



**FCC CFR47 PART 15 SUBPART C  
CLASS II PERMISSIVE CHANGE**

**TEST REPORT**

**FOR**

**BLUETOOTH V2.0 MODULE**

**MODEL NUMBER: PA3418U-1BTM**

**FCC ID: CJ6UPA3418BT**

**REPORT NUMBER: 05U3309-1**

**ISSUE DATE: MARCH 16, 2005**

*Prepared for*  
**TOSHIBA CORPORATION DIGITAL MEDIA NETWORK COMPANY**  
**2-9 SUEHIRO-CHO, OME**  
**TOKYO, 198-8710, JAPAN**

*Prepared by*  
**COMPLIANCE ENGINEERING SERVICES, INC.**  
**d.b.a.**  
**COMPLIANCE CERTIFICATION SERVICES**  
**561F MONTEREY ROAD,**  
**MORGAN HILL, CA 95037, USA**  
**TEL: (408) 463-0885**  
**FAX: (408) 463-0888**



**LAB CODE:200065-0**

Revision History

| <u>Rev.</u> | <u>Revisions</u> | <u>Revised By</u> |
|-------------|------------------|-------------------|
|-------------|------------------|-------------------|

## TABLE OF CONTENTS

|                                                         |           |
|---------------------------------------------------------|-----------|
| <b>1. ATTESTATION OF TEST RESULTS.....</b>              | <b>4</b>  |
| <b>2. TEST METHODOLOGY .....</b>                        | <b>5</b>  |
| <b>3. FACILITIES AND ACCREDITATION .....</b>            | <b>5</b>  |
| <b>4. CALIBRATION AND UNCERTAINTY.....</b>              | <b>5</b>  |
| 4.1. MEASURING INSTRUMENT CALIBRATION.....              | 5         |
| 4.2. MEASUREMENT UNCERTAINTY.....                       | 5         |
| <b>5. EQUIPMENT UNDER TEST.....</b>                     | <b>6</b>  |
| 5.1. DESCRIPTION OF EUT .....                           | 6         |
| 5.2. CLASS II PERMISSIVE CHANGE DESCRIPTION .....       | 6         |
| 5.3. MAXIMUM OUTPUT POWER .....                         | 6         |
| 5.4. DESCRIPTION OF AVAILABLE ANTENNAS.....             | 6         |
| 5.5. SOFTWARE AND FIRMWARE .....                        | 7         |
| 5.6. WORST-CASE CONFIGURATION AND MODE.....             | 7         |
| 5.7. DESCRIPTION OF TEST SETUP .....                    | 7         |
| <b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>          | <b>9</b>  |
| <b>7. LIMITS AND RESULTS .....</b>                      | <b>10</b> |
| 7.1. ANTENNA PORT CHANNEL TESTS .....                   | 10        |
| 7.1.1. 20 dB BANDWIDTH .....                            | 10        |
| 7.1.2. HOPPING FREQUENCY SEPARATION.....                | 14        |
| 7.1.3. NUMBER OF HOPPING CHANNELS.....                  | 16        |
| 7.1.4. AVERAGE TIME OF OCCUPANCY .....                  | 21        |
| 7.1.5. PEAK OUTPUT POWER .....                          | 24        |
| 7.1.6. MAXIMUM PERMISSIBLE EXPOSURE.....                | 28        |
| 7.1.7. AVERAGE POWER.....                               | 31        |
| 7.1.8. PEAK POWER SPECTRAL DENSITY .....                | 32        |
| 7.1.9. CONDUCTED SPURIOUS EMISSIONS.....                | 36        |
| 7.2. RADIATED EMISSIONS.....                            | 45        |
| 7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS .....    | 45        |
| 7.2.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ ..... | 48        |
| 7.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz.....   | 57        |
| 7.3. POWERLINE CONDUCTED EMISSIONS .....                | 61        |
| <b>8. SETUP PHOTOS.....</b>                             | <b>65</b> |

## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** TOSHIBA CORPORATION DIGITAL MEDIA NETWORK COMPANY  
2-9 SUEHIRO-CHO, OME  
TOKYO, 198-8710, JAPAN

**EUT DESCRIPTION:** BLUETOOTH V2.0 MODULE

**MODEL:** PA3418U-1BTM

**DATE OF ORIGINAL TEST:** FEBRUARY 22-23, 2005

**DATE OF ADDITIONAL TEST:** MARCH 13, 2005

| APPLICABLE STANDARDS  |                         |
|-----------------------|-------------------------|
| STANDARD              | TEST RESULTS            |
| FCC PART 15 SUBPART C | NO NON-COMPLIANCE NOTED |

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & released for CCS by:



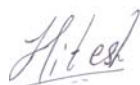
THU CHAN / EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

Original tests conducted by:



CHIN PANG / EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

Additional tests conducted by:



HITESH SOLANKI / EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                           | UNCERTAINTY    |
|-------------------------------------|----------------|
| Radiated Emission, 30 to 200 MHz    | +/- 3.3 dB     |
| Radiated Emission, 200 to 1000 MHz  | +4.5 / -2.9 dB |
| Radiated Emission, 1000 to 2000 MHz | +4.5 / -2.9 dB |
| Power Line Conducted Emission       | +/- 2.9 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The Toshiba Bluetooth module is a wireless Frequency Hopping Spread Spectrum that operates on the 2400-2483.5 MHz band. It is designed to be installed in the host system. This unit provides a power output of +1.46 dBm (1.40mw).

### 5.2. CLASS II PERMISSIVE CHANGE DESCRIPTION

The EUT was originally tested and reported under CCS project no.: 05U3286, and granted by TCB on February 28, 2005. The major changes filed under this application are as follows:

Changing from Limited Modular Approval to Full Modular Approval including all the same antennas tested under 05U3286.

Additional tests were conducted on radiated emissions and AC power line conducted emissions, while conducted emissions data remains the same as what was performed under CCS project no.: 05U3286.

### 5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

2400 to 2483.5 MHz Authorized Band

| Frequency Range<br>(MHz) | Output Power<br>(dBm) | Output Power<br>(mW) |
|--------------------------|-----------------------|----------------------|
| 2402 - 2480              | 1.46                  | 1.40                 |

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The BT radio utilizes four alternate PIFA antennas. These four antennas are:

1. HTL017L: 4.24 dBi at 2.4GHz without cable loss;
2. HTL004: 4.18 dBi at 2.4GHz without cable loss;
3. HTL008: 2.89 dBi at 2.4GHz without cable loss;
4. TIAN01: 4.02 dBi at 2.4GHz without cable loss.

## 5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the Toshiba Laptop equipment during testing was CSR-BC01  
The test utility software used during testing was Bluetest rev. 1.20.

## 5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2441 MHz.

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST |              |              |               |        |
|-----------------------------------|--------------|--------------|---------------|--------|
| Description                       | Manufacturer | Model        | Serial Number | FCC ID |
| Laptop                            | Toshiba      | PPM20U-AAAA8 | Z3044588-JU   | DoC    |
| AC Adapater                       | Toshiba      | ADP-80RH     | 148162        | DoC    |

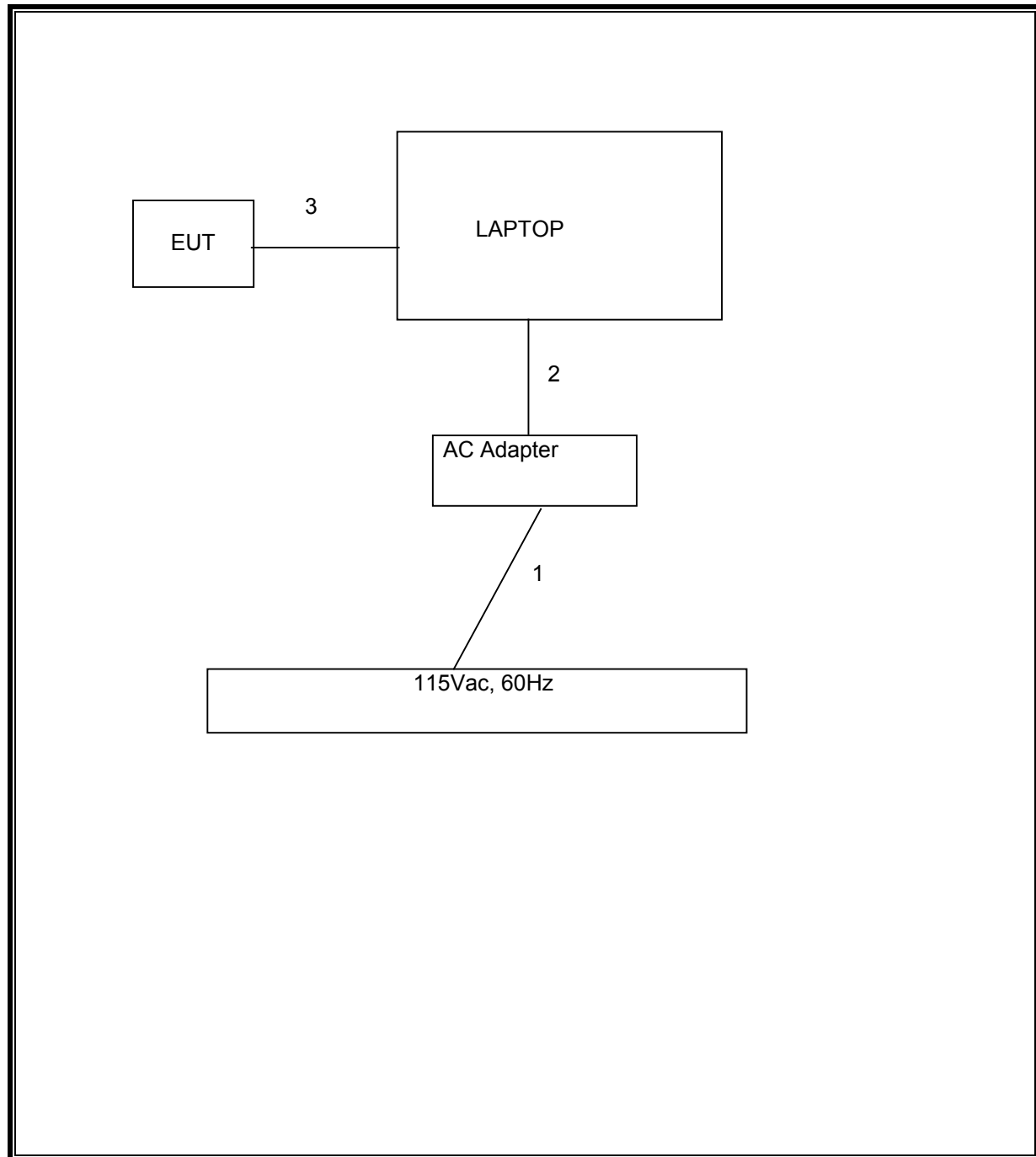
### I/O CABLES

| I/O CABLE LIST |      |                    |                |             |              |         |
|----------------|------|--------------------|----------------|-------------|--------------|---------|
| Cable No.      | Port | # of Identic Ports | Connector Type | Cable Type  | Cable Length | Remarks |
| 1              | AC   | 1                  | US 115V        | Un-shielded | 2m           | No      |
| 2              | DC   | 1                  | DC             | Un-shielded | 1m           | No      |
| 3              | USB  | 1                  | USB            | Un-shielded | 1.5m         | No      |

### TEST SETUP

The EUT connected to host laptop computer during the tests via USB cable. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST           |                |                  |               |            |
|-------------------------------|----------------|------------------|---------------|------------|
| Description                   | Manufacture    | Model            | Serial Number | Cal Due    |
| EMI Test Receiver             | R & S          | ESHS 20          | 827129/006    | 10/22/2005 |
| Line Stabilizer / Conditioner | Tripplite      | LC-1800a         | A0051681      | CNR        |
| LISN, 10 kHz ~ 30 MHz         | FCC            | LISN-50/250-25-2 | 2023          | 8/30/05    |
| Amplifier 1-26GHz             | MITEQ          | NSP2600-SP       | 924342        | 8/17/05    |
| 30MHz---- 2Ghz                | Sunol Sciences | JB1 Antenna      | A121003       | 9/21/05    |
| Spectrum Analyzer, 26.5 GHz   | HP             | 8593EM           | 3710A00205    | 1/6/06     |
| Preamplifier, 1300MHz         | HP             | 8447D            | 2944A06550    | 8/26/05    |
| PSA Series Spectrum Analyzer  | Agilent        | E4440A           | US42511954    | 6/16/05    |
| Peak Power Meter              | Agilent        | E4416A           | GB41291160    | 2/9/06     |
| Peak / Average Power Sensor   | Agilent        | E9327A           | US40440755    | 2/10/06    |
| 4.0G HPF                      | MicroTronic    | HPM13193         | 2             | CNR        |

## 7. LIMITS AND RESULTS

### 7.1. ANTENNA PORT CHANNEL TESTS

#### 7.1.1. 20 dB BANDWIDTH

##### LIMIT

None; for reporting purposes only.

##### TEST PROCEDURE

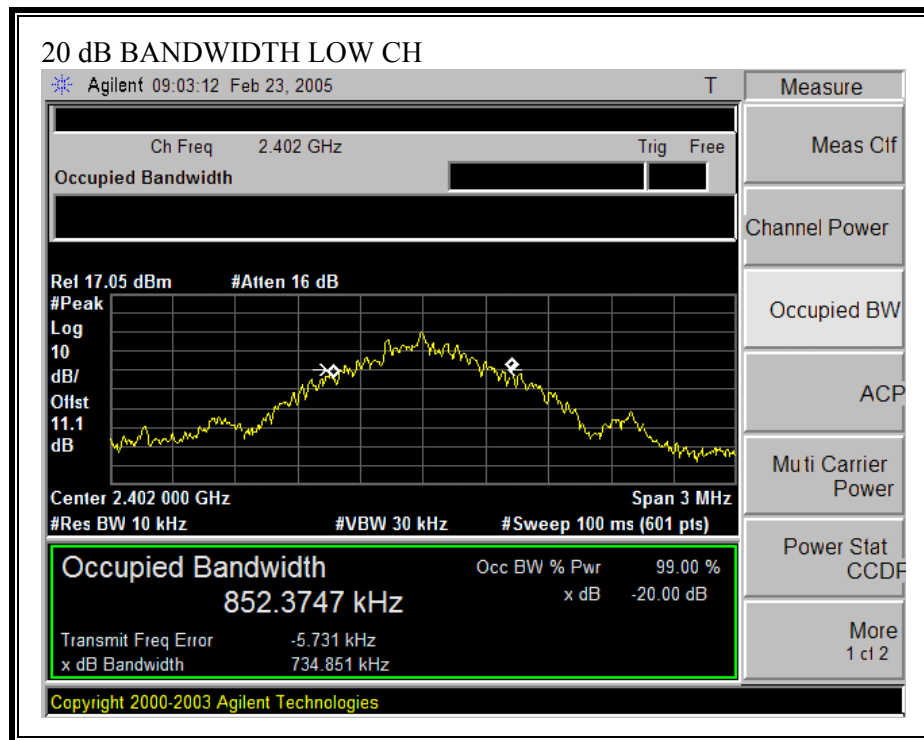
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

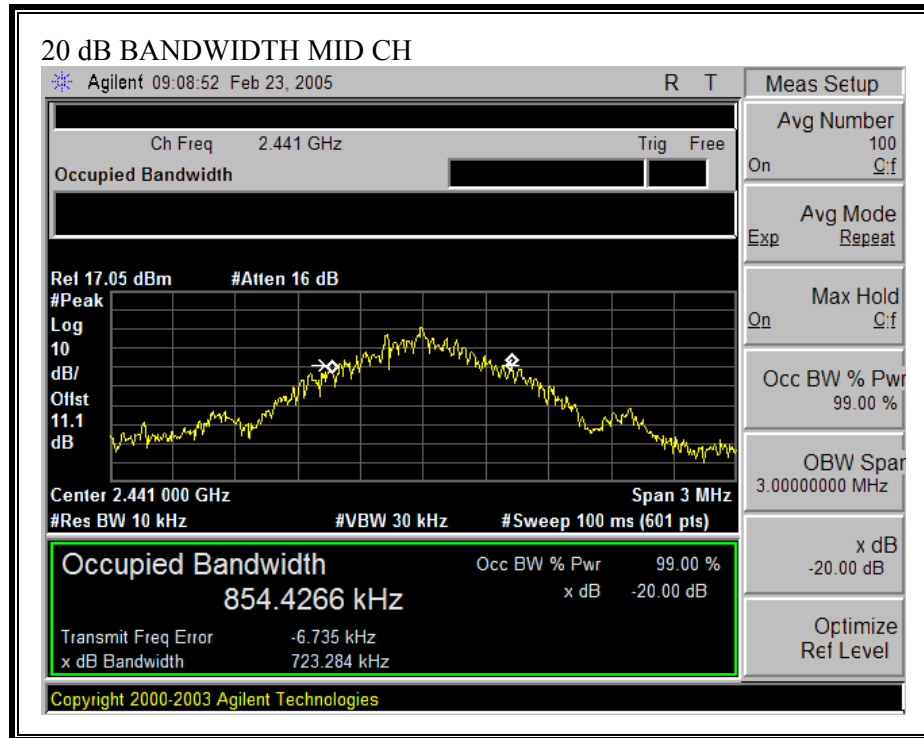
##### RESULTS

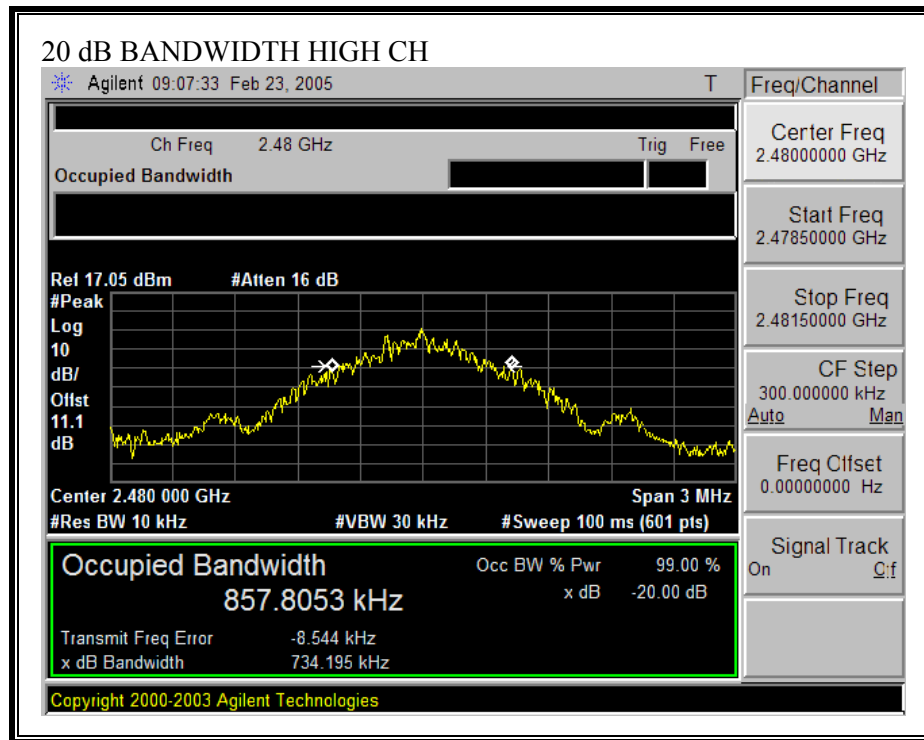
No non-compliance noted:

| Channel | Frequency<br>(MHz) | 20 dB Bandwidth<br>(kHz) |
|---------|--------------------|--------------------------|
| Low     | 2402               | 734.851                  |
| Middle  | 2441               | 723.284                  |
| High    | 2480               | 734.195                  |

## 20 dB BANDWIDTH







### **7.1.2. HOPPING FREQUENCY SEPARATION**

#### **LIMIT**

§15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

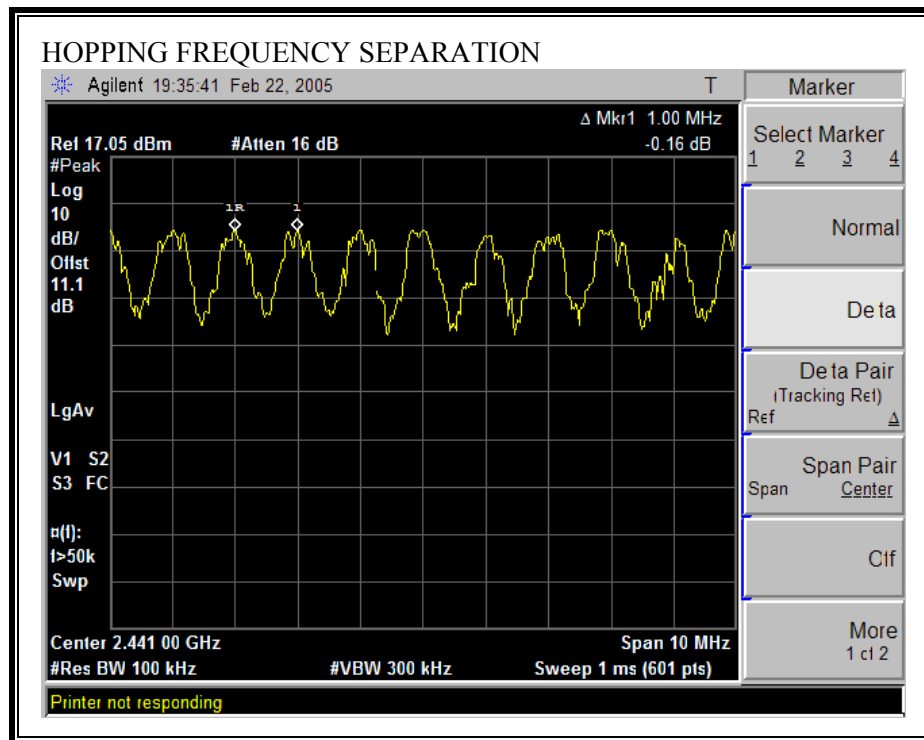
#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

#### **RESULTS**

No non-compliance noted:

## HOPPING FREQUENCY SEPARATION



### **7.1.3. NUMBER OF HOPPING CHANNELS**

#### **LIMIT**

§15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

#### **TEST PROCEDURE**

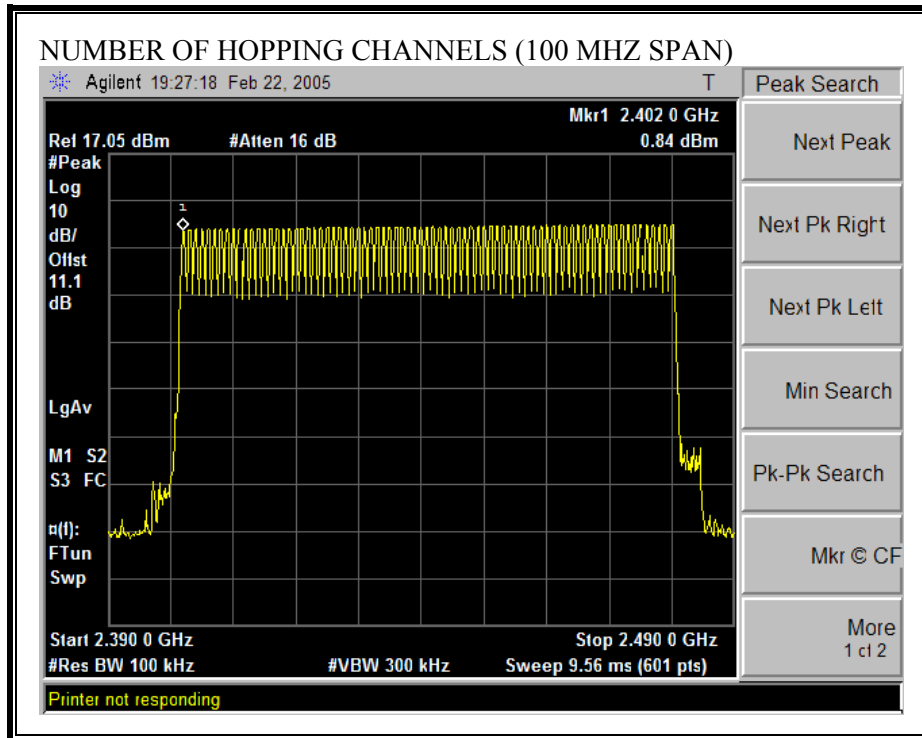
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

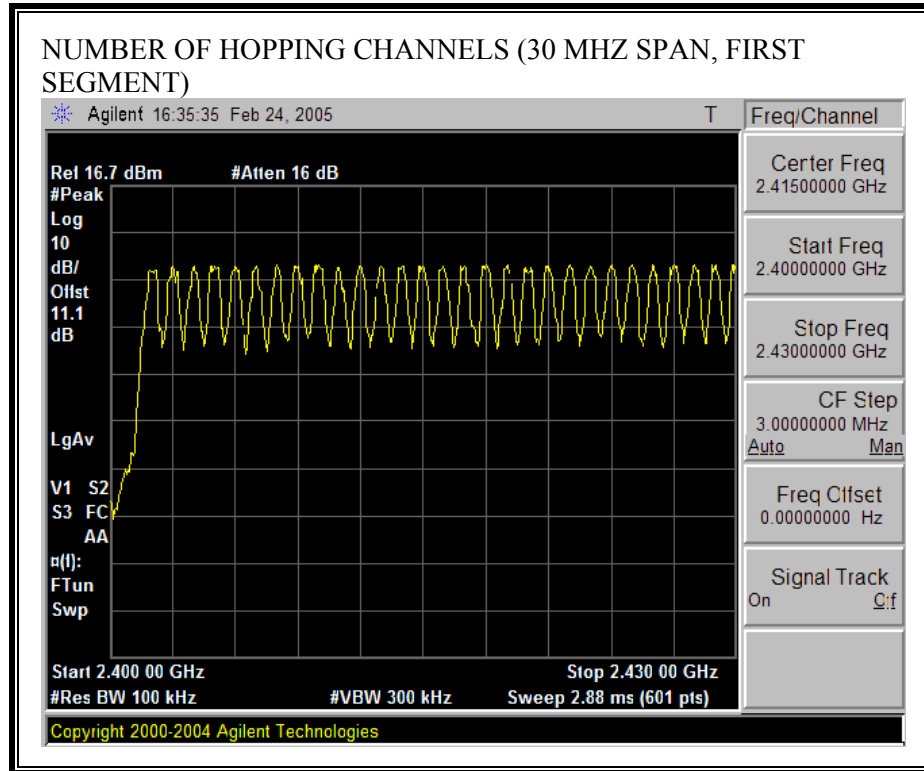
#### **RESULTS**

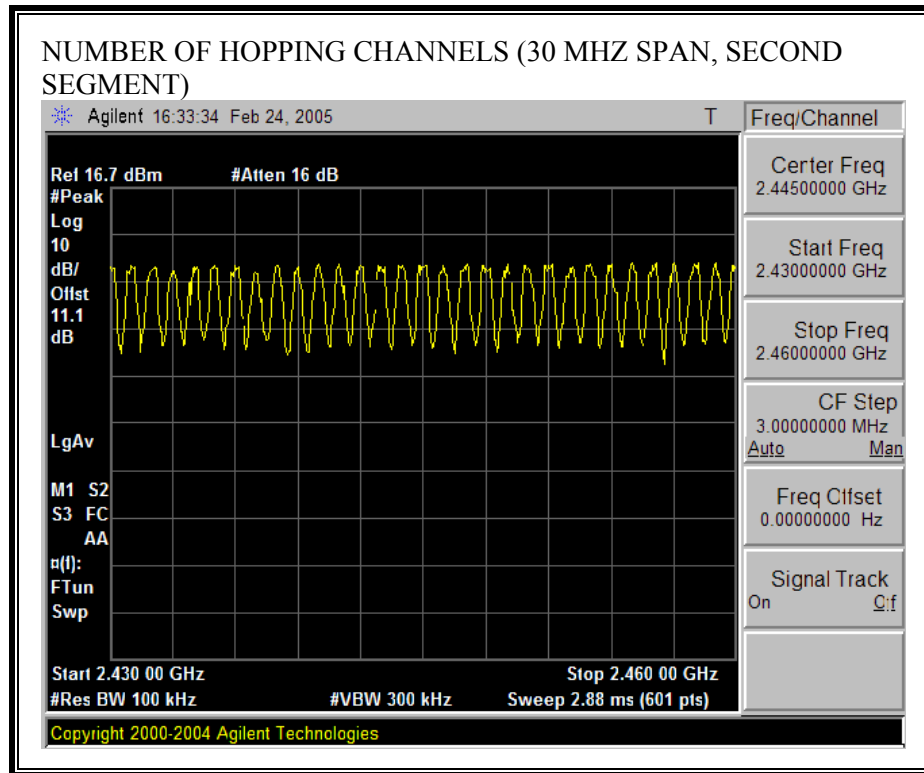
No non-compliance noted:

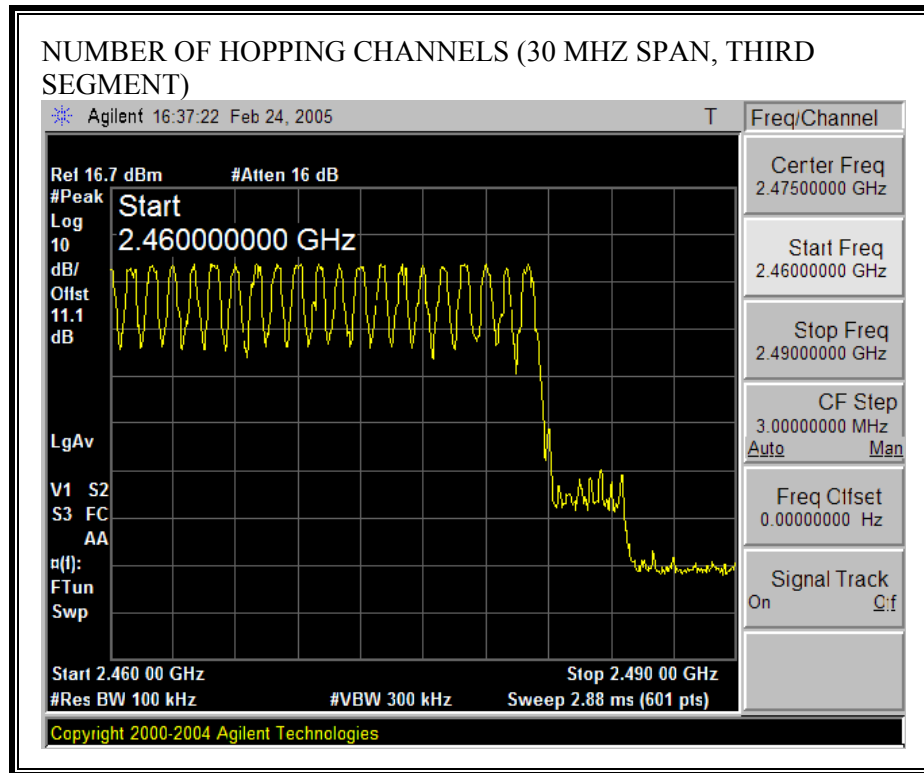
79 Channels observed.

**NUMBER OF HOPPING CHANNELS**









#### **7.1.4. AVERAGE TIME OF OCCUPANCY**

##### **LIMIT**

§15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping 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.

##### **TEST PROCEDURE**

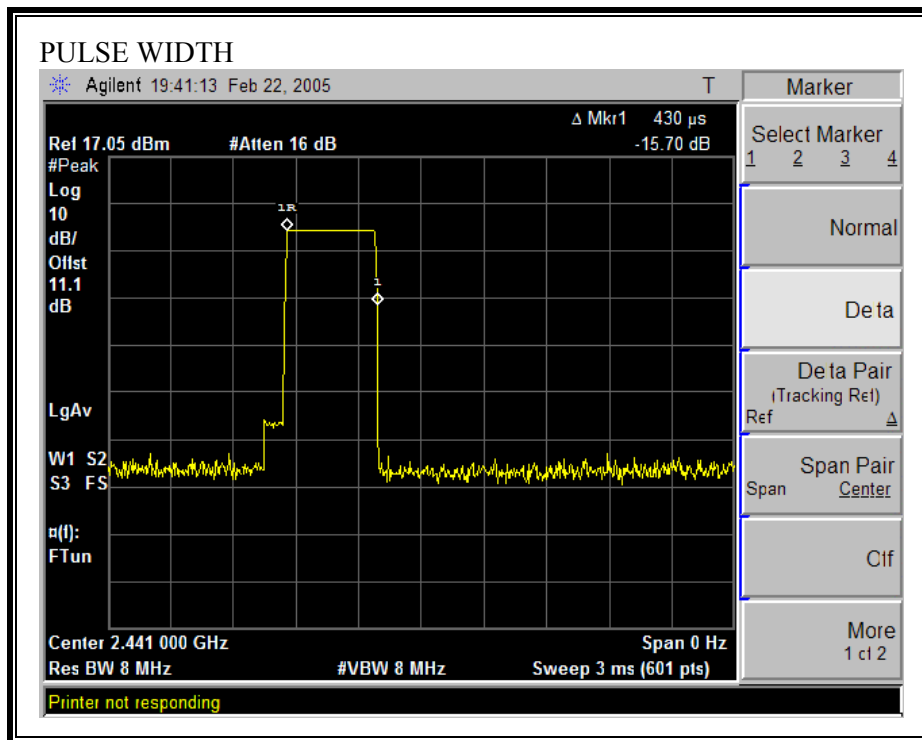
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to 10 \* (# of pulses in 3.16 s) \* pulse width.

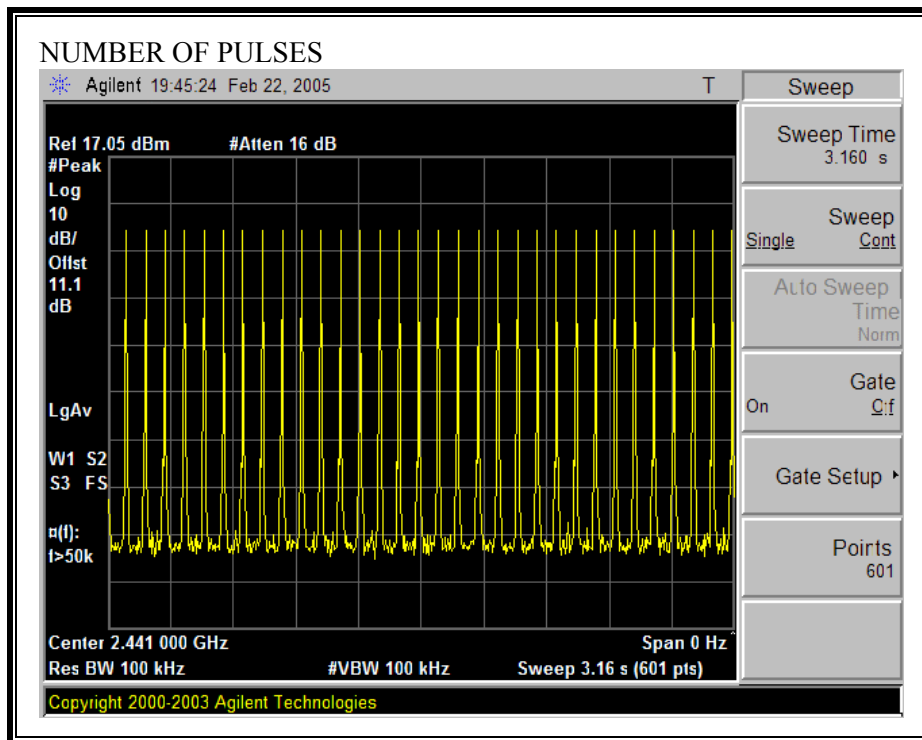
##### **RESULTS**

No non-compliance noted:

## PULSE WIDTH



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



## 7.1.5. PEAK OUTPUT POWER

### PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

1

The maximum antenna gain is 4.18dBi, therefore the limit is 30 dBm.

### TEST PROCEDURE

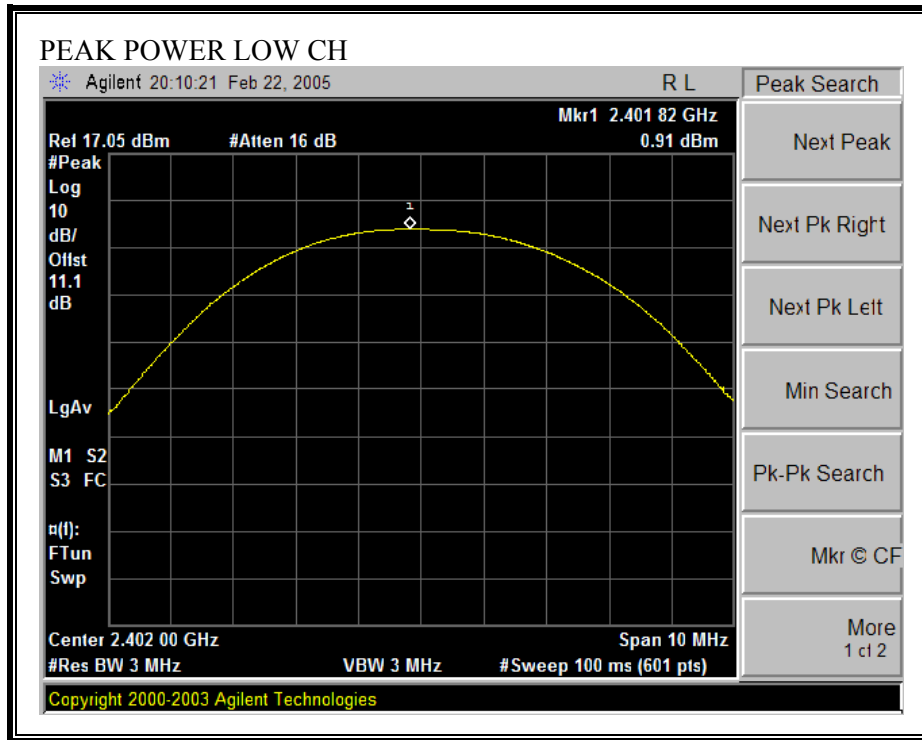
The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

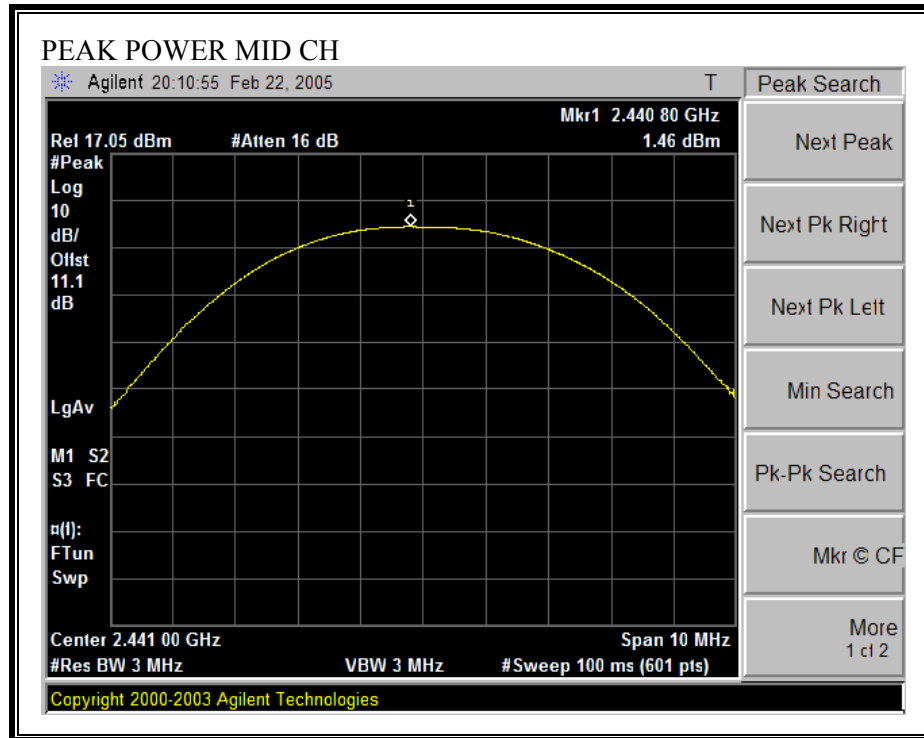
### RESULTS

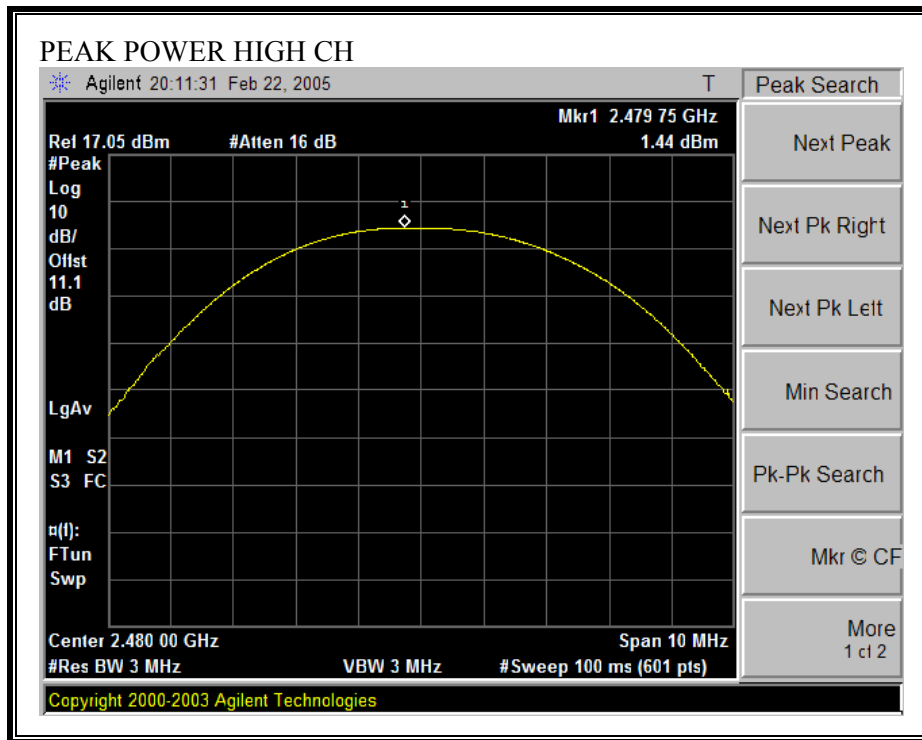
No non-compliance noted:

| Channel | Frequency<br>(MHz) | Peak Power<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|---------------------|----------------|----------------|
| Low     | 2402               | 0.91                | 30             | -29.09         |
| Middle  | 2441               | 1.46                | 30             | -28.54         |
| High    | 2480               | 1.44                | 30             | -28.56         |

**OUTPUT POWER**







## 7.1.6. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency range (MHz)                                   | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|---------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                               |                               |                                     |                          |
| 0.3–3.0 .....                                           | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0–30 .....                                            | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30–300 .....                                            | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300–1500 .....                                          | .....                         | .....                         | f/300                               | 6                        |
| 1500–100,000 .....                                      | .....                         | .....                         | 5                                   | 6                        |
| (B) 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                       |

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| 30–300 .....          | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300–1500 .....        | .....                         | .....                         | f/1500                              | 30                       |
| 1500–100,000 .....    | .....                         | .....                         | 1.0                                 | 30                       |

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

## **CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

Equation (1) and the measured peak power is used to calculate the MPE distance.

## **LIMITS**

From §1.1310 Table 1 (B),  $S = 1.0 \text{ mW/cm}^2$

## **RESULTS**

No non-compliance noted:

| <b>Power Density<br/>Limit<br/>(mW/cm<sup>2</sup>)</b> | <b>Output<br/>Power<br/>(dBm)</b> | <b>Antenna<br/>Gain<br/>(dBi)</b> | <b>MPE<br/>Distance<br/>(cm)</b> |
|--------------------------------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| 1.0                                                    | 1.46                              | 4.24                              | 0.54                             |

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

### 7.1.7. AVERAGE POWER

#### AVERAGE POWER LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11.1 dB (including 10 dB pad and 1.1dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency<br>(MHz) | Average Power<br>(dBm) |
|---------|--------------------|------------------------|
| Low     | 2402               | 0.32                   |
| Middle  | 2441               | 0.88                   |
| High    | 2480               | 1.02                   |

### 7.1.8. PEAK POWER SPECTRAL DENSITY

#### LIMIT

§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 3 kHz band during any time interval of continuous transmission.

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

#### TEST PROCEDURE

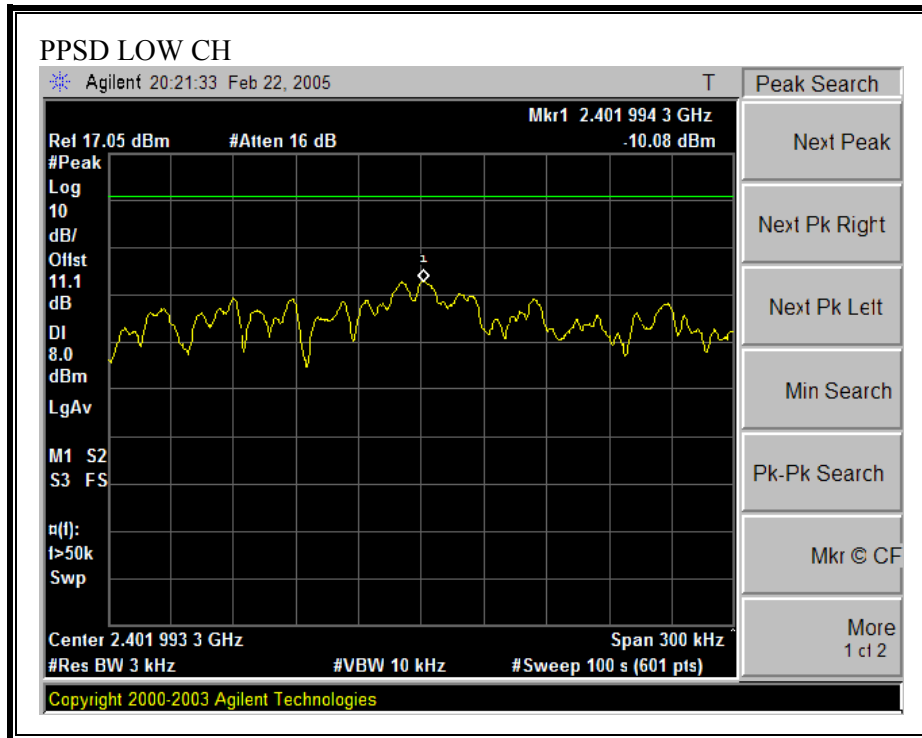
The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

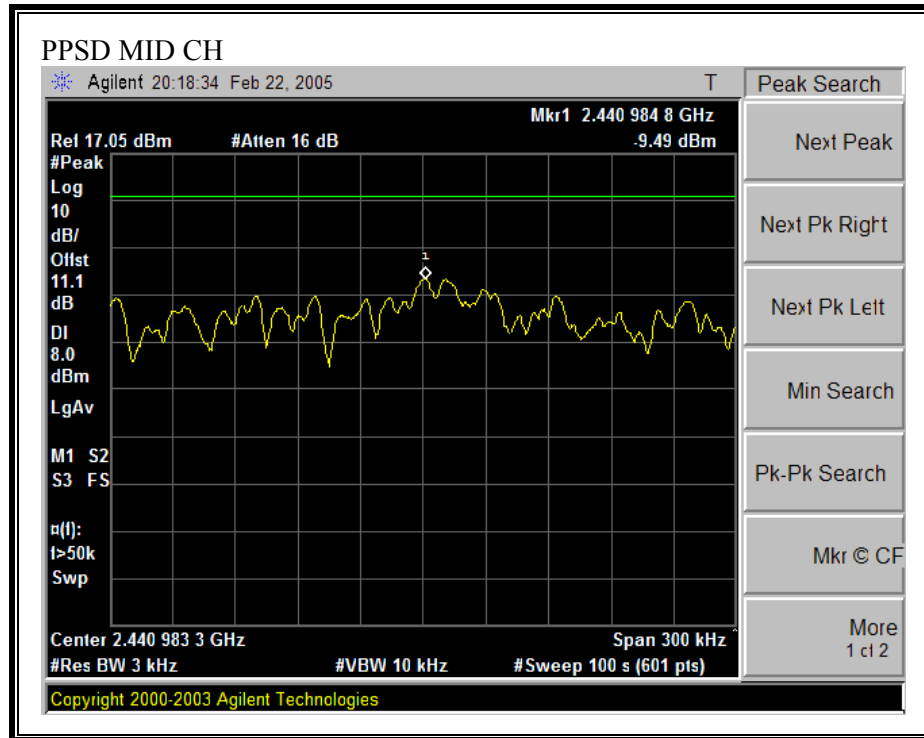
#### RESULTS

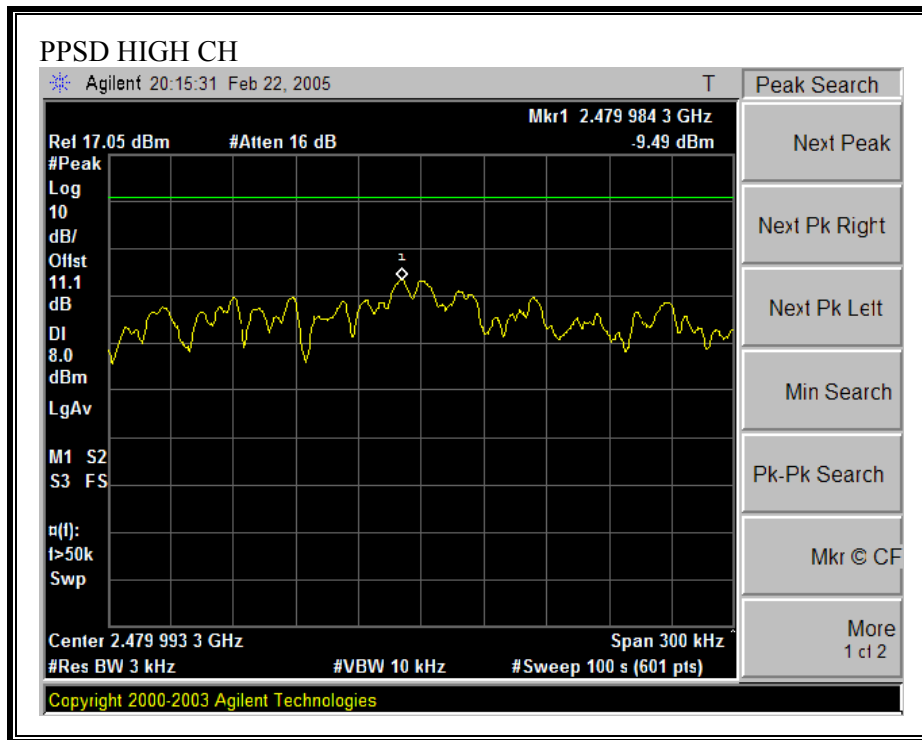
No non-compliance noted:

| Channel | Frequency<br>(MHz) | PPSD<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|---------------|----------------|----------------|
| Low     | 2402               | -10.08        | 8              | -18.08         |
| Middle  | 2441               | -9.49         | 8              | -17.49         |
| High    | 2480               | -9.49         | 8              | -17.49         |

**PEAK POWER SPECTRAL DENSITY**







## **7.1.9. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### **TEST PROCEDURE**

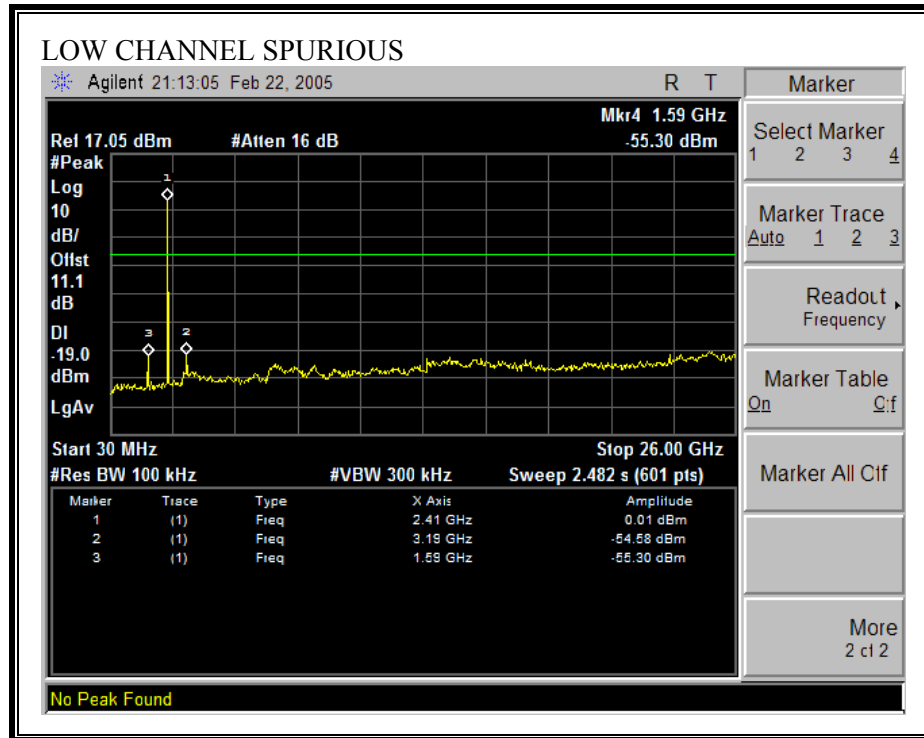
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

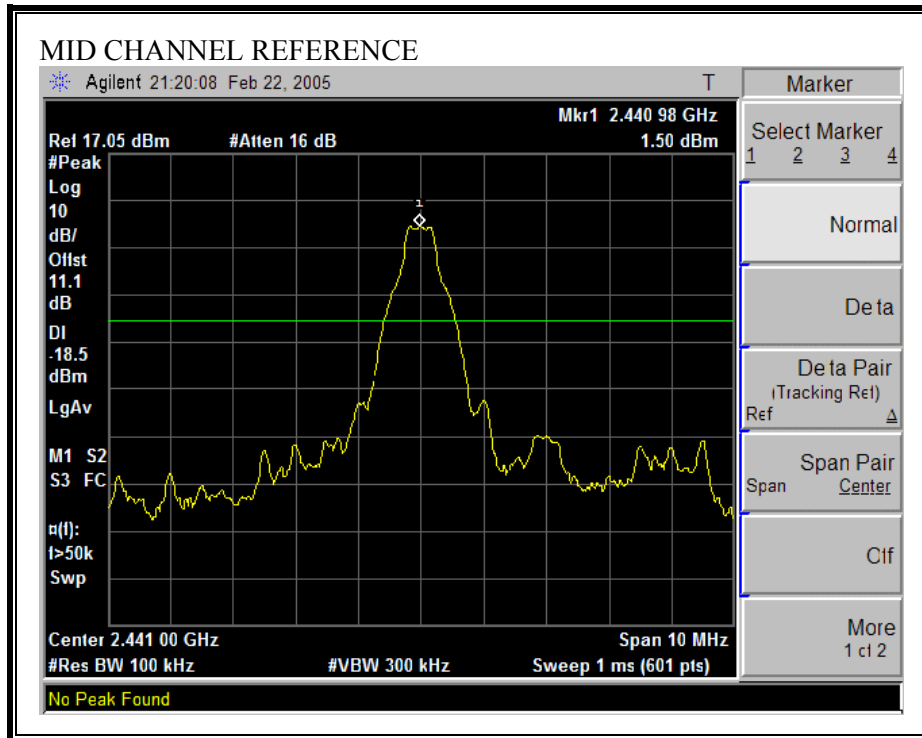
### **RESULTS**

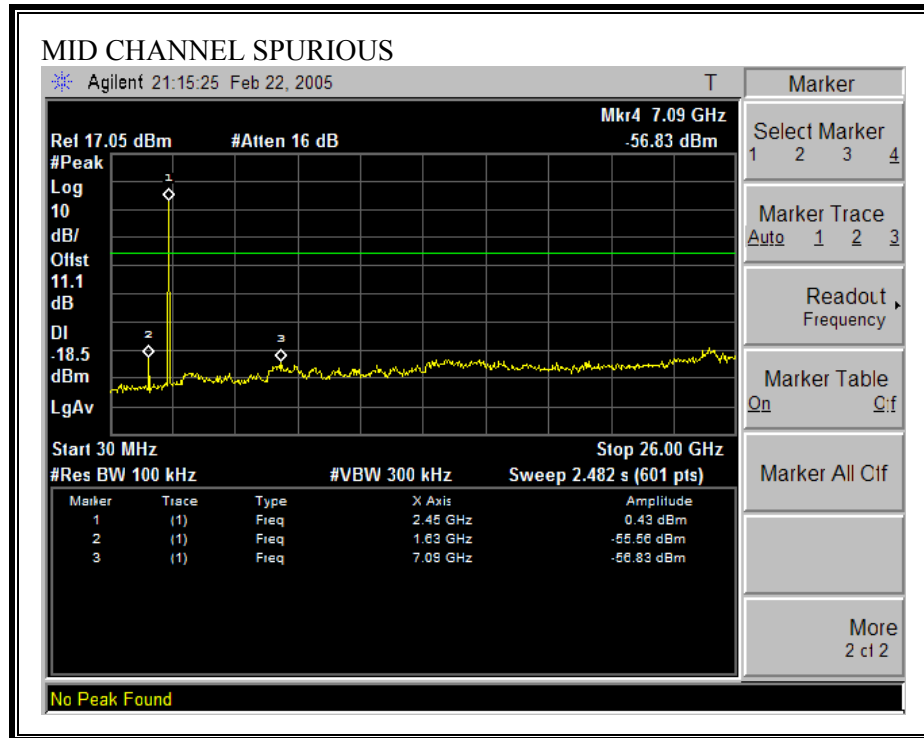
No non-compliance noted:



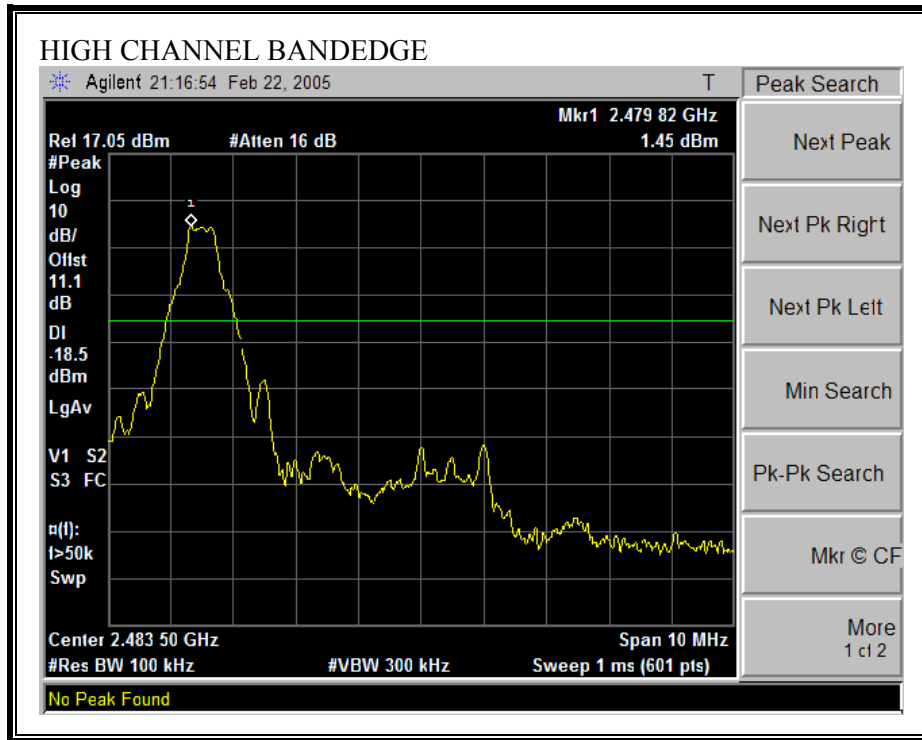


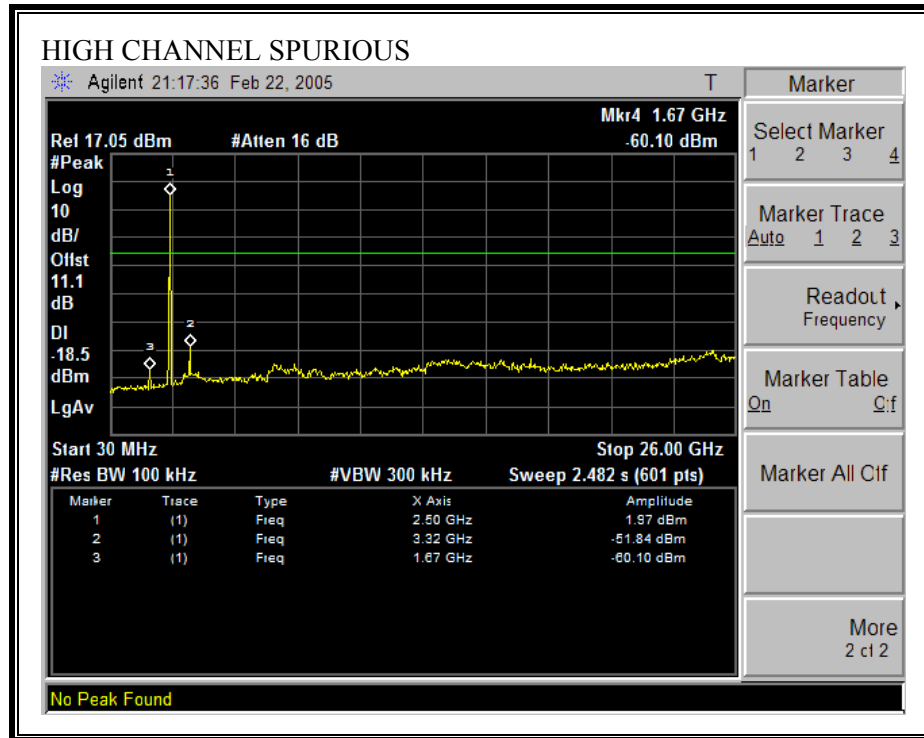
**SPURIOUS EMISSIONS, MID CHANNEL**



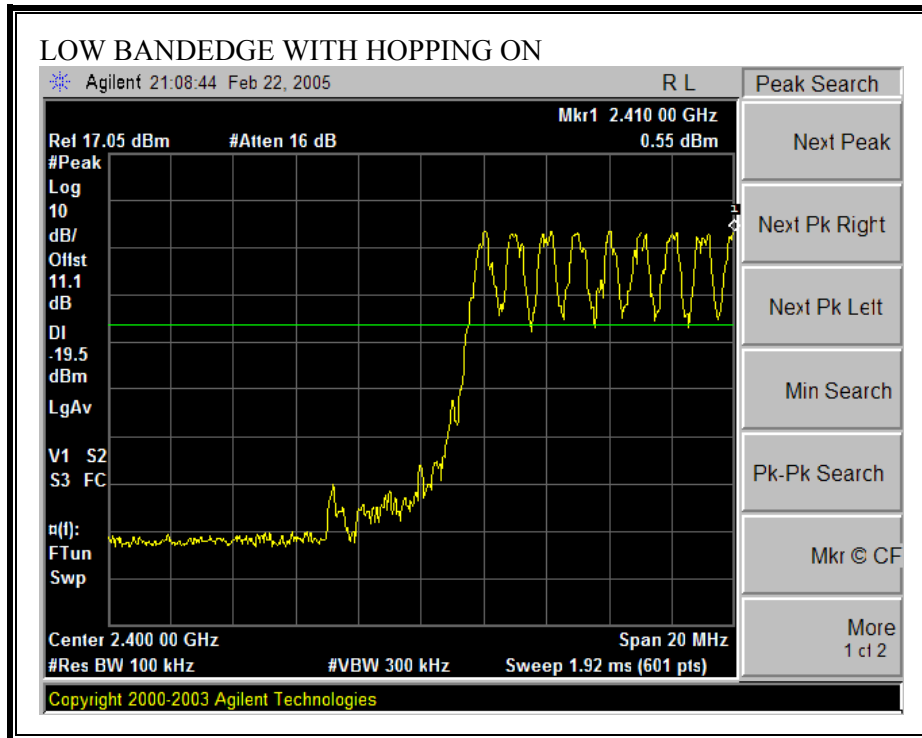


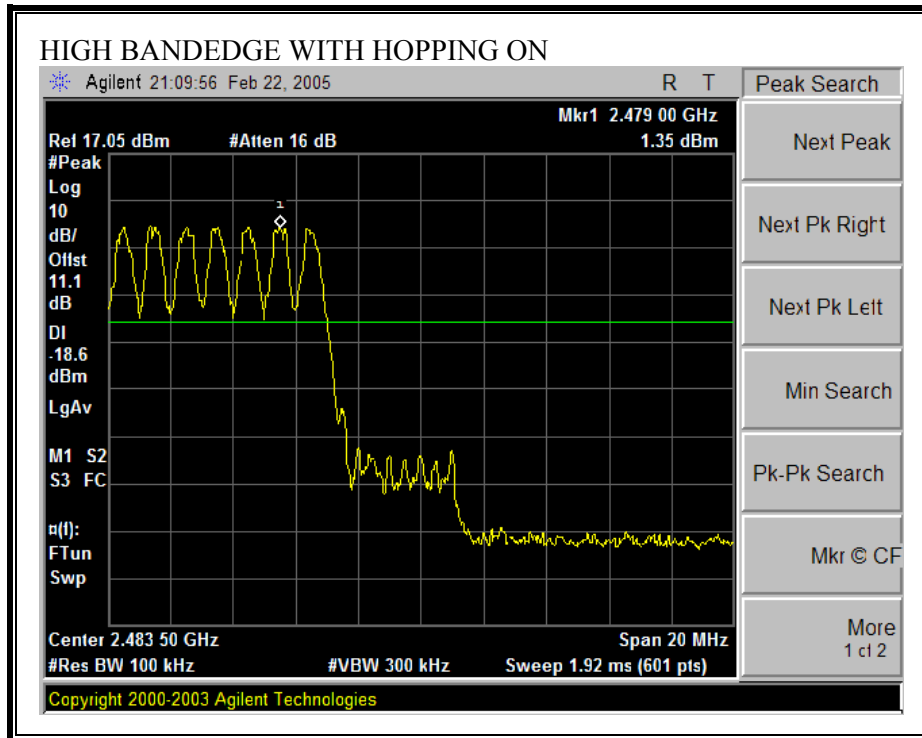
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**





## 7.2. RADIATED EMISSIONS

### 7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

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

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

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

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

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

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(meters) |
|--------------------|--------------------------------------|----------------------------------|
| 30 - 88            | 100 **                               | 3                                |
| 88 - 216           | 150 **                               | 3                                |
| 216 - 960          | 200 **                               | 3                                |
| Above 960          | 500                                  | 3                                |

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

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

## **TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

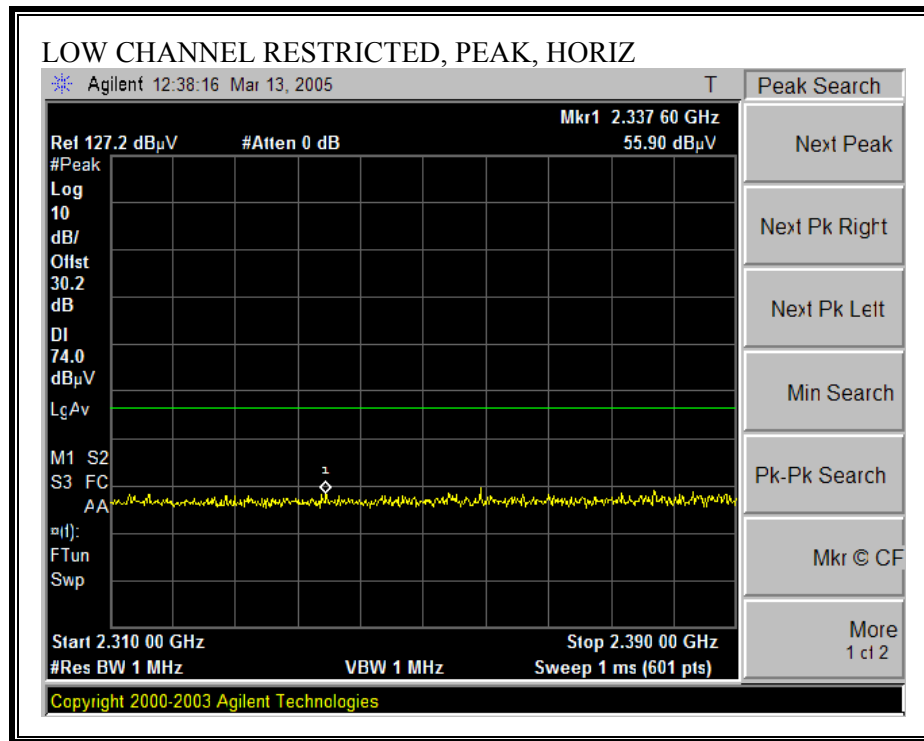
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

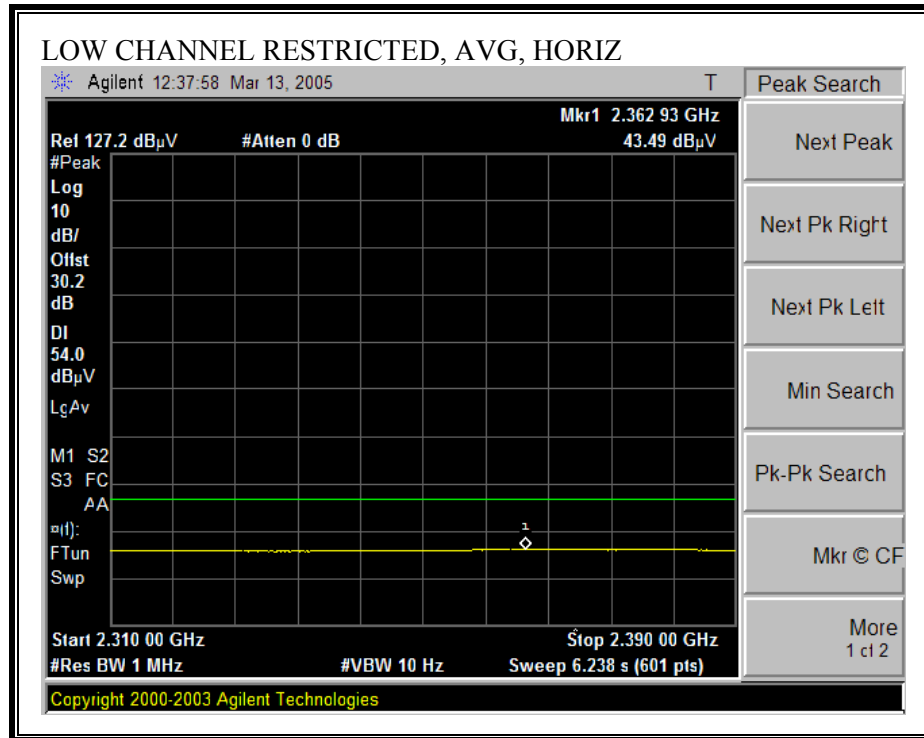
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

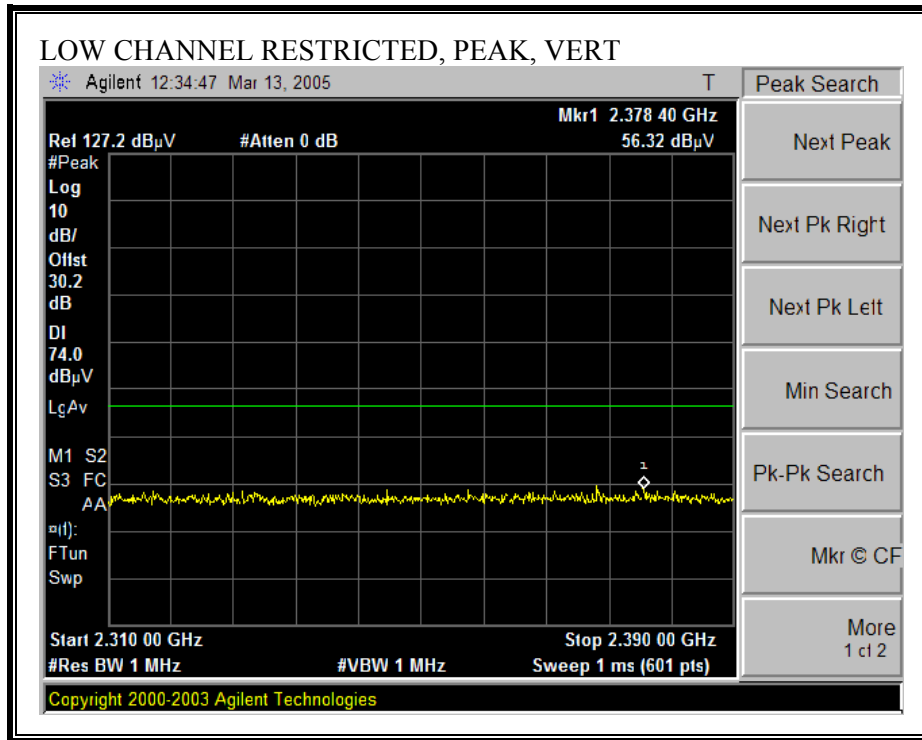
## 7.2.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

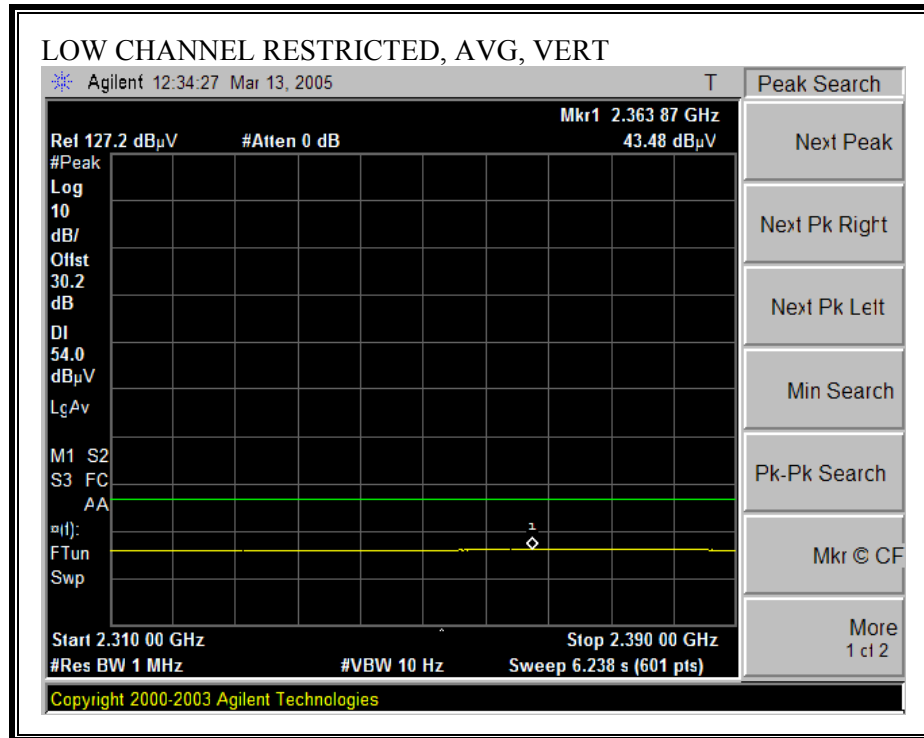
### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



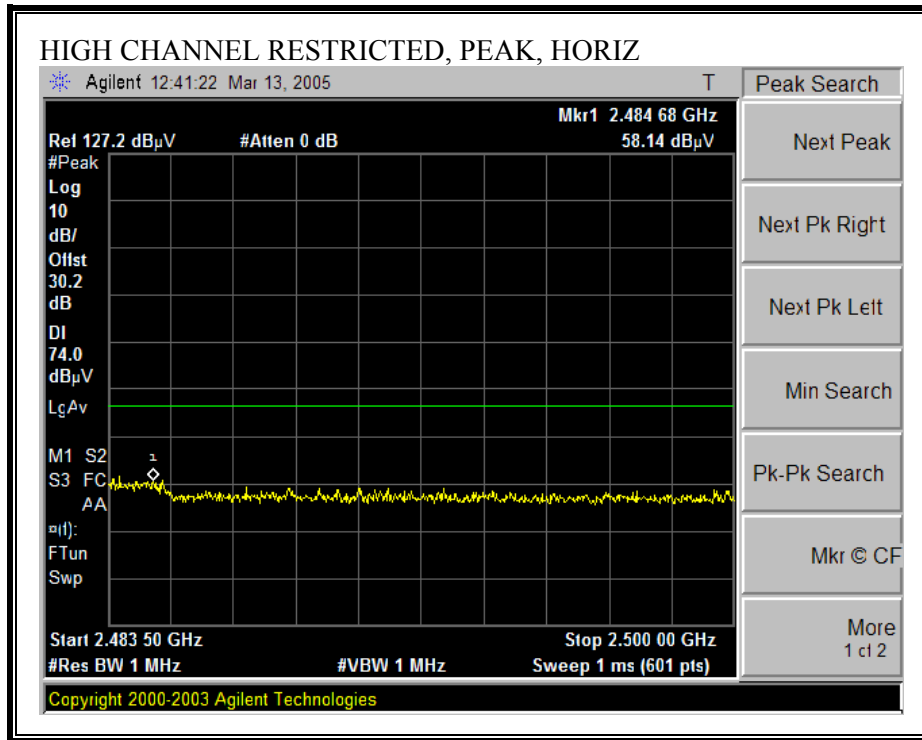


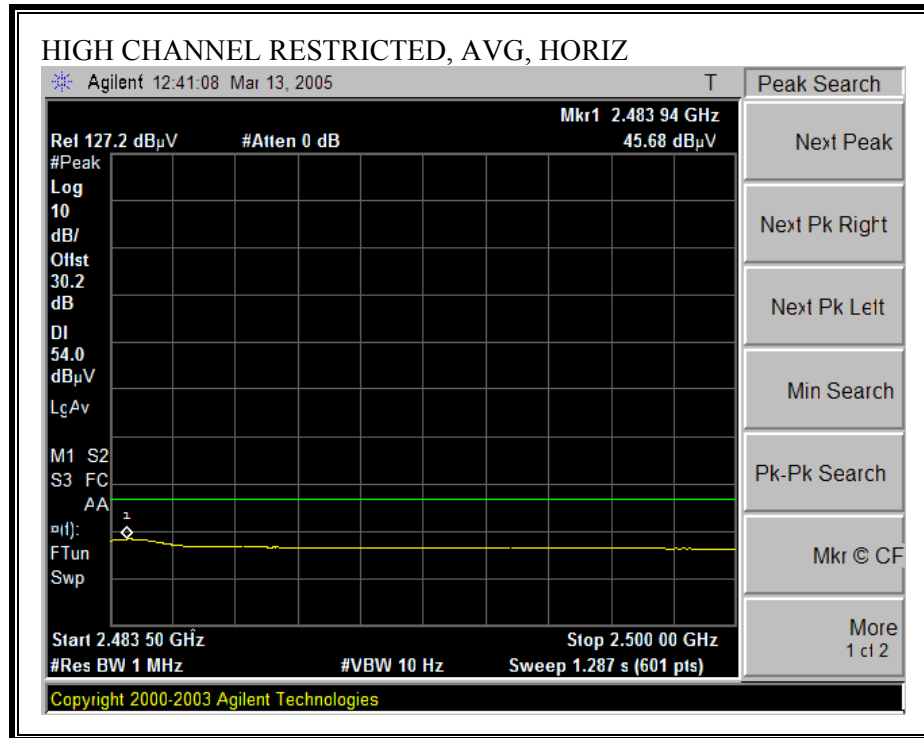
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



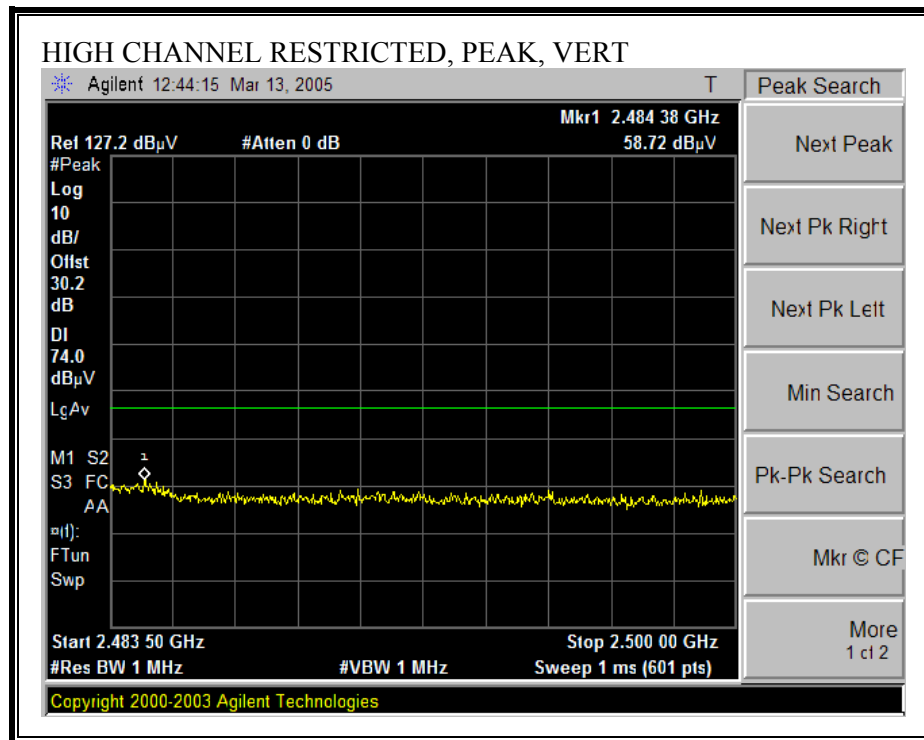


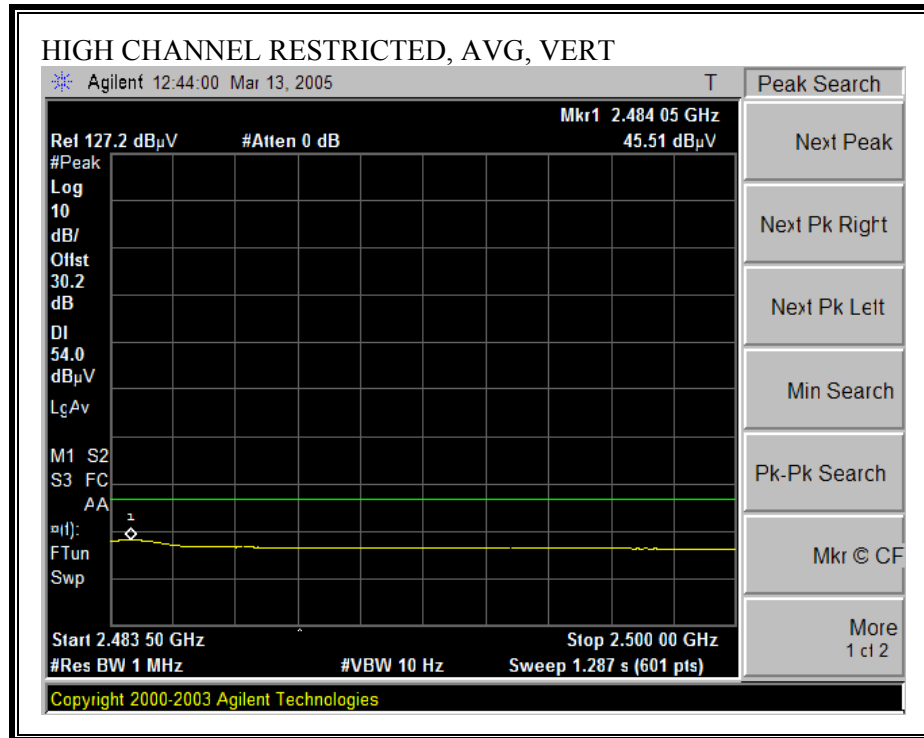
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



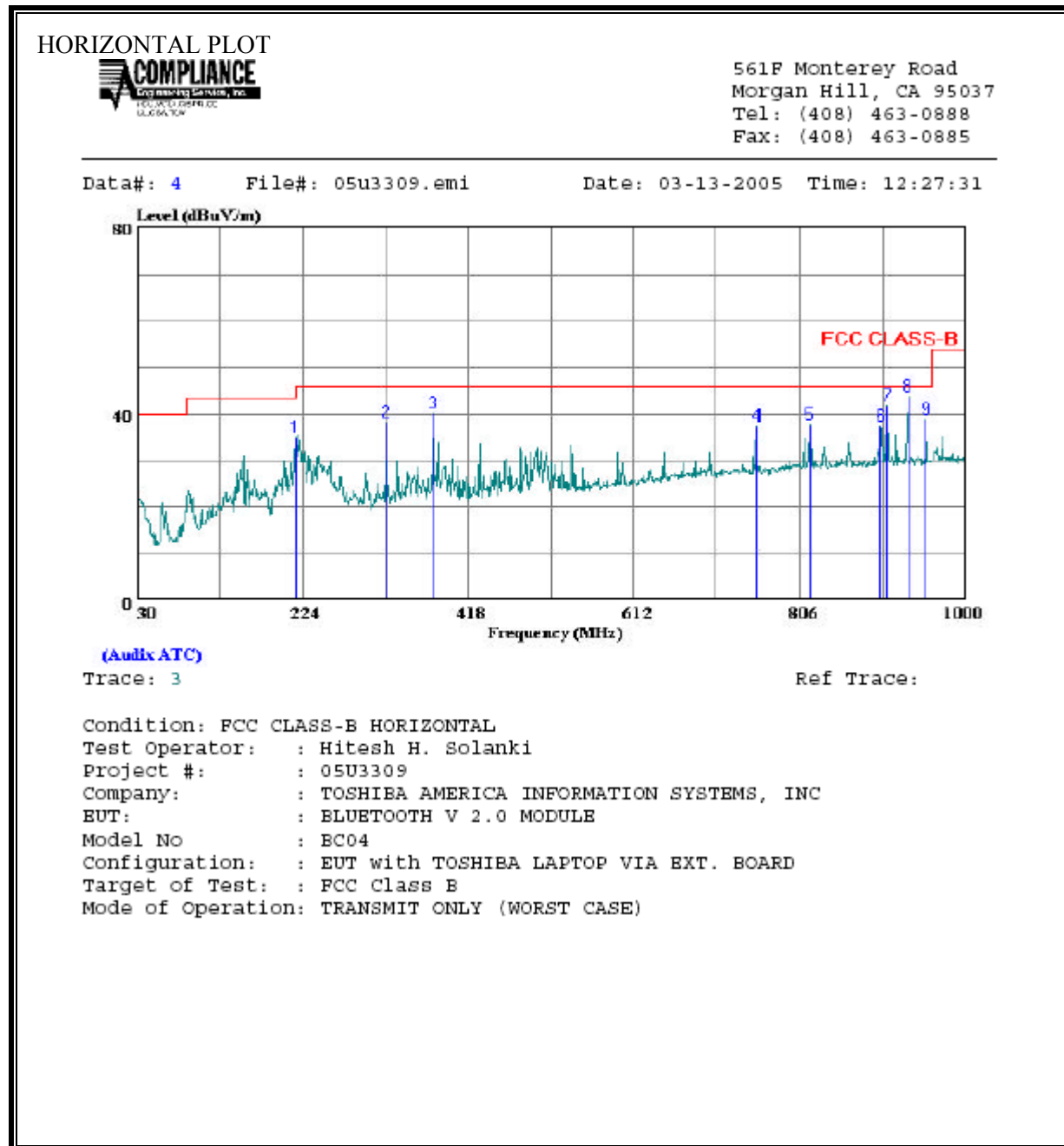


## HARMONICS AND SPURIOUS EMISSIONS

|                                                                                                                                                                                                                                                   |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------------------------|-------------------|------------------------|----------|------------------------|--------------------------------|----------------------------|----------------|-------------------|------------------|------------------------|------------------------------|--------------------------------------------------------------------------------------|----------------|--|
| 03/13/05 High Frequency Measurement<br>Compliance Certification Services, Morgan Hill Open Field Site                                                                                                                                             |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| Test Engr: HITESH H. SOLANKI<br>Project #: 05U3309<br>Company: TOSHIBA AMERICA INFORMATION SYSTEMS, INC.<br>EUT Descrip.: BLUETOOTH V 2.0 MODULE<br>EUT M/N: BC04<br>Test Target: FCC CLASS B<br>Mode Oper: TRANSMIT ONLY (ON SPECIFIED CHANNELS) |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| Test Equipment:                                                                                                                                                                                                                                   |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| EMCO Horn 1-18GHz<br>T60; S/N: 2238 @3m                                                                                                                                                                                                           |                       | Pre-amplifier 1-26GHz<br>T63 Miteq 646456 |                   | Pre-amplifier 26-40GHz |          | Horn > 18GHz           |                                | Limit<br>FCC 15.209        |                |                   |                  |                        |                              |                                                                                      |                |  |
| Hi Frequency Cables                                                                                                                                                                                                                               |                       | 2 foot cable<br>3_Vien                    |                   | 3 foot cable<br>3_Vien |          | 4 foot cable<br>3_Vien |                                | 12 foot cable<br>12_Hitesh |                | HPF<br>HPF_4.0GHz |                  | Reject Filter<br>R_002 |                              | Peak Measurements<br>REW=VBW=1MHz<br><br>Average Measurements<br>REW=1MHz ; VBW=10Hz |                |  |
| f<br>GHz                                                                                                                                                                                                                                          | Dist<br>(m)           | Read Pk<br>dBuV                           | Read Avg.<br>dBuV | AF<br>dB/m             | CL<br>dB | Amp<br>dB              | D Corr<br>dB                   | Filtr<br>dB                | Peak<br>dBuV/m | Avg<br>dBuV/m     | Pk Lim<br>dBuV/m | Avg Lim<br>dBuV/m      | Pk Mar<br>dB                 | Avg Mar<br>dB                                                                        | Notes<br>(V/H) |  |
| LOW CHANNEL 2402 MHz                                                                                                                                                                                                                              |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| 4.804                                                                                                                                                                                                                                             | 3.0                   | 53.4                                      | 40.1              | 33.0                   | 3.8      | -35.5                  | 0.0                            | 0.6                        | 55.3           | 42.0              | 74               | 54                     | -18.7                        | -12.0                                                                                | H              |  |
| 4.804                                                                                                                                                                                                                                             | 3.0                   | 53.9                                      | 38.8              | 33.0                   | 3.8      | -35.5                  | 0.0                            | 0.6                        | 55.8           | 40.7              | 74               | 54                     | -18.2                        | -13.3                                                                                | V              |  |
| 7.206                                                                                                                                                                                                                                             | 3.0                   | 46.1                                      | 34.3              | 35.8                   | 5.2      | -34.9                  | 0.0                            | 0.6                        | 52.8           | 41.0              | 74               | 54                     | -21.2                        | -13.0                                                                                | H              |  |
| 7.206                                                                                                                                                                                                                                             | 3.0                   | 44.9                                      | 33.1              | 35.8                   | 5.2      | -34.9                  | 0.0                            | 0.6                        | 51.6           | 39.8              | 74               | 54                     | -22.4                        | -14.2                                                                                | V              |  |
| MID CHANNEL 2441 MHz                                                                                                                                                                                                                              |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| 4.882                                                                                                                                                                                                                                             | 3.0                   | 53.2                                      | 39.9              | 33.0                   | 3.9      | -35.5                  | 0.0                            | 0.6                        | 55.2           | 41.9              | 74               | 54                     | -18.8                        | -12.1                                                                                | H              |  |
| 4.882                                                                                                                                                                                                                                             | 3.0                   | 53.2                                      | 39.5              | 33.0                   | 3.9      | -35.5                  | 0.0                            | 0.6                        | 55.2           | 41.5              | 74               | 54                     | -18.8                        | -12.5                                                                                | V              |  |
| 7.323                                                                                                                                                                                                                                             | 3.0                   | 44.6                                      | 33.0              | 35.9                   | 5.3      | -34.8                  | 0.0                            | 0.6                        | 51.6           | 40.0              | 74               | 54                     | -22.4                        | -14.0                                                                                | H              |  |
| 7.323                                                                                                                                                                                                                                             | 3.0                   | 44.0                                      | 32.2              | 35.9                   | 5.3      | -34.8                  | 0.0                            | 0.6                        | 51.0           | 39.2              | 74               | 54                     | -23.0                        | -14.8                                                                                | V              |  |
| 9.764                                                                                                                                                                                                                                             | 3.0                   | 42.6                                      | 31.2              | 38.3                   | 6.5      | -33.0                  | 0.0                            | 0.8                        | 55.2           | 43.8              | 74               | 54                     | -18.8                        | -10.2                                                                                | H              |  |
| 9.764                                                                                                                                                                                                                                             | 3.0                   | 42.0                                      | 30.7              | 38.3                   | 6.5      | -33.0                  | 0.0                            | 0.8                        | 54.6           | 43.3              | 74               | 54                     | -19.4                        | -10.7                                                                                | V              |  |
| HIGH CHANNEL 2480 MHz                                                                                                                                                                                                                             |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| 4.960                                                                                                                                                                                                                                             | 3.0                   | 52.1                                      | 38.5              | 33.0                   | 3.9      | -35.5                  | 0.0                            | 0.6                        | 54.2           | 40.6              | 74               | 54                     | -19.8                        | -13.4                                                                                | H              |  |
| 4.960                                                                                                                                                                                                                                             | 3.0                   | 54.4                                      | 40.2              | 33.0                   | 3.9      | -35.5                  | 0.0                            | 0.6                        | 56.5           | 42.3              | 74               | 54                     | -17.5                        | -11.7                                                                                | V              |  |
| 7.440                                                                                                                                                                                                                                             | 3.0                   | 44.8                                      | 32.9              | 36.1                   | 5.3      | -34.7                  | 0.0                            | 0.6                        | 52.1           | 40.2              | 74               | 54                     | -21.9                        | -13.8                                                                                | H              |  |
| 7.440                                                                                                                                                                                                                                             | 3.0                   | 44.6                                      | 32.8              | 36.1                   | 5.3      | -34.7                  | 0.0                            | 0.6                        | 51.9           | 40.1              | 74               | 54                     | -22.1                        | -13.9                                                                                | V              |  |
| Note: No other emissions were detected above the system noise floor.                                                                                                                                                                              |                       |                                           |                   |                        |          |                        |                                |                            |                |                   |                  |                        |                              |                                                                                      |                |  |
| f                                                                                                                                                                                                                                                 | Measurement Frequency |                                           |                   |                        |          | Amp                    | Preamp Gain                    |                            |                |                   |                  | Avg Lim                | Average Field Strength Limit |                                                                                      |                |  |
| Dist                                                                                                                                                                                                                                              | Distance to Antenna   |                                           |                   |                        |          | D Corr                 | Distance Correct to 3 meters   |                            |                |                   |                  | Pk Lim                 | Peak Field Strength Limit    |                                                                                      |                |  |
| Read                                                                                                                                                                                                                                              | Analyzer Reading      |                                           |                   |                        |          | Avg                    | Average Field Strength @ 3 m   |                            |                |                   |                  | Avg Mar                | Margin vs. Average Limit     |                                                                                      |                |  |
| AF                                                                                                                                                                                                                                                | Antenna Factor        |                                           |                   |                        |          | Peak                   | Calculated Peak Field Strength |                            |                |                   |                  | Pk Mar                 | Margin vs. Peak Limit        |                                                                                      |                |  |
| CL                                                                                                                                                                                                                                                | Cable Loss            |                                           |                   |                        |          | HPF                    | High Pass Filter               |                            |                |                   |                  |                        |                              |                                                                                      |                |  |

### 7.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



# HORIZONTAL DATA

Page: 1

|   | Freq    | Read<br>Level | Factor | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|---------|---------------|--------|--------|---------------|---------------|--------|
|   | MHz     | dBuV          | dB     | dBuV/m | dBuV/m        | dB            |        |
| 1 | 215.270 | 50.00         | -15.21 | 34.79  | 43.50         | -8.71         | Peak   |
| 2 | 322.940 | 49.40         | -11.21 | 38.19  | 46.00         | -7.81         | Peak   |
| 3 | 377.260 | 50.20         | -10.01 | 40.19  | 46.00         | -5.81         | Peak   |
| 4 | 756.530 | 39.90         | -2.47  | 37.43  | 46.00         | -8.57         | Peak   |
| 5 | 816.670 | 39.30         | -1.67  | 37.63  | 46.00         | -8.37         | Peak   |
| 6 | 900.090 | 38.60         | -1.08  | 37.52  | 46.00         | -8.48         | Peak   |
| 7 | 907.850 | 42.70         | -0.91  | 41.79  | 46.00         | -4.21         | Peak   |
| 8 | 932.100 | 44.50         | -0.67  | 43.83  | 46.00         | -2.17         | Peak   |
| 9 | 953.440 | 39.30         | -0.66  | 38.64  | 46.00         | -7.36         | Peak   |

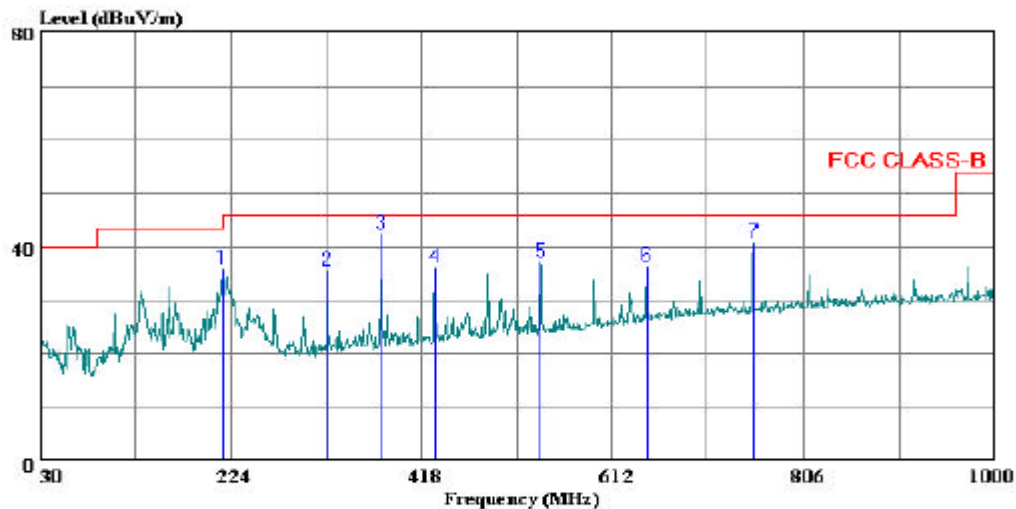
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**

VERTICAL PLOT



561F Monterey Road  
Morgan Hill, CA 95037  
Tel: (408) 463-0888  
Fax: (408) 463-0885

Data#: 2 File#: 05u3309.emi Date: 03-13-2005 Time: 12:20:21



(Auxiliary ATC)

Trace: 1

Ref Trace:

Condition: FCC CLASS-B VERTICAL  
Test Operator: : Hitesh H. Solanki  
Project #: : 05U3309  
Company: : TOSHIBA AMERICA INFORMATION SYSTEMS, INC  
EUT: : BLUETOOTH V 2.0 MODULE  
Model No : BC04  
Configuration: : EUT with TOSHIBA LAPTOP VIA EXT. BOARD  
Target of Test: : FCC Class B  
Mode of Operation: TRANSMIT ONLY (WORST CASE)

VERTICAL DATA

Page: 1

|   | Freq    | Read<br>Level | Factor | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|---------|---------------|--------|--------|---------------|---------------|--------|
|   | MHZ     | dBuV          | dB     | dBuV/m | dBuV/m        | dB            |        |
| 1 | 215.270 | 50.90         | -15.21 | 35.69  | 43.50         | -7.81         | Peak   |
| 2 | 322.940 | 46.70         | -11.21 | 35.49  | 46.00         | -10.51        | Peak   |
| 3 | 377.260 | 52.30         | -10.01 | 42.29  | 46.00         | -3.71         | Peak   |
| 4 | 431.580 | 44.60         | -8.74  | 35.86  | 46.00         | -10.14        | Peak   |
| 5 | 539.250 | 43.60         | -6.61  | 36.99  | 46.00         | -9.01         | Peak   |
| 6 | 647.890 | 40.80         | -4.41  | 36.39  | 46.00         | -9.61         | Peak   |
| 7 | 756.530 | 43.20         | -2.47  | 40.73  | 46.00         | -5.27         | Peak   |

### 7.3. POWERLINE CONDUCTED EMISSIONS

#### LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

| Frequency of Emission (MHz) | Conducted Limit (dBuV) |            |
|-----------------------------|------------------------|------------|
|                             | Quasi-peak             | Average    |
| 0.15-0.5                    | 66 to 56 *             | 56 to 46 * |
| 0.5-5                       | 56                     | 46         |
| 5-30                        | 60                     | 50         |

\* Decreases with the logarithm of the frequency.

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

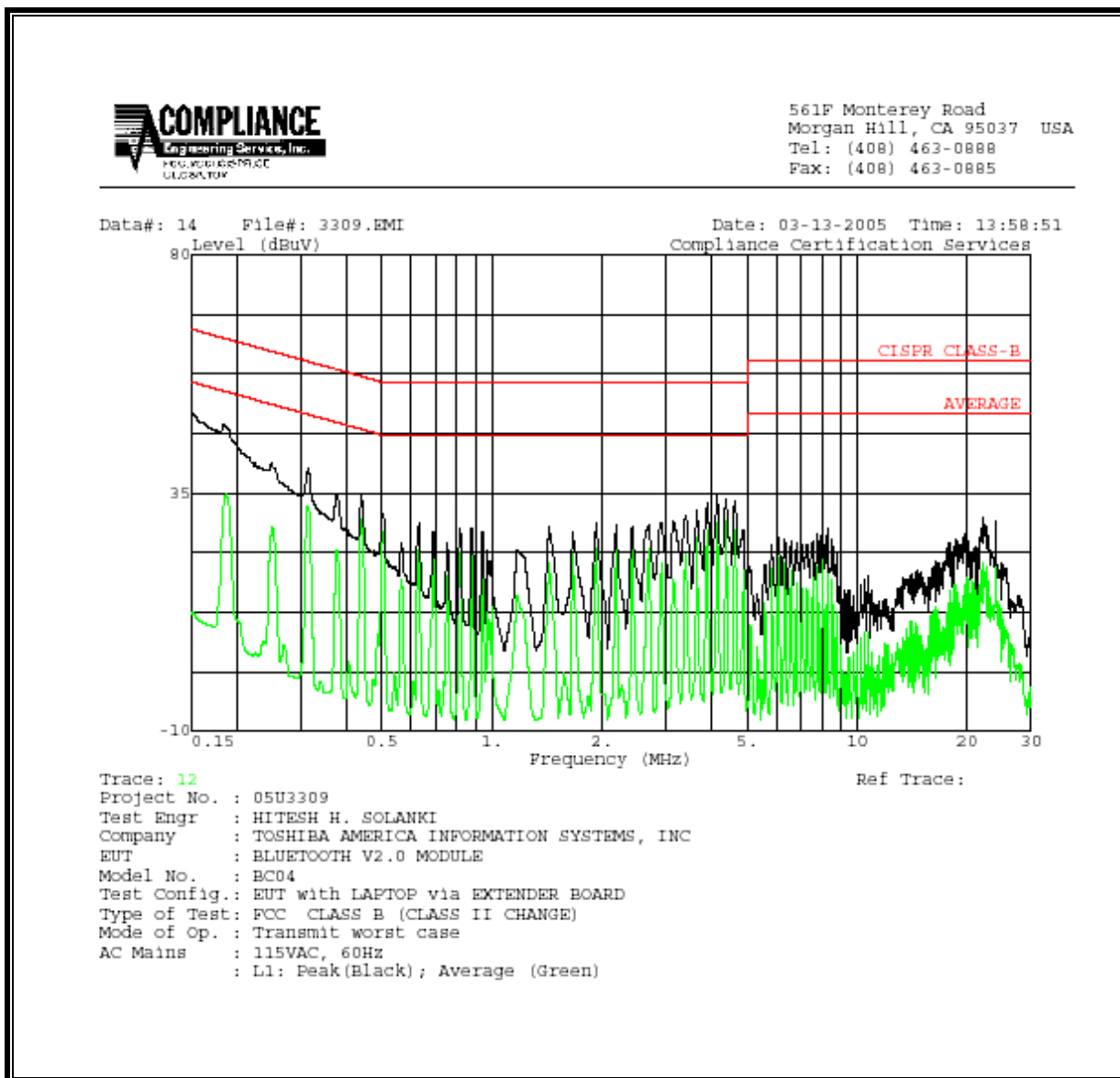
#### RESULTS

No non-compliance noted:

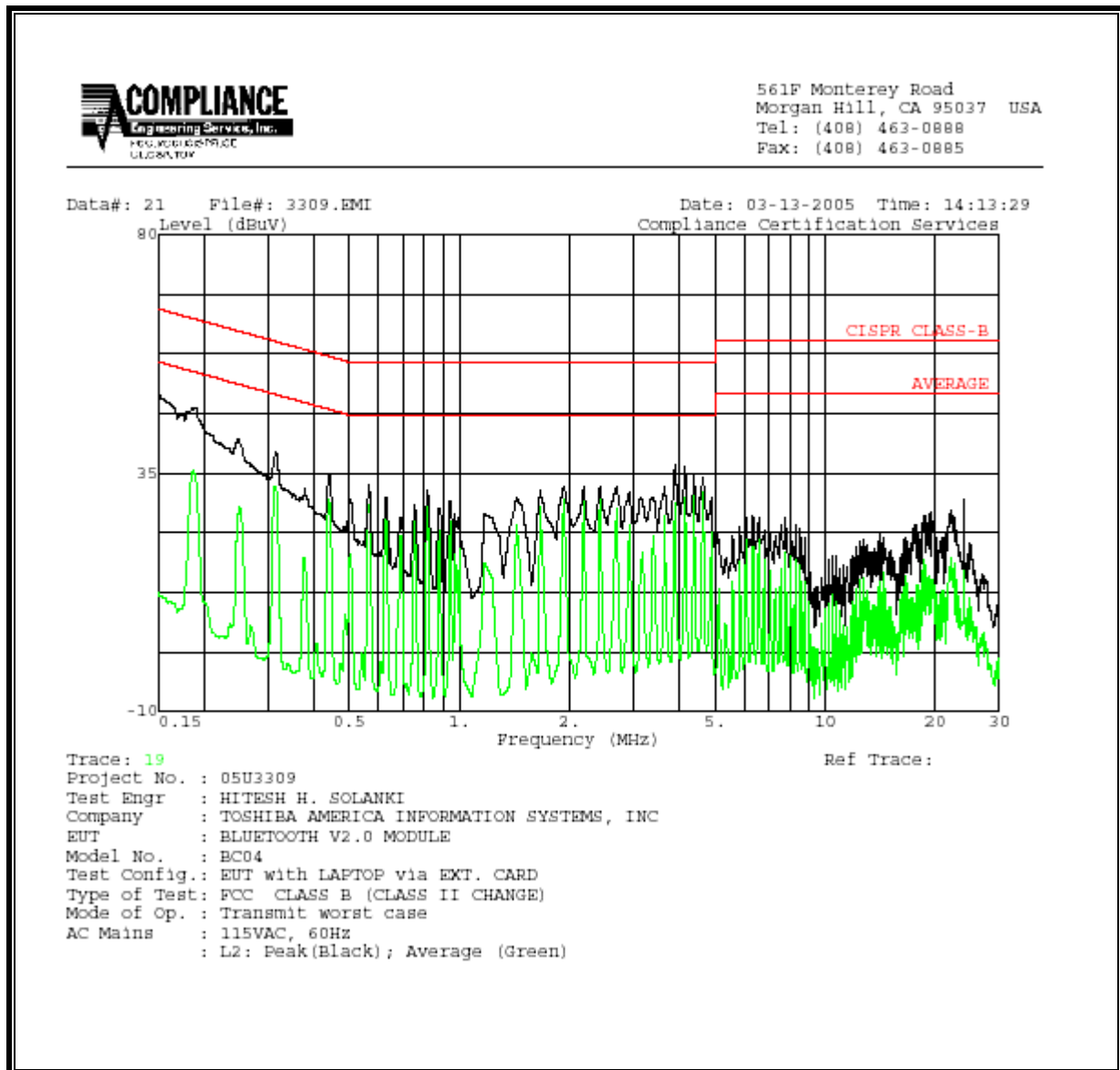
# **6 WORST EMISSIONS**

| CONDUCTED EMISSIONS DATA (115VAC 60Hz) |           |           |           |       |       |       |         |         |         |
|----------------------------------------|-----------|-----------|-----------|-------|-------|-------|---------|---------|---------|
| Freq.                                  | Reading   |           |           | Closs | Limit | FCC B | Margin  |         | Remark  |
| (MHz)                                  | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB)  | QP    | AV    | QP (dB) | AV (dB) | L1 / L2 |
| 0.15                                   | 49.96     | --        | --        | 0.00  | 66.00 | 56.00 | -16.04  | -6.04   | L1      |
| 4.14                                   | 34.48     | --        | --        | 0.00  | 56.00 | 46.00 | -21.52  | -11.52  | L1      |
| 22.18                                  | 30.52     | --        | --        | 0.00  | 60.00 | 50.00 | -29.48  | -19.48  | L1      |
| 0.15                                   | 49.98     | --        | --        | 0.00  | 66.00 | 56.00 | -16.02  | -6.02   | L2      |
| 3.88                                   | 36.72     | --        | --        | 0.00  | 56.00 | 46.00 | -19.28  | -9.28   | L2      |
| 24.01                                  | 30.16     | --        | --        | 0.00  | 60.00 | 50.00 | -29.84  | -19.84  | L2      |
| 6 Worst Data                           |           |           |           |       |       |       |         |         |         |

## LINE 1 RESULTS

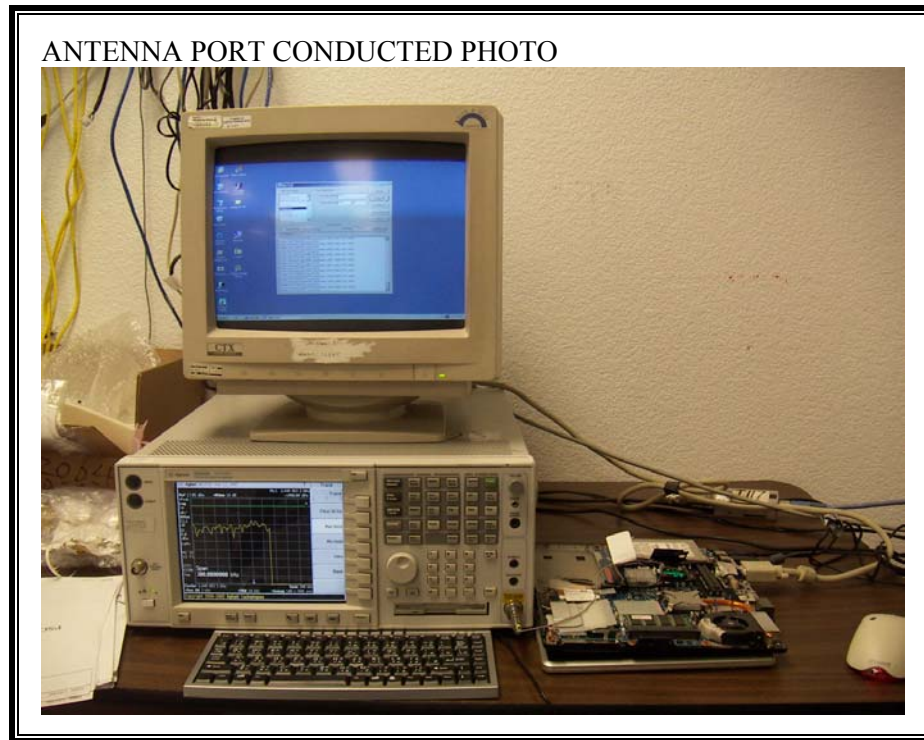


**LINE 2 RESULTS**



## 8. SETUP PHOTOS

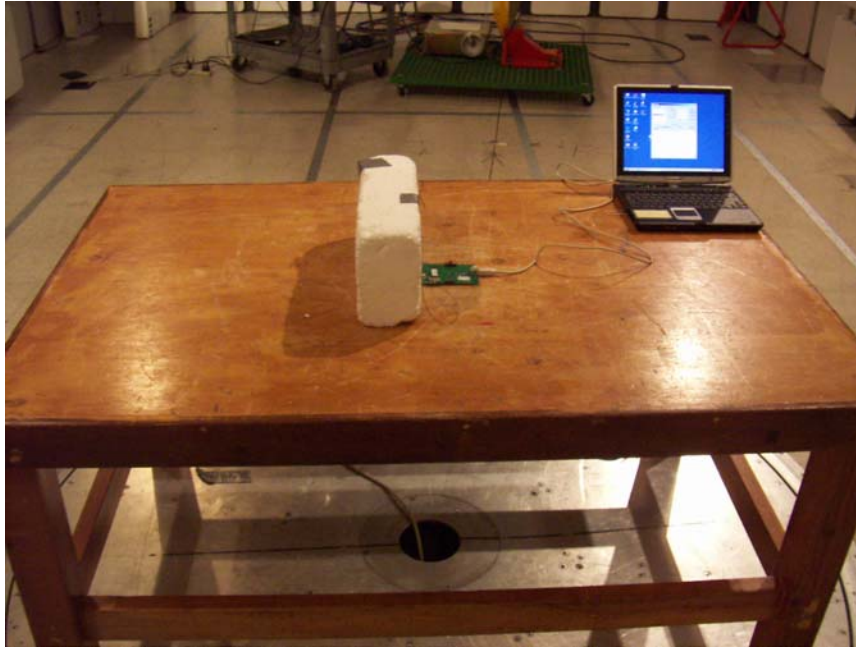
### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



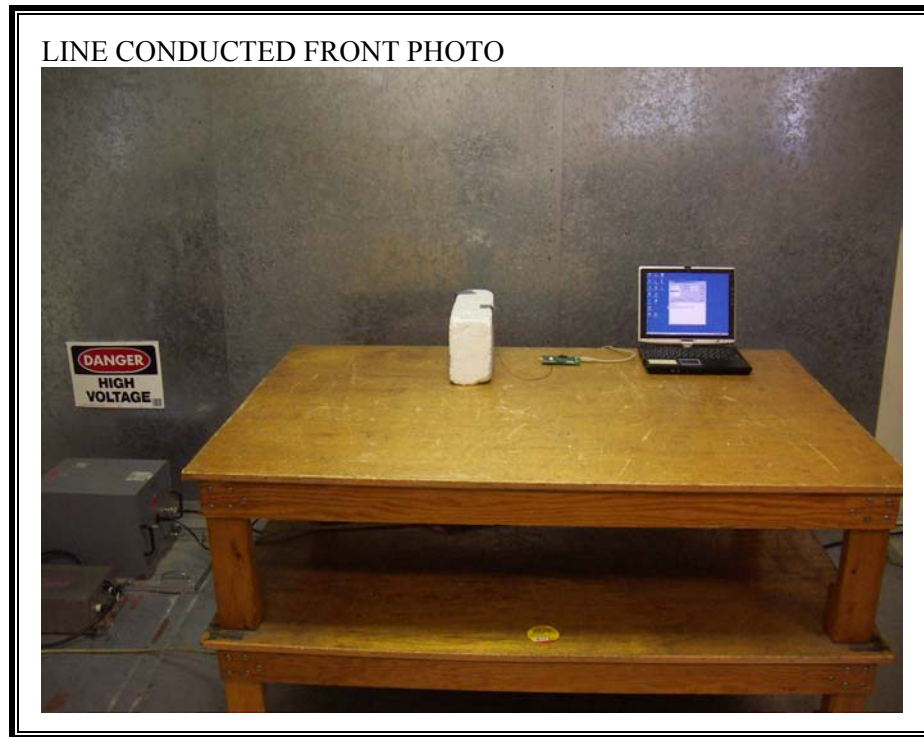
**RADIATED RF MEASUREMENT SETUP**



RADIATED BACK PHOTO



**POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP**



LINE CONDUCTED BACK PHOTO



**END OF REPORT**