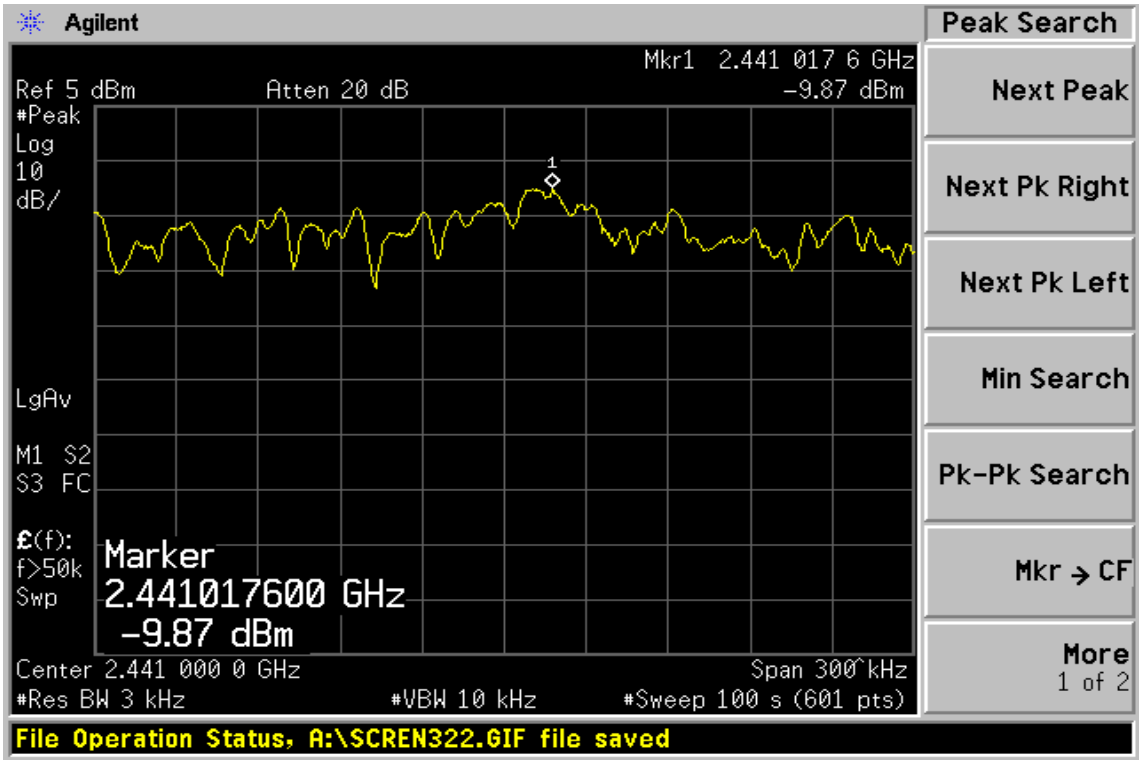
## 13.4. Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP 40 | 100034 | 05/27/2004 | 05/26/2005 |
| Spectrum Analyzer | Agilent | E7405A | US41160416 | 08/27/2004 | 08/26/2005 |
| Low Loss Cable | HUBER+SUHNER | SUCOFLEX 104PEA | N/A | N/A | N/A |
| Attenuator | Mini-Circult | BW-S6W5 | N/A | 10/07/2004 | 10/06/2005 |

## Power Spectral Density Test Plot (CH-Low)




## Power Spectral Density Test Plot (CH-Mid)



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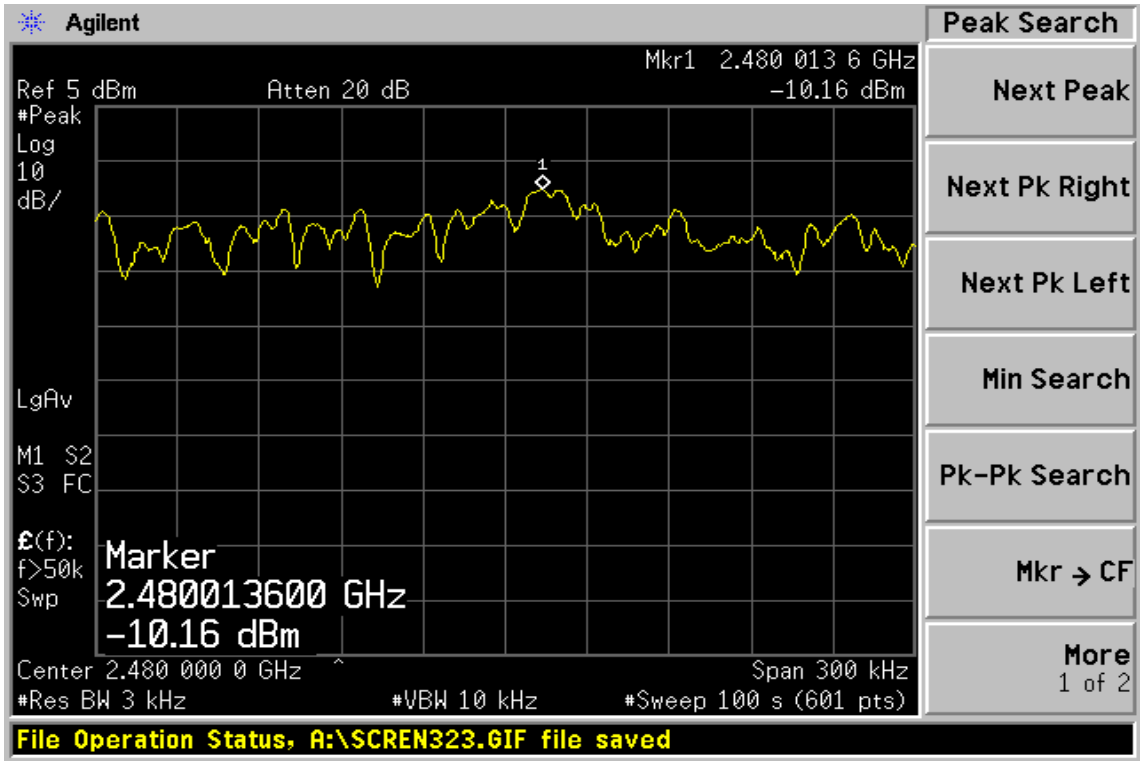
ILAC MRA

## Power Spectral Density Test Plot (CH-High)



# 14. ANTENNA REQUIREMENT

## 14.1. Standard Applicable

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

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

## 14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 2 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

# 15. RF EXPOSURE

## 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 Portable device.

## 15.2. Measurement Result:

This is a portable device and the Max peak output power is 2dBm (0.00163W) lower than low threshold 60/fGHz mW (24.48mW), d<2.5cm in general population category；

The SAR measurement is not necessary.