# DIGITAL EMC CO., LTD.

683-3, Yubang-Dong, Yongin-Si, Kyunggi-Do, Korea. 449-080
Tel: +82-31-321-2664     Fax: +82-31-321-1664
http://www.digitalemc.com

# CERTIFICATION OF COMPLIANCE

**UNB Tech**

Daiyoung B/D 2nd FL, 1423-6, Gwanyang 1-dong,
Dongan-gu, Anyang-city, Gyeonggi-Do, Korea

Dates of Tests: January 06 ~ 14, 2010
Test Report S/N: DR50111001J
Test Site : DIGITAL EMC CO., LTD.

FCC ID          **X3F-UBC-100**

APPLICANT          **UNB Tech**

| | | |
|---|---|---|
| **Purpose** | : | **Original Grant** |
| **FCC Equipment Class** | : | **Part 15 Spread Spectrum Transmitter(DSS)** |
| **Device name** | : | **Bluetooth Hands Free Car Kit** |
| **Manufacturer** | : | **SK Tech** |
| **FCC ID** | : | **X3F-UBC-100** |
| **Model name** | : | **UBC-100** |
| **Test Device Serial number** | : | **Identical prototype** |
| **FCC Rule Part(s)** | : | **FCC Part 15.247 Subpart C** |
| | | **ANSI C63.4-2003** |
| **Frequency Range** | : | **2402 ~ 2480 MHz** |
| **Max. Output power** | : | **-3.09 dBm Conducted** |
| **Data of issue** | : | **January 22, 2010** |

*The Test results relate only to the tested sample. It is not allowed to copy this report even partly without the allowance of DIGITAL EMC CO., LTD.*

# TABLE OF CONTENTS

# 1. General information

This report contains the result of tests performed by:

DIGITAL EMC CO., LTD.

Address: 683-3, Yubang-Dong, Yongin-Si, Kyunggi-Do, Korea. 449-080

http://www.digitalemc.com    E-mail: Harveysung@digitalemc.com

Tel: +82-31-321-2664      Fax: +82-31-321-1664

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competent of calibration and testing laboratory".

**Tested by:**      *Engineer*

| | | |
|---|---|---|
| January 22, 2010 | Sun-Kyu Ryu | |
| Date | Name | Signature |

**Reviewed by:**      *Manager*

| | | |
|---|---|---|
| January 22, 2010 | W.J. Lee | |
| Date | Name | Signature |

**Applicant:**

Company name  :  UNB Tech

Address  :  Daiyoung B/D 2nd FL, 1423-6, Gwanyang 1-dong, Dongan-gu, Anyang-city, Gyeonggi-Do, Korea

Date of order  :  December 16, 2009

# 2. Equipment information

| X3F-UBC-100 |
|---|

## 2.1 Equipment description

| | |
|---|---|
| Equipment model no. | UBC-100 |
| Equipment serial no. | Identical prototype |
| Type of equipment | Bluetooth Hands Free Car Kit |
| Frequency band | 2402 ~ 2480 MHz |
| Type of Modulation | ☒ GFSK for 1Mbps(BDR mode)<br>☐ π/4-DQPSK for 2Mbps(EDR mode)<br>☐ 8DPSK for 3Mbps(EDR mode) |
| Spread Spectrum | Frequency Hopping |
| Channel Spacing | 1.0 MHz |
| Power | DC 3.7V (Lithium Battery) |
| Type of antenna | ☒ Internal Type: Chip Antenna<br>☐ External Type: |



## 2.2 Ancillary equipment

| Equipment | Model No. | Serial No. | Manufacturer | Note |
|---|---|---|---|---|
| - | - | - | - | - |
| - | - | - | - | - |

# 3. Information about test items

## X3F-UBC-100

### 3.1 Tested frequency

- Hopping Function: Enable

| Frequency | TX | RX |
|---|---|---|
| Frequency band of operation | 2402MHz ~ 2480MHz | 2402MHz ~ 2480MHz |

- Hopping Function: Disable

| Frequency | TX | RX |
|---|---|---|
| Lowest frequency | 2402MHz | 2402MHz |
| Middle frequency | 2441MHz | 2441MHz |
| Highest frequency | 2480MHz | 2480MHz |

### 3.2 Tested environment

| | | |
|---|---|---|
| Temperature | : | 15 ~ 35 ($^o$C) |
| Relative humidity content | : | 20 ~ 75 % |
| Air pressure | : | 86 ~ 103 kPa |
| Details of power supply | : | DC 3.7 V |

### 3.3 Test mode

| | |
|---|---|
| Test Case 1 | - |
| Test Case 2 | - |
| Test Case 3 | - |

### 3.4 Auxiliary equipment

| Equipment | Model No. | Serial No. | Manufacturer | Note |
|---|---|---|---|---|
| - | - | - | - | - |
| - | - | - | - | - |

### 3.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing

→ None

# 4. Test Report

## 4.1 Summary of tests

| FCC Part Section(s) | Parameter | Limit (Using in 2400 ~ 2483.5MHz) | Test Condition | Status Note 1 |
|---|---|---|---|---|
| **I. Test Items** | | | | |
| 15.247(a) | Carrier Frequency Separation | >= 20dB BW or >= Two-Thirds of the 20dB BW | Conducted | **C** |
| | Number of Hopping Frequencies | >= 15 hops | | **C** |
| | 20 dB Bandwidth | None | | **C** |
| | Dwell Time | =< 0.4 seconds | | **C** |
| 15.247(b) | Transmitter Output Power | =< 1Watt , if CHs >= 75 Others =<0.125W | | **C** |
| 15.247(c) | Band-edge /Conducted | The radiated emission to any 100 kHz of out-band shall be at least 20dB below the highest in-band spectral density. | | **C** |
| | Conducted Spurious Emissions | | | **C** |
| 15.205 15.209 | Radiated Spurious Emissions | FCC 15.209 Limits | Radiated | **C** |
| 15.207 | AC Conducted Emissions | EN 55022 | AC Line Conducted | **NA** Note 2 |
| 15.203 | Antenna Requirements | FCC 15.203 | - | **C** |

Note 1: **C**=Comply    **NC**=Not Comply    **NT**=Not Tested    **NA**=Not Applicable

Note 2: Conducted emission test is not applicable. Because the power of the EUT is supplied from a car battery using a cigar jack adapter.

The sample was tested according to the following specification:
ANSI C-63.4-2003, DA00-705

## 4.2 Transmitter requirements

## 4.2.1 Carrier Frequency Separation

**- Procedure:**

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span =   wide enough to capture the peaks of two adjacent channels

RBW =   1% of the span                          Sweep =   auto

VBW =   ≥ RBW                                   Detector function =   peak

Trace =   max hold

**- Measurement Data: <span style="color:red">Comply</span>**

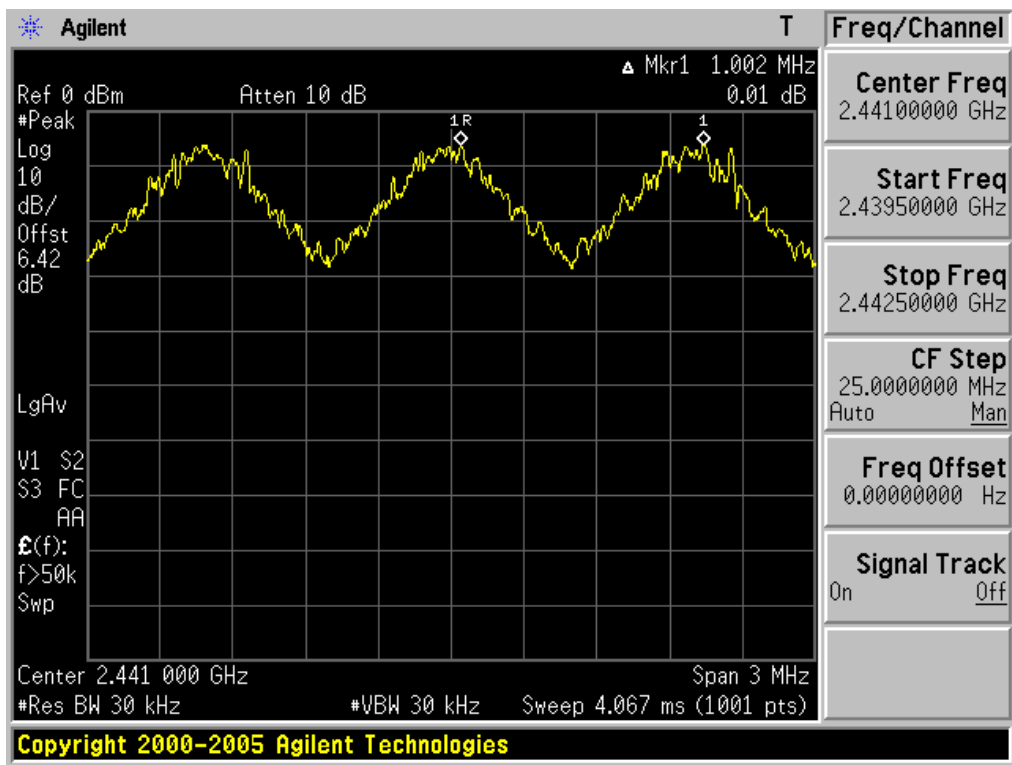| Hopping mode | Data rate | Peak of center channel (MHz) | Peak of adjacent Channel (MHz) | Test Result (MHz) |
|---|---|---|---|---|
| Enable | 1Mbps | 2441.039000 | 2442.041000 | 1.002000 |

See next page for actual measured spectrum plot.

**- Minimum Standard:**

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

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

**Carrier Frequency Separation**          Hopping mode: Enable  &  Data rate: 1Mbps

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## 4.2.2 Number of Hopping Frequencies

**- Procedure:**

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, four frequency ranges within the 2400 ~ 2483.5 MHz FH band were examined.

The spectrum analyzer is set to:

Span =   25MHz        Plot 1: Start Frequency = 2389.5MHz,   Stop Frequency = 2414.5 MHz

Plot 2: Start Frequency = 2414.5MHz,   Stop Frequency = 2439.5 MHz

Plot 3: Start Frequency = 2439.5MHz,   Stop Frequency = 2464.5 MHz

Plot 4: Start Frequency = 2464.5MHz,   Stop Frequency = 2489.5 MHz

RBW =   1% of the span or more            Sweep =   auto

VBW =   $\geq$ RBW                              Detector function =   peak

Trace =   max hold

**- Measurement Data: Comply**

| Hopping mode | Data rate | Test Result (Total Hops) |
|:---:|:---:|:---:|
| Enable | 1Mbps | 79 |

Note 1: See next pages for actual measured spectrum plots.

**- Minimum Standard:**

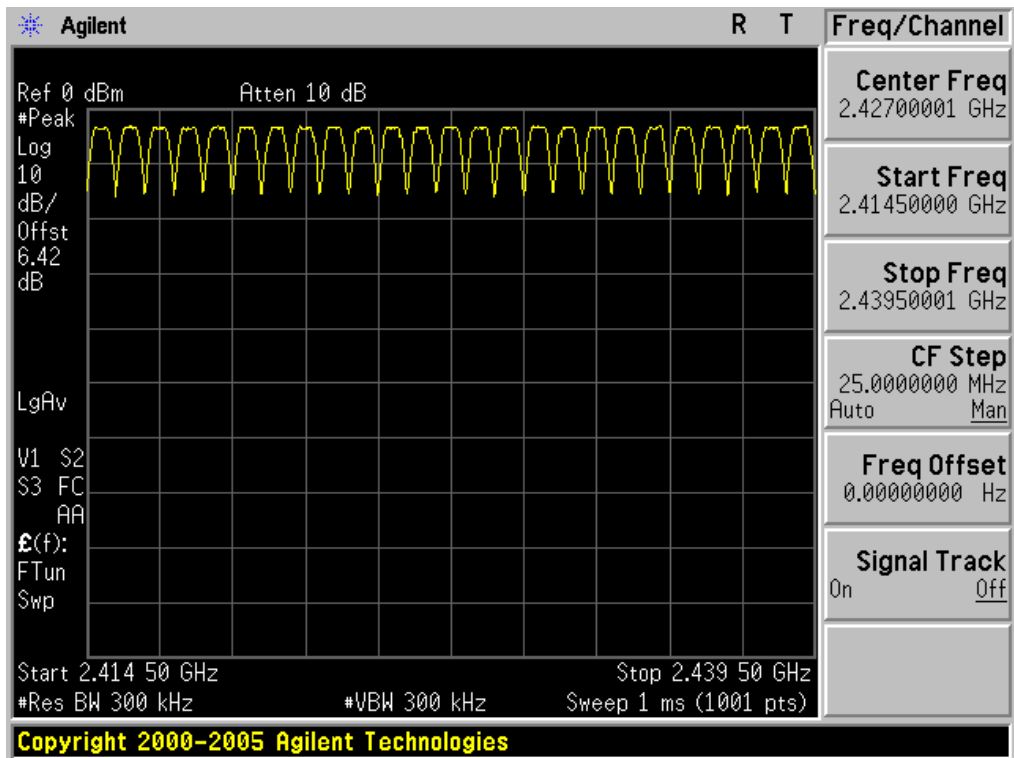At least 15 hopes

**Number of Hopping Frequencies 1**     Hopping mode: Enable  &  Data rate: 1Mbps
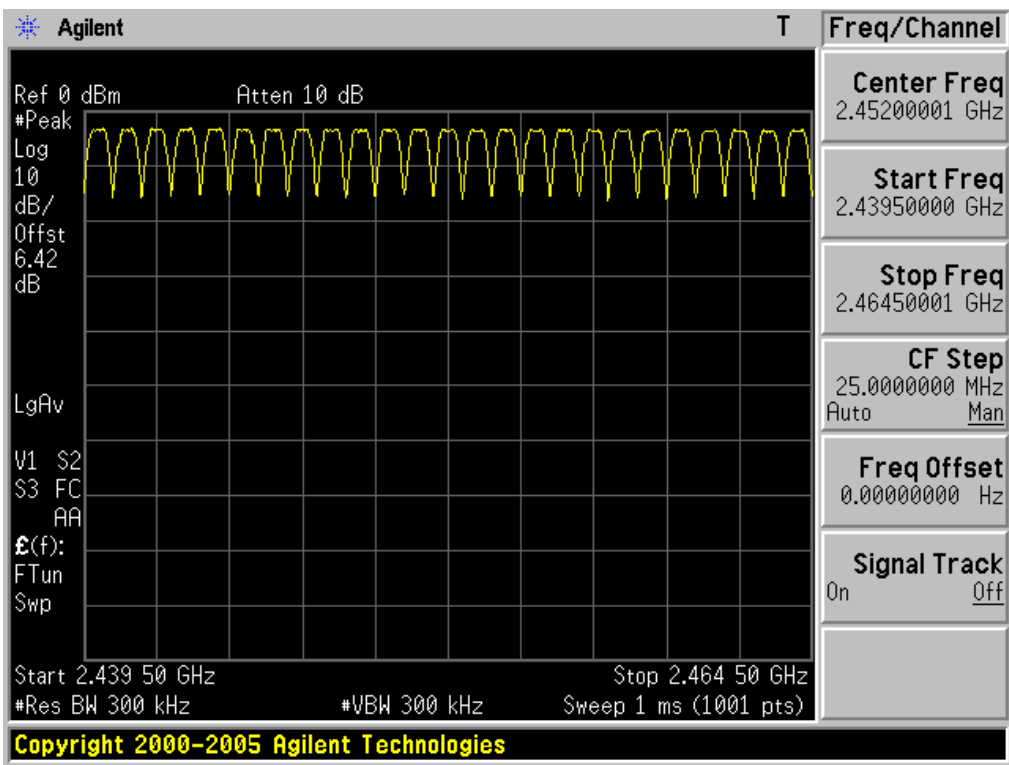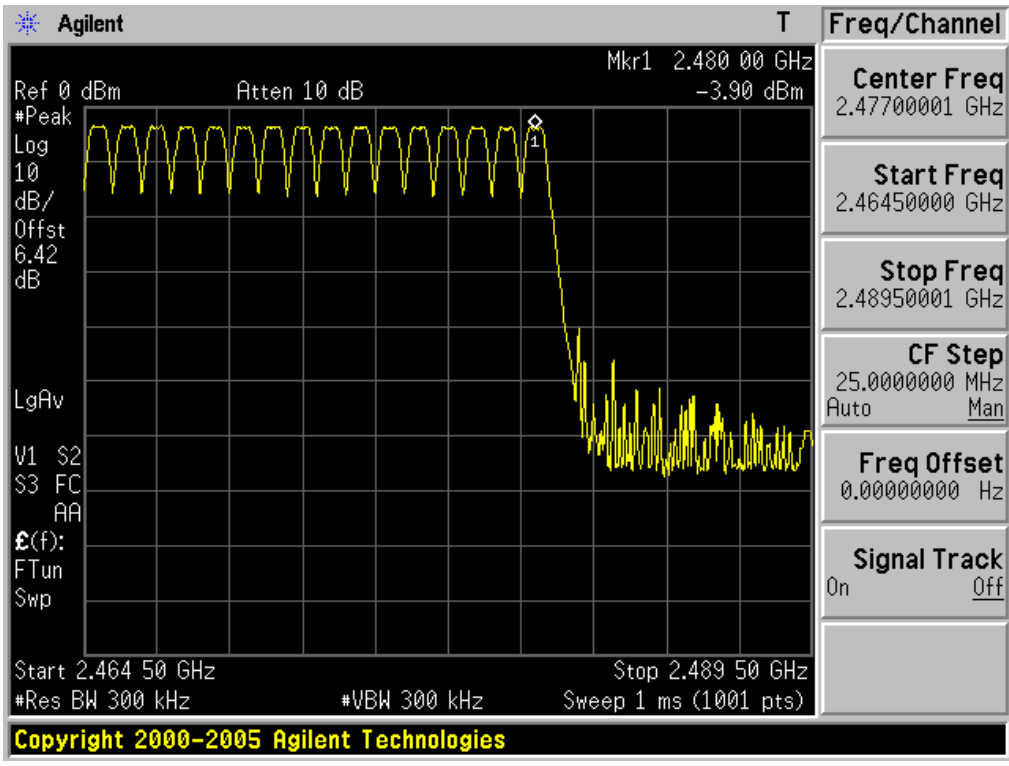


**Number of Hopping Frequencies 2**     Hopping mode: Enable  &  Data rate: 1Mbps

**Number of Hopping Frequencies 3**      Hopping mode: Enable   &   Data rate: 1Mbps



**Number of Hopping Frequencies 4**      Hopping mode: Enable   &   Data rate: 1Mbps

## 4.2.3 20 dB Bandwidth

**- Procedure:**

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission.  Use the marker-delta function to measure 20dB down one side of the emission.  Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level.  The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency =   the highest, middle and the lowest Frequencies

Span =   approximately 2 or 3 times of the 20 dB bandwidth

RBW =   1% of the 20dB bandwidth or more          Sweep =   auto

VBW =   ≥  RBW                                             Detector function =   peak

Trace =   max hold

**- Measurement Data: <span style="color:red">Comply</span>**

| Hopping mode | Data rate | Tested Frequency | Test Results (MHz) |
|---|---|---|---|
| Disable | 1Mbps | Lowest | 0.945 |
| | | Middle | 0.950 |
| | | Highest | 0.945 |

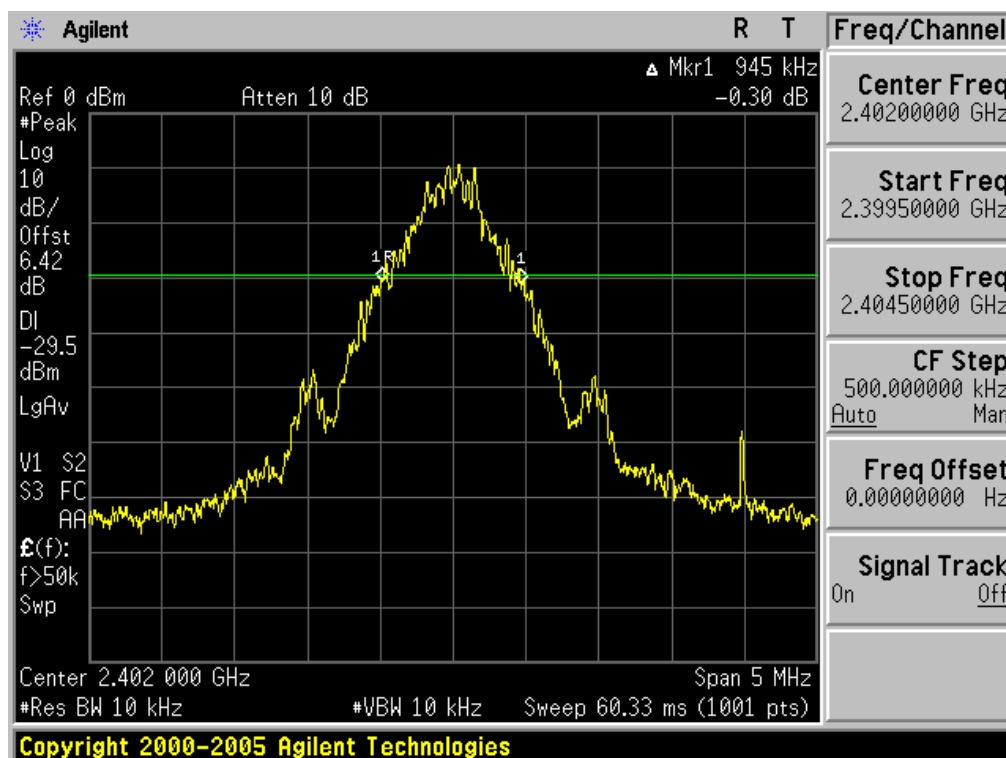Note 1: See next pages for actual measured spectrum plots.

**- Minimum Standard:**
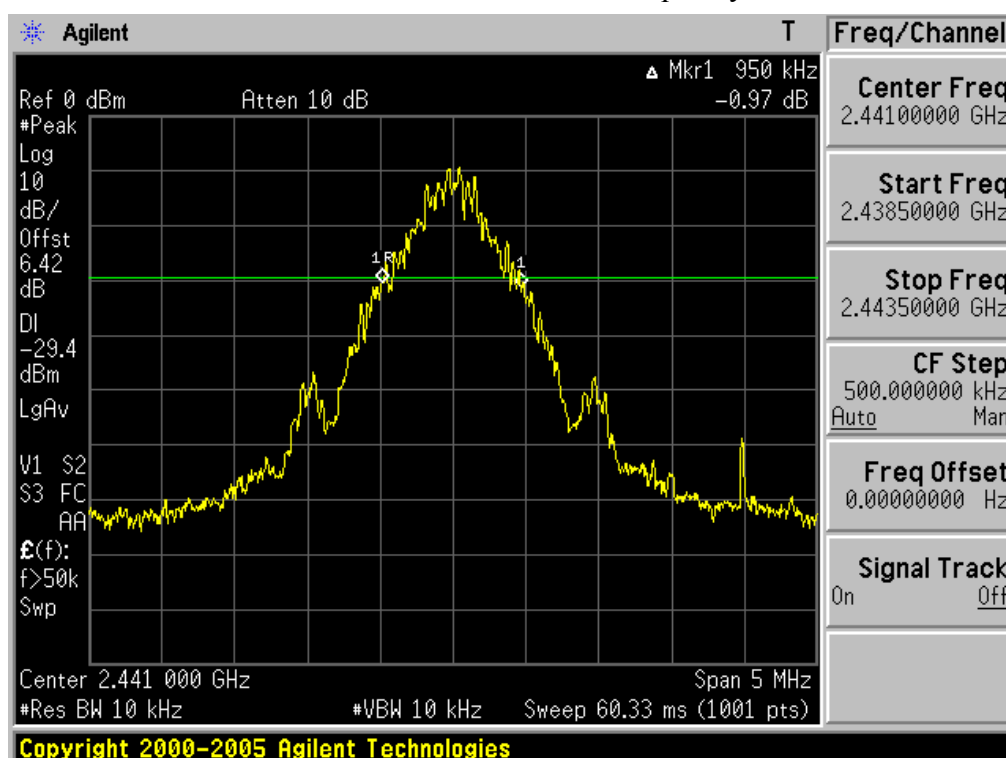
None

**20dB Bandwidth**                                Lowest Frequency   &   Data rate: 1Mbps
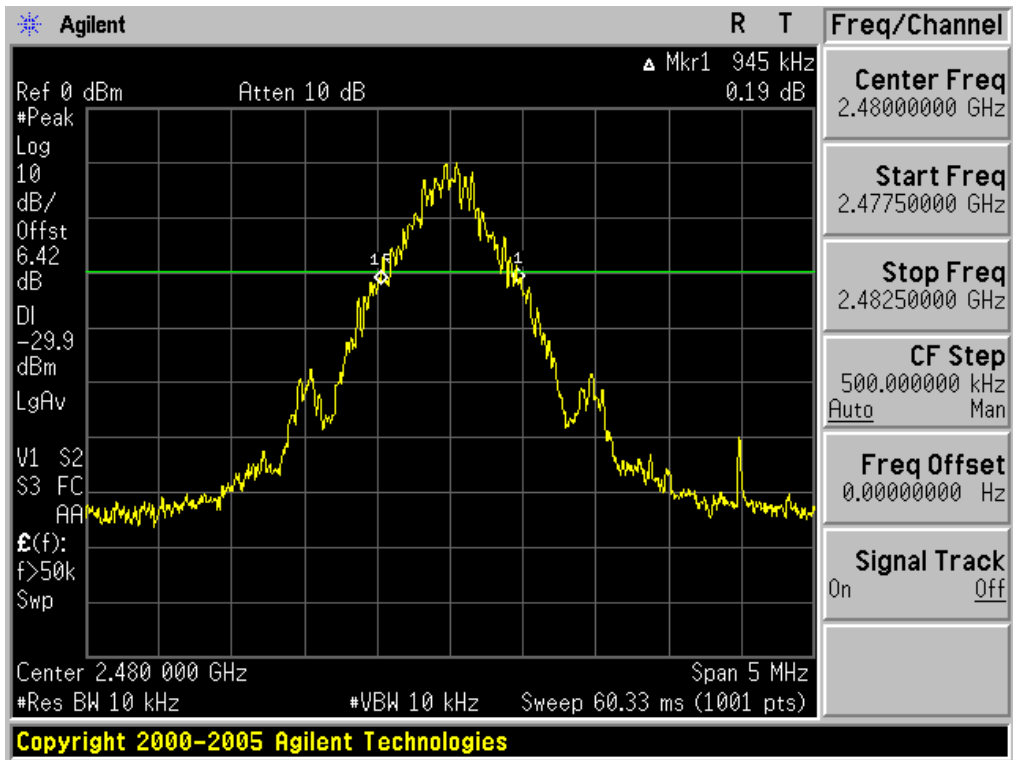


**20dB Bandwidth**                                Middle Frequency   &   Data rate: 1Mbps

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**20dB Bandwidth**                    Highest Frequency  &  Data rate: 1Mbps

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## 4.2.4 Time of Occupancy (Dwell Time)

**- Procedure:**

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = 2441 MHz          Span = zero

RBW = 1 MHz                          VBW = ≥ RBW

Trace = max hold                     Detector function = peak

**- Measurement Data: Comply**

| Hopping mode | Data rate | Packet Type | Burst On Time (ms) | Period (ms) | Number of hopping Channels | Test Result (s) |
|---|---|---|---|---|---|---|
| Enable | 1Mbps | DH 5 | 2.895 | 3.75 | 79 | 0.3088 |

Note 1: Each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event.
DWELL TIME=(0.4 x Number of hopping Channels) x Burst On time / (period x Number of hopping Channels)
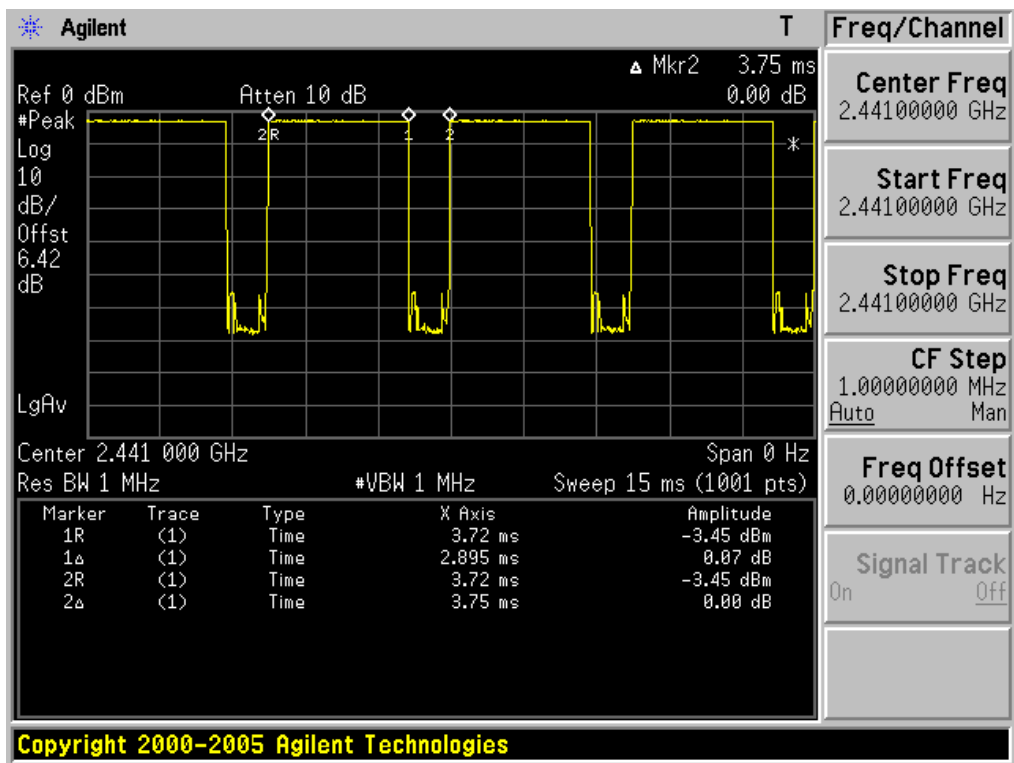Note 2: See next pages for actual measured spectrum plots.

**- Minimum Standard:**

No greater than 0.4 seconds

**Time of Occupancy**                    Hopping mode: Enable   &   Data rate: 1Mbps

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## 4.2.5 Peak Output Power

**- Procedure:**

The peak output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission.   The indicated level is the peak output power.

The spectrum analyzer is set to:

Center frequency =    the highest, middle and the lowest Frequencies

Span =    approximately 5 times of the 20 dB bandwidth

RBW =    greater than the 20dB bandwidth of the emission being measured

VBW =    $\geq$  RBW                                      Detector function =    peak

Trace =    max hold                                         Sweep =    auto

**- Measurement Data: <span style="color:red">Comply</span>**

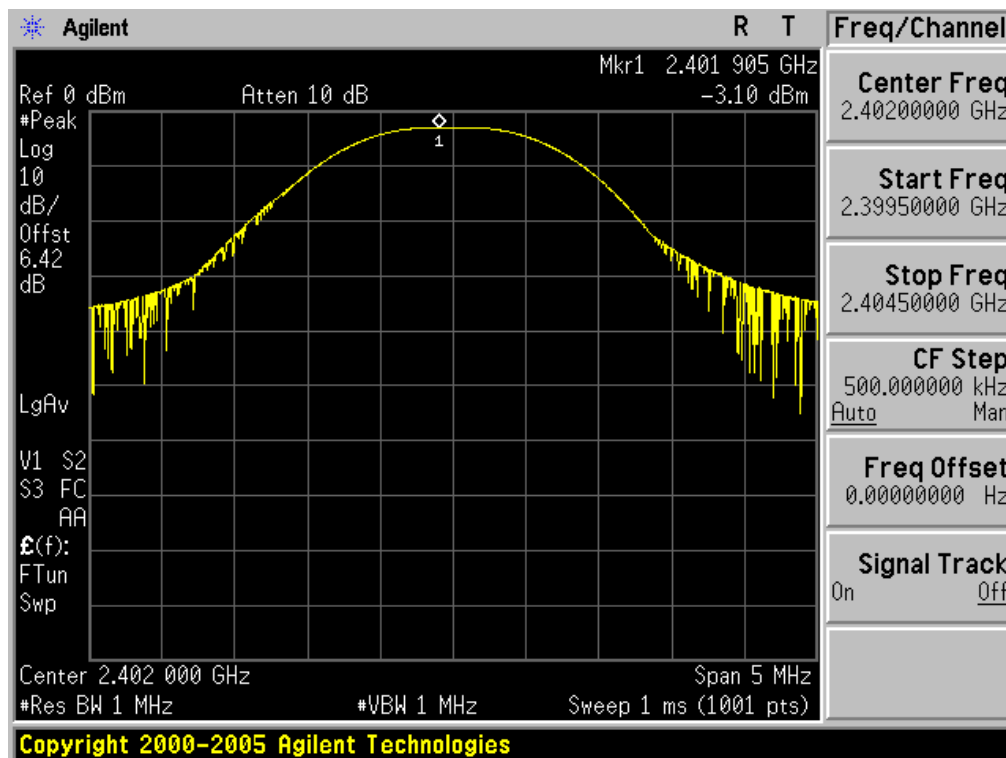| Hopping mode | Data rate | Tested Frequency | Test Results | |
|---|---|---|---|---|
| | | | dBm | mW |
| Disable | 1Mbps | Lowest | -3.10 | 0.490 |
| | | **Middle** | **-3.09** | **0.491** |
| | | Highest | -3.68 | 0.429 |

Note 1: See next pages for actual measured spectrum plots.

**- Minimum Standard:**

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: **1 Watt**. For all other frequency hopping systems in the 2400-2483.5 MHz band: **0.125 Watts**
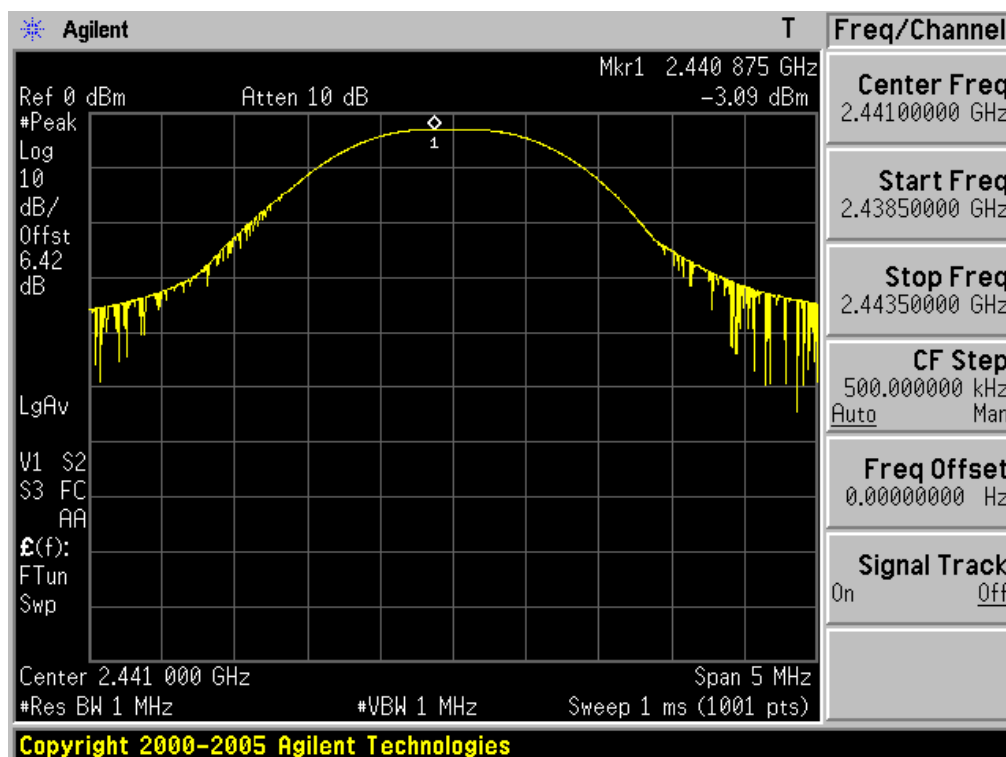
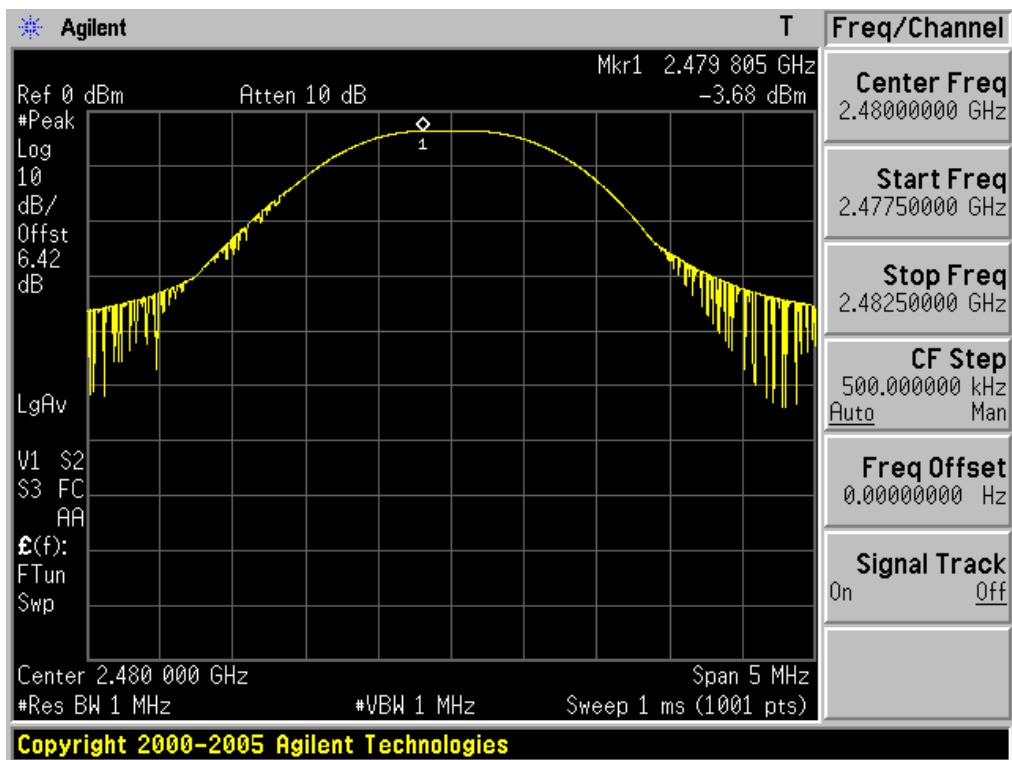**Peak Output Power**        Lowest Frequency   &   Data rate: 1Mbps



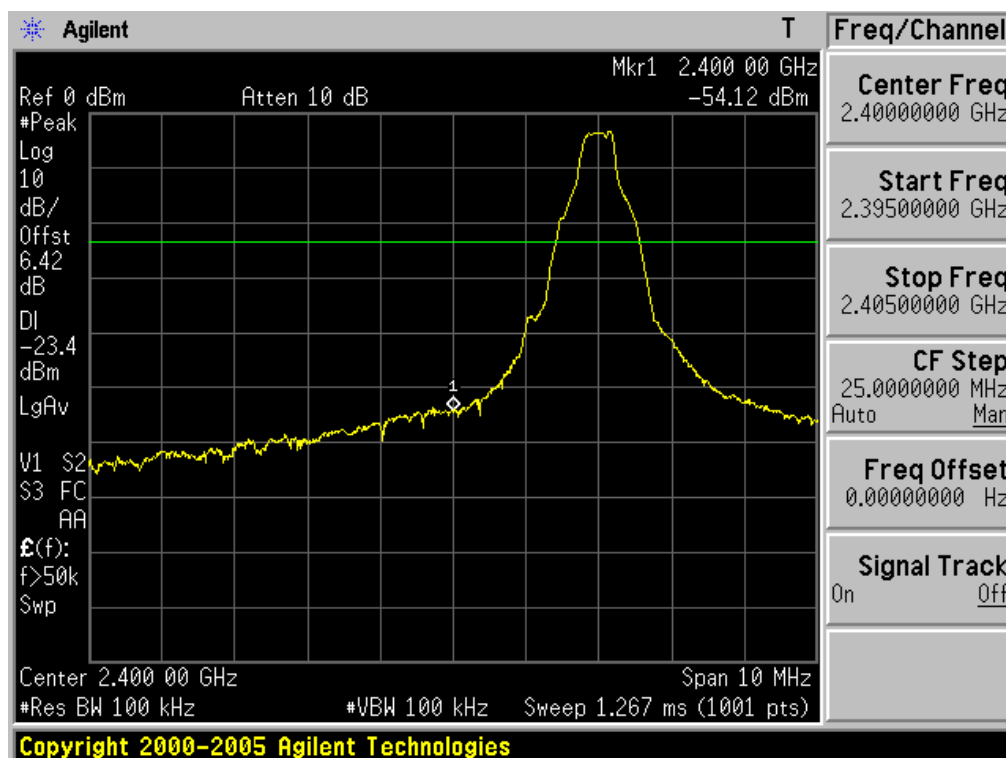**Peak Output Power**        Middle Frequency   &   Data rate: 1Mbps

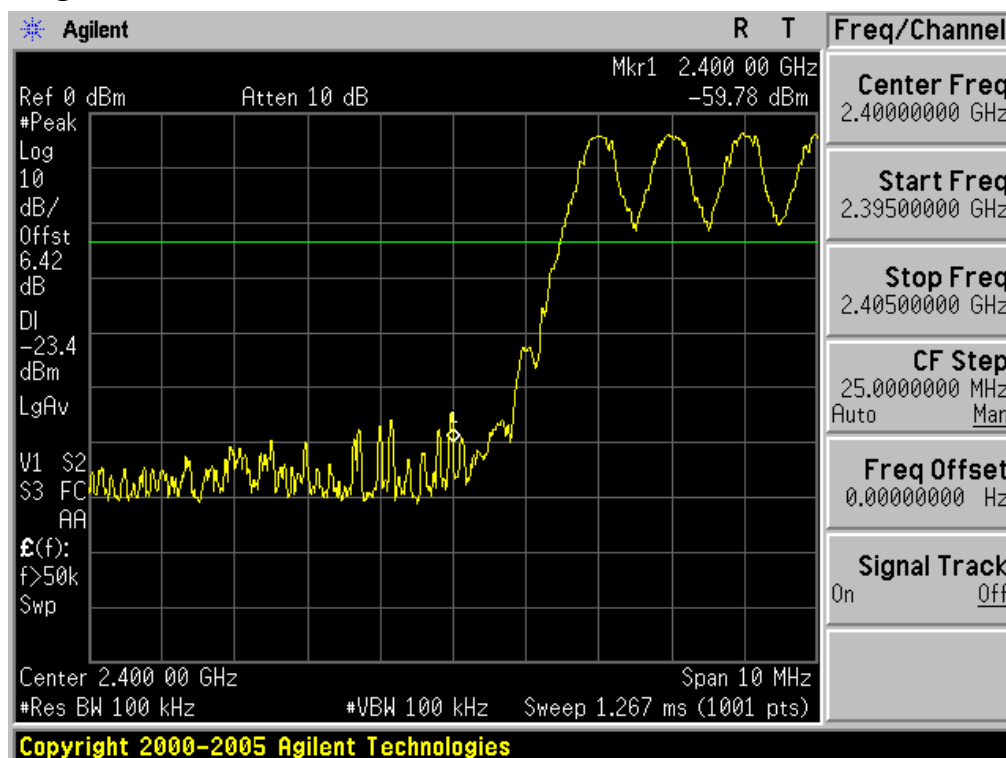**Peak Output Power**　　　　　　　　Highest Frequency　&　Data rate: 1Mbps

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## 4.2.6 Conducted Spurious Emissions

**- Procedure:**

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

For Band-edge testing the spectrum analyzer is set to:

Tested frequency =    the highest and the lowest Frequencies

Center frequency =    2400MHz, 2483.5MHz

Span =   10MHz                          Detector function =   peak

RBW =   1% of the span              VBW =   100 kHz

Trace =   max hold                      Sweep =   auto

For spurious testing the spectrum analyzer is set to:

Tested frequency =    the highest, middle and the lowest Frequencies

RBW =   100 kHz                        VBW =   100 kHz

Detector function =   peak            Sweep =   auto

Trace =   max hold

**- Measurement Data: Comply**

Note 1: See next pages for actual measured spectrum plots.

**- Minimum Standard:**

| **Minimum Standard:** | > 20 dBc |
|---|---|

**Low Band-edge**    Hopping mode: Disable  &  Data rate: 1Mbps



**Low Band-edge**    Hopping mode: Enable  &  Data rate: 1Mbps
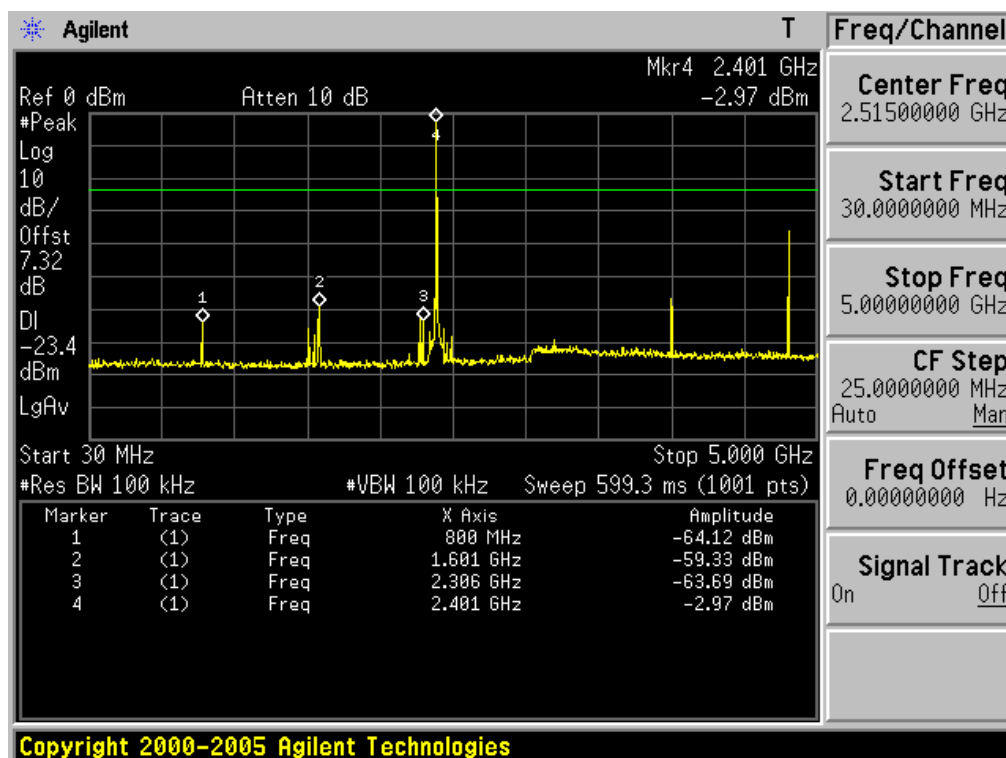
**High Band-edge**     Hopping mode: Disable   &    Data rate: 1Mbps
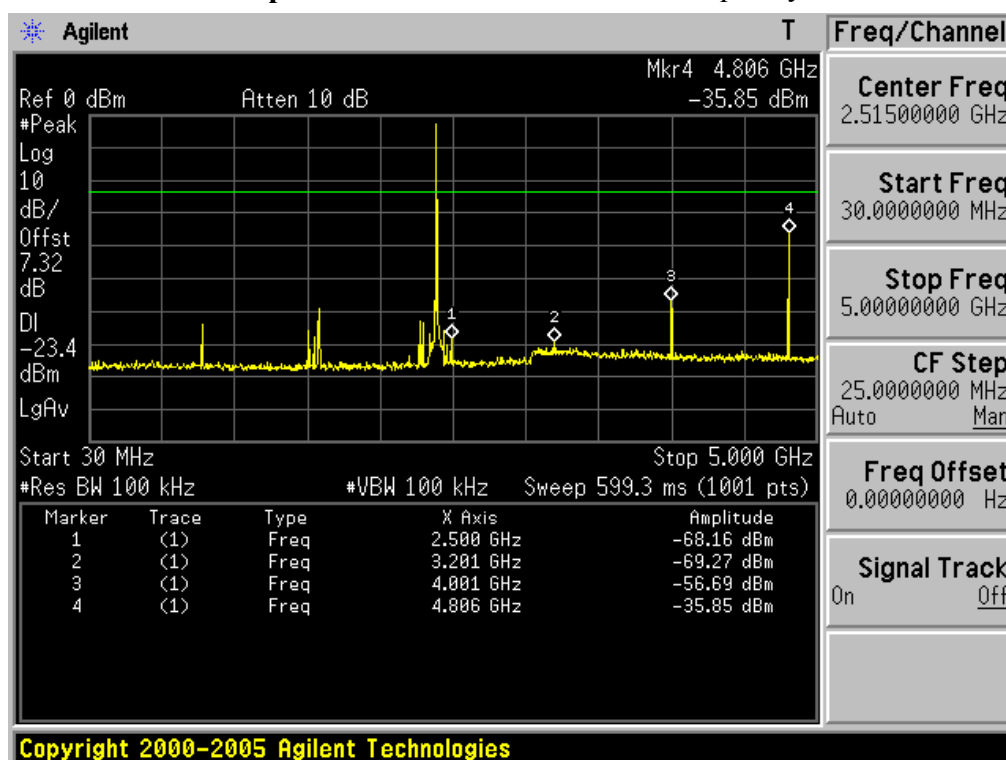


**High Band-edge**     Hopping mode: Enable   &    Data rate: 1Mbps
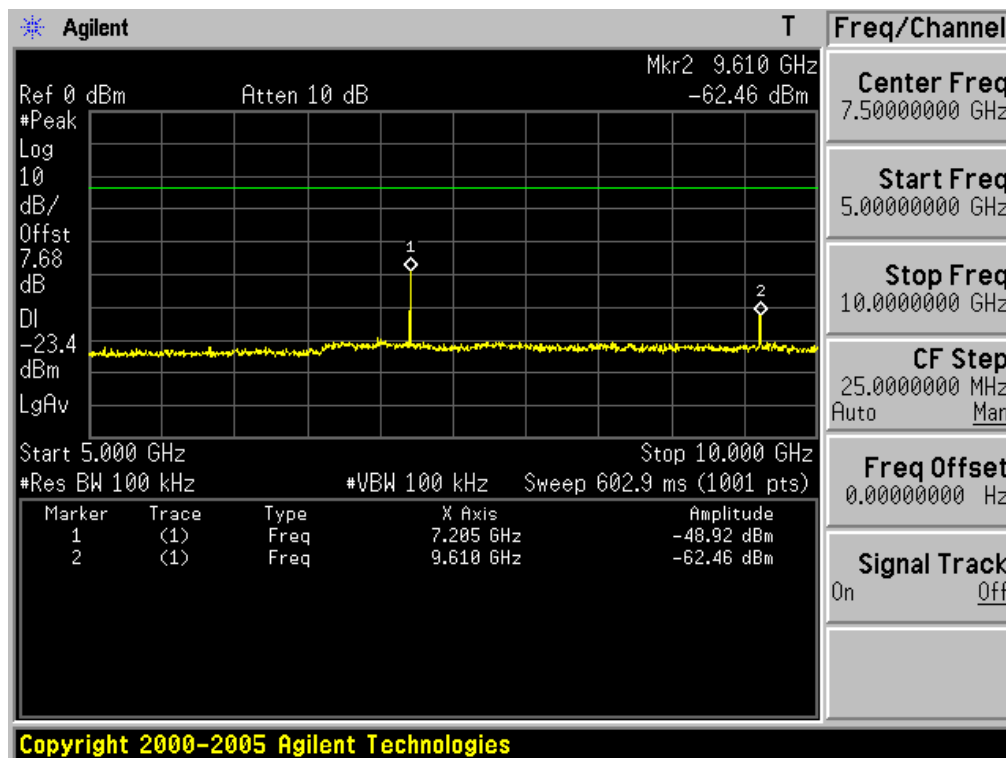
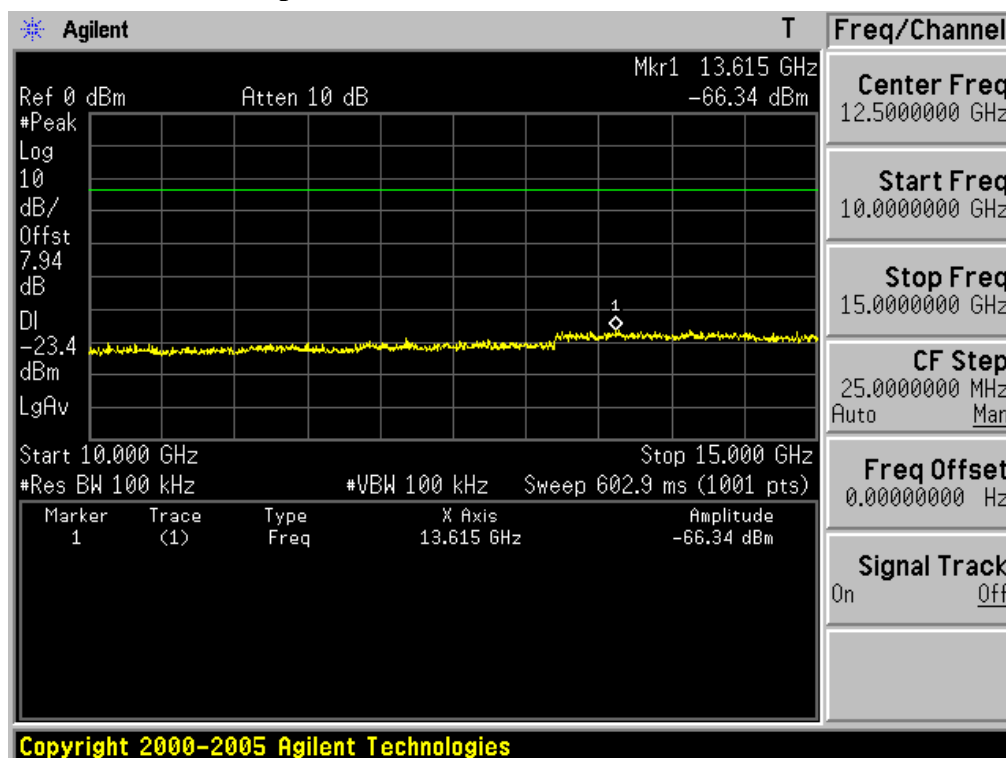**30MHz ~ 5GHz Conducted Spurious Emissions**   Lowest Frequency   &   Data rate: 1Mbps



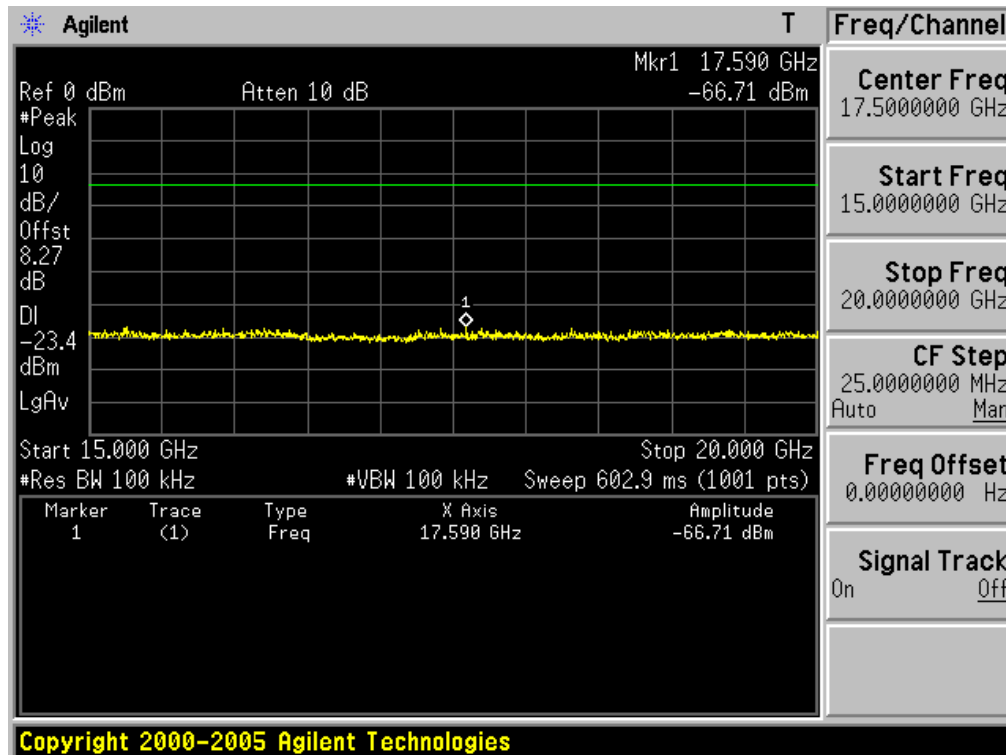**30MHz ~ 5GHz Conducted Spurious Emissions**   Lowest Frequency   &   Data rate: 1Mbps

**5GHz ~ 10GHz Conducted Spurious Emissions**   Lowest Frequency   &   Data rate: 1Mbps
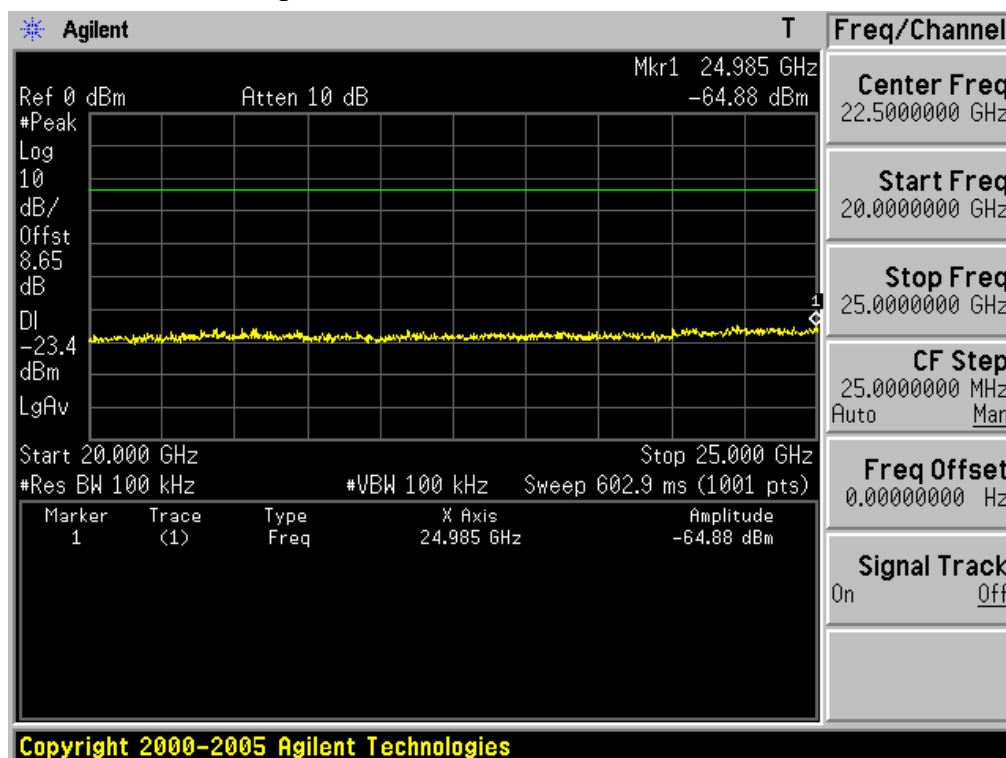


**10GHz ~ 15GHz Conducted Spurious Emissions**   Lowest Frequency   &   Data rate: 1Mbps

**15GHz ~ 20GHz Conducted Spurious Emissions**   Lowest Frequency   &   Data rate: 1Mbps
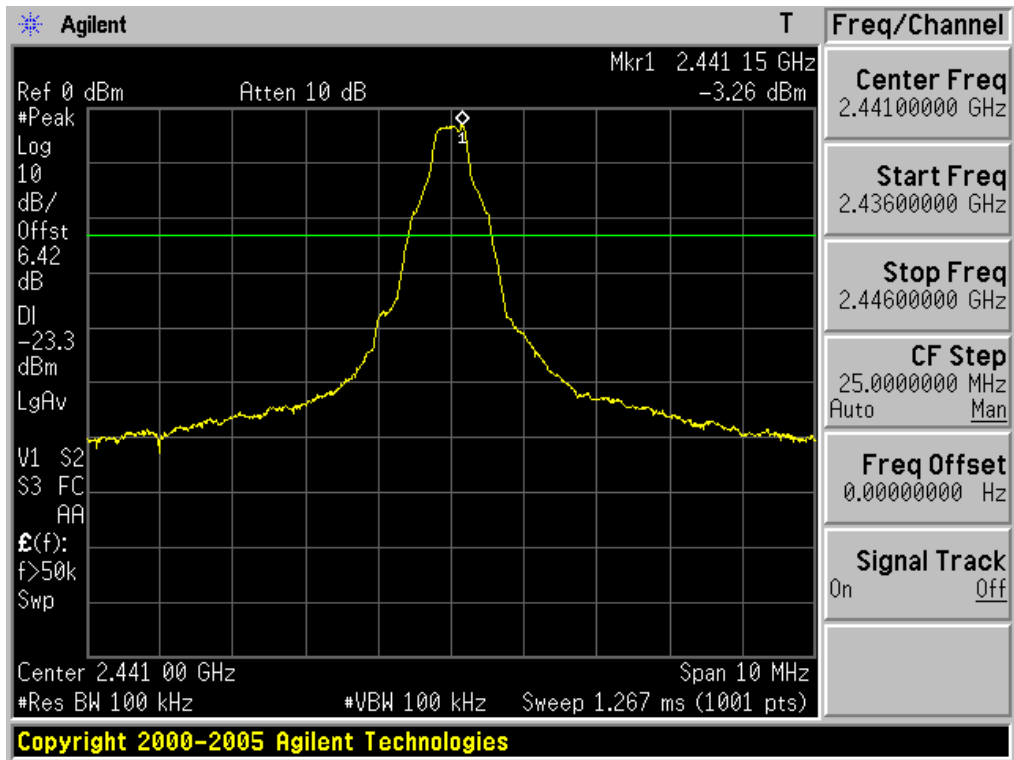


**20GHz ~ 25GHz Conducted Spurious Emissions**   Lowest Frequency   &   Data rate: 1Mbps
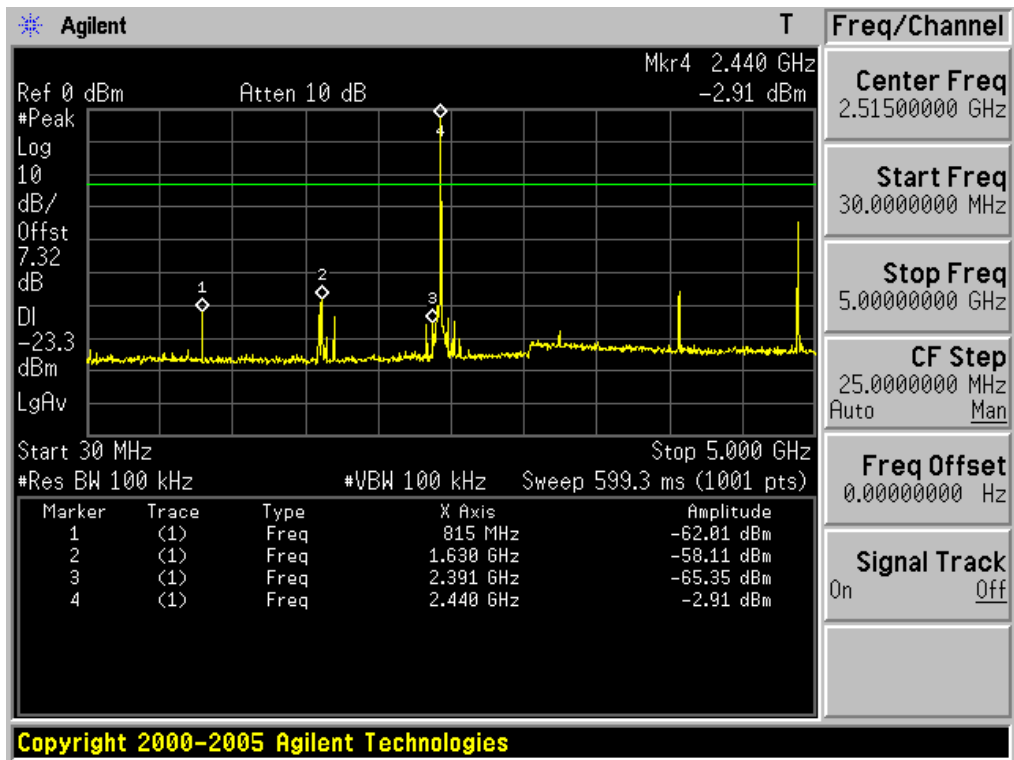
**Reference for limit**                    Middle Frequency   &   Data rate: 1Mbps
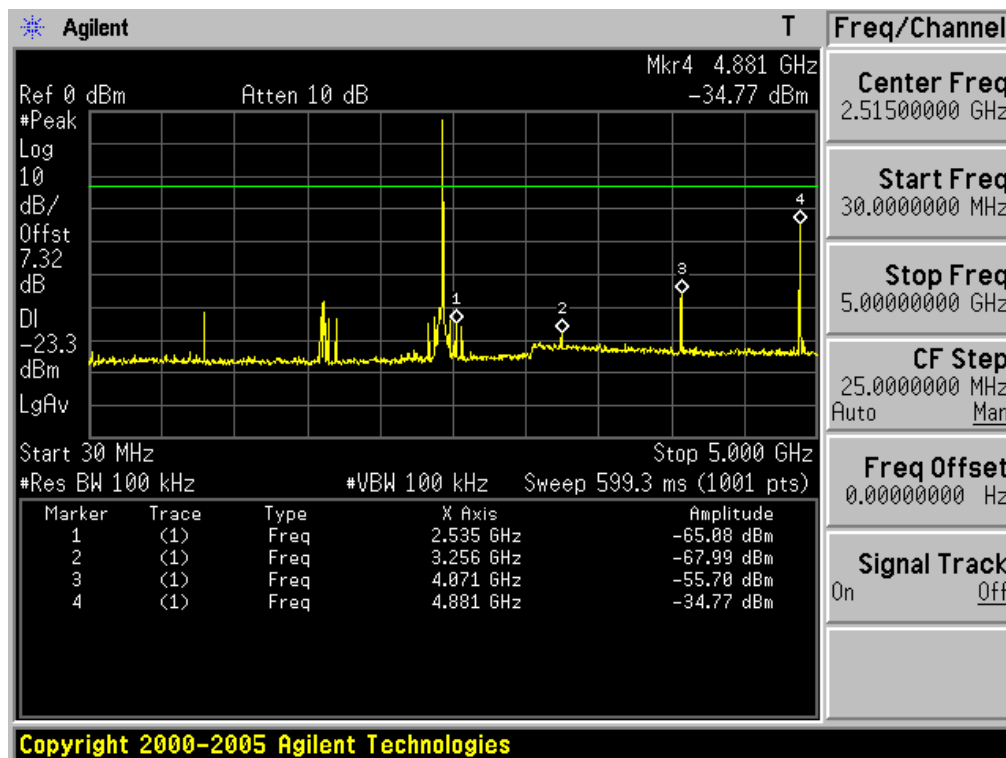


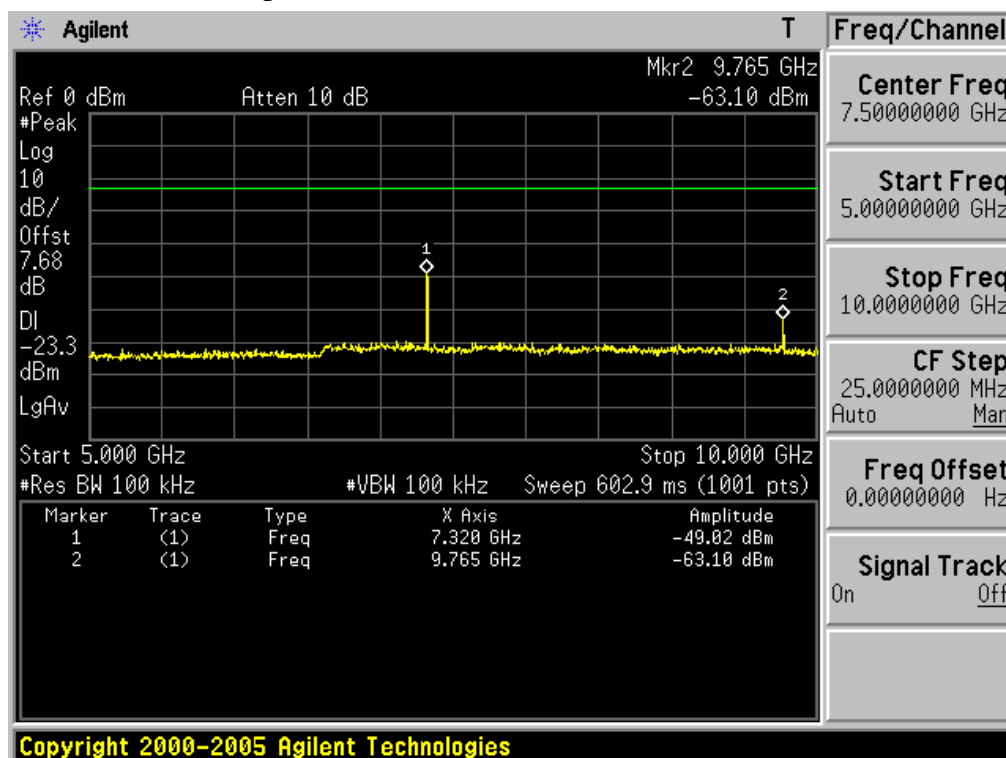**30MHz ~ 5GHz Conducted Spurious Emissions**   Middle Frequency   &   Data rate: 1Mbps

**30MHz ~ 5GHz Conducted Spurious Emissions**  Middle Frequency  &  Data rate: 1Mbps



**5GHz ~ 10GHz Conducted Spurious Emissions**  Middle Frequency  &  Data rate: 1Mbps

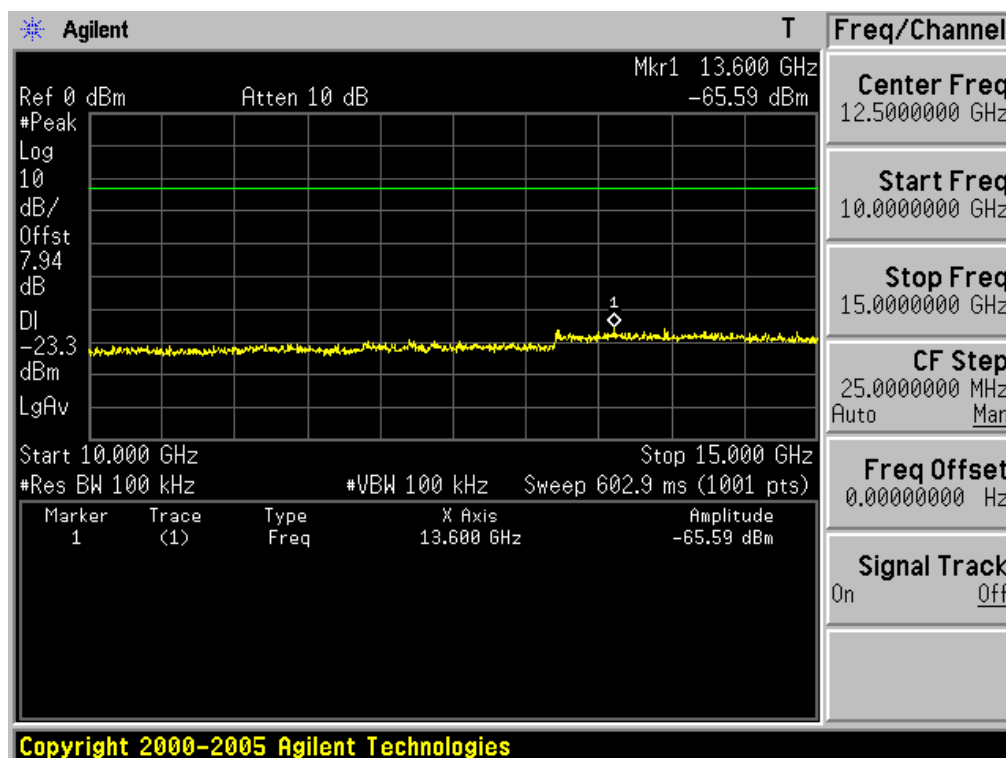**10GHz ~ 15GHz Conducted Spurious Emissions**   Middle Frequency   &   Data rate: 1Mbps
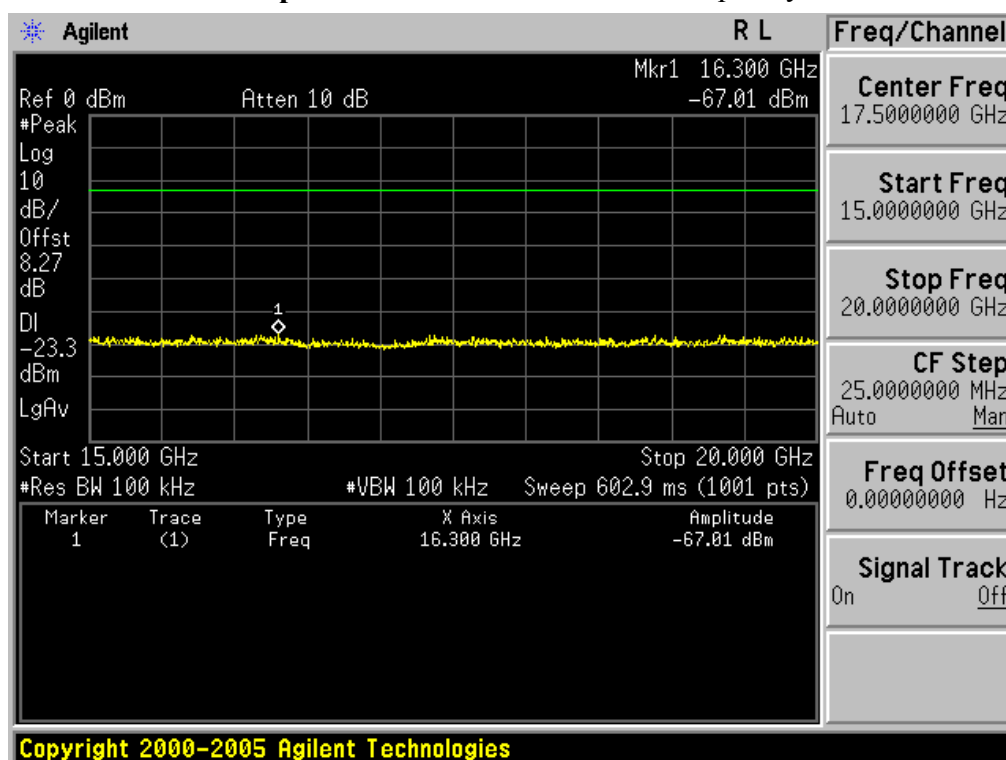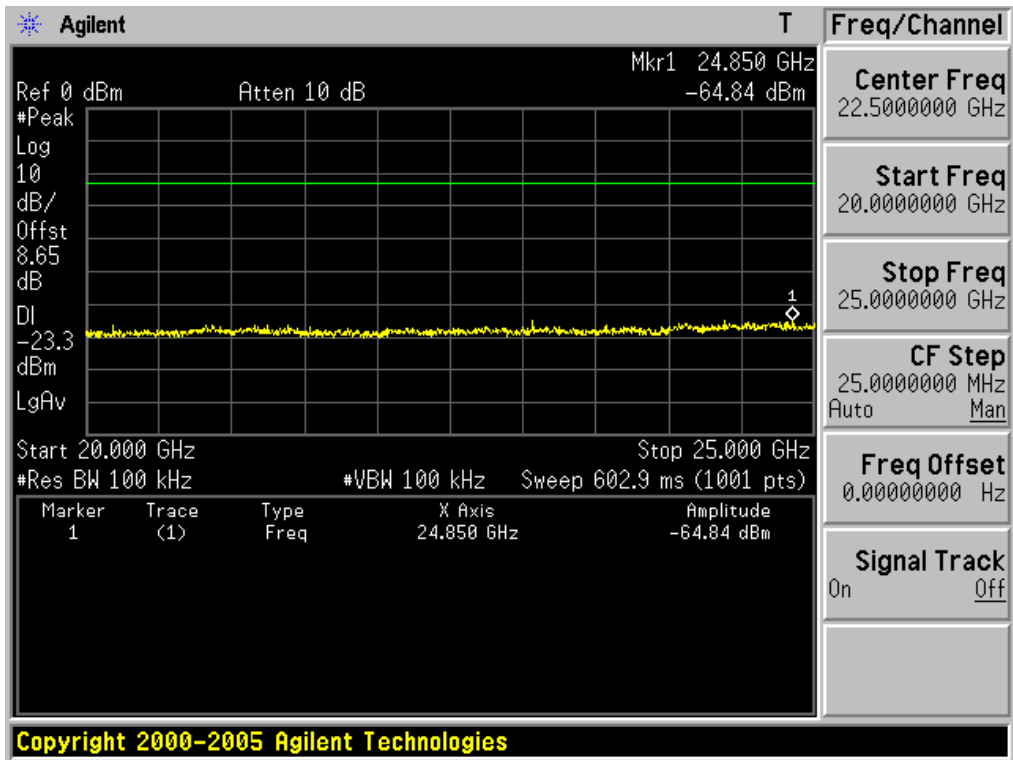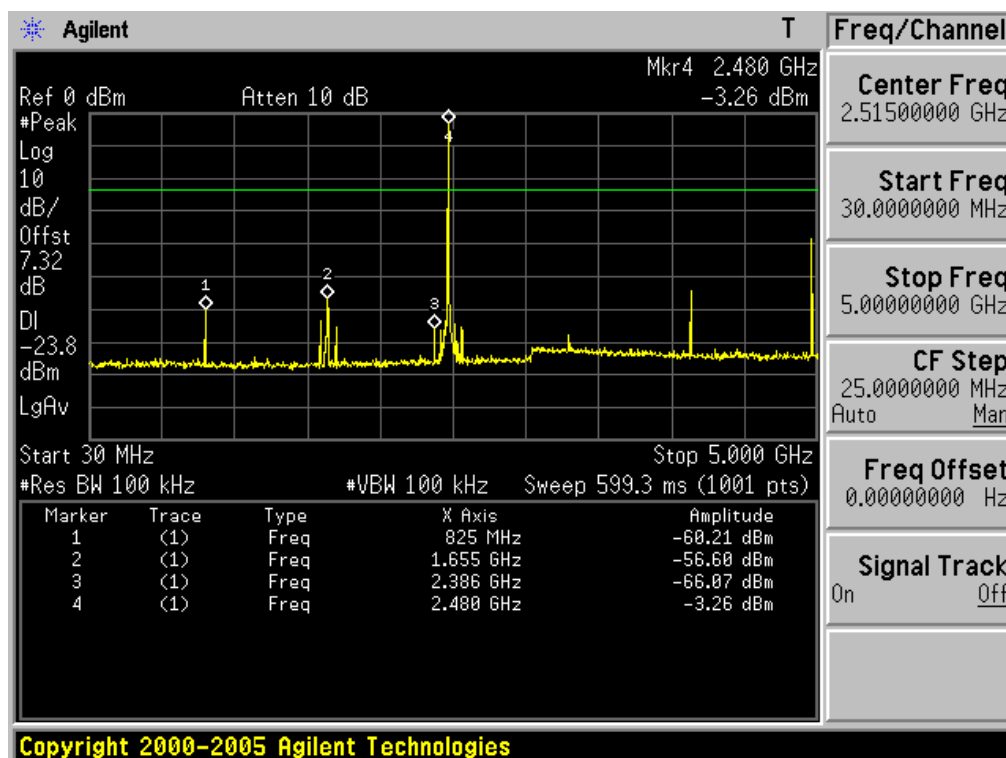


**15GHz ~ 20GHz Conducted Spurious Emissions**   Middle Frequency   &   Data rate: 1Mbps

**20GHz ~ 25GHz Conducted Spurious Emissions**   Middle Frequency   &   Data rate: 1Mbps

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**30MHz ~ 5GHz Conducted Spurious Emissions**　Highest Frequency　&　Data rate: 1Mbps



**30MHz ~ 5GHz Conducted Spurious Emissions**　Highest Frequency　&　Data rate: 1Mbps

**5GHz ~ 10GHz Conducted Spurious Emissions**     Highest Frequency   &   Data rate: 1Mbps



**10GHz ~ 15GHz Conducted Spurious Emissions**   Highest Frequency   &   Data rate: 1Mbps
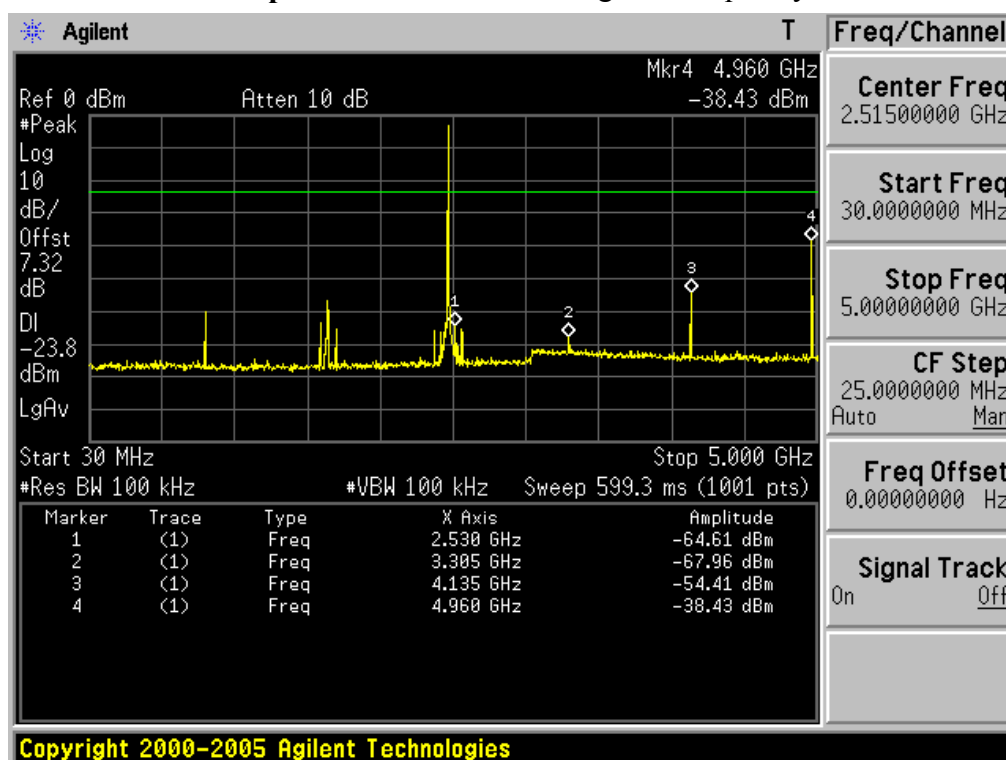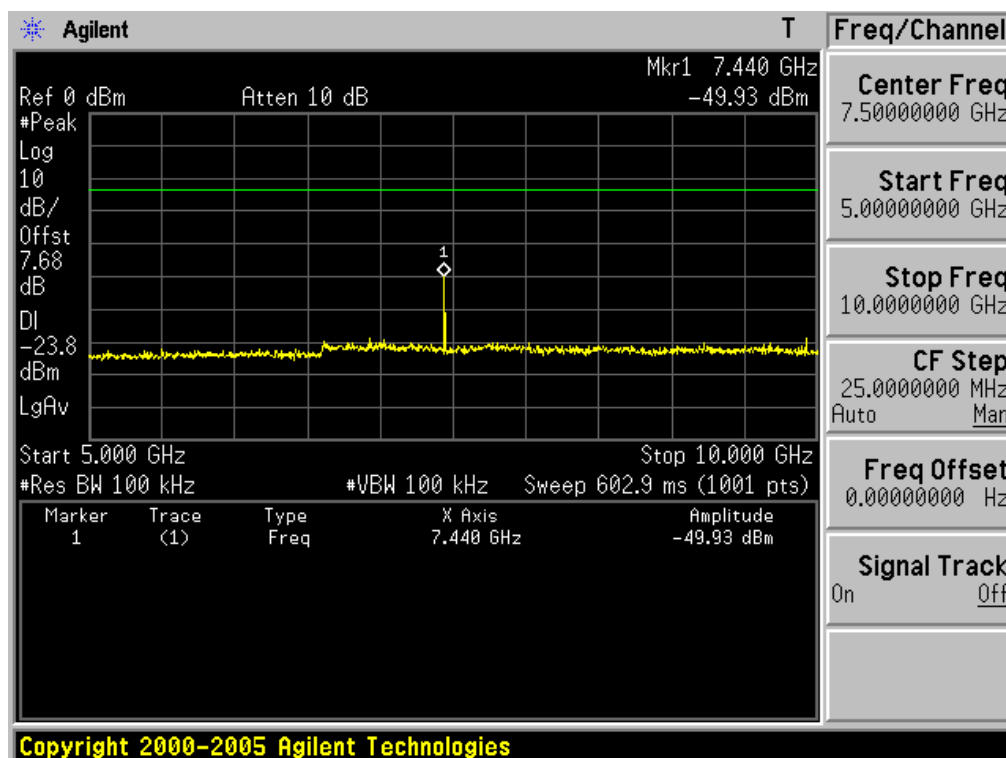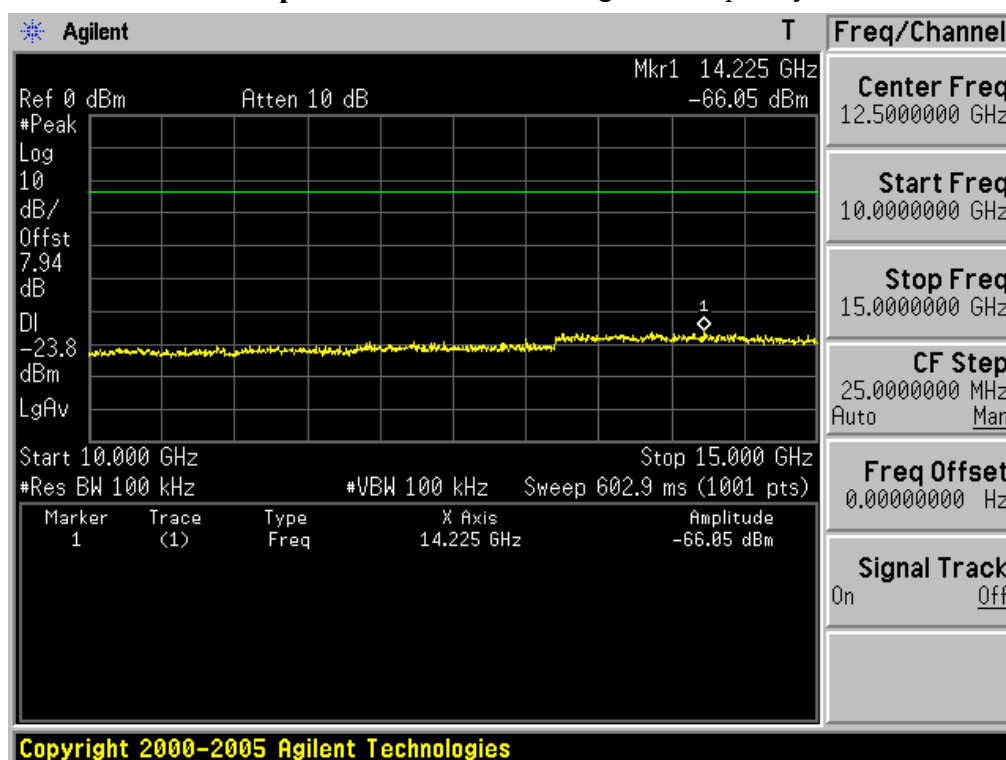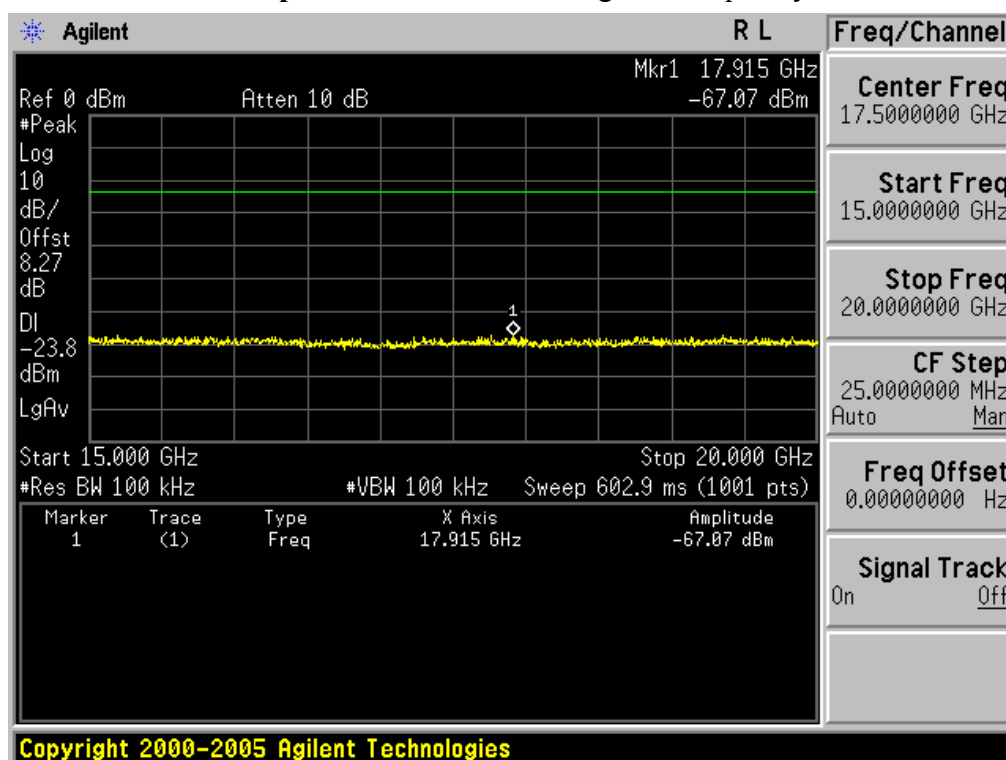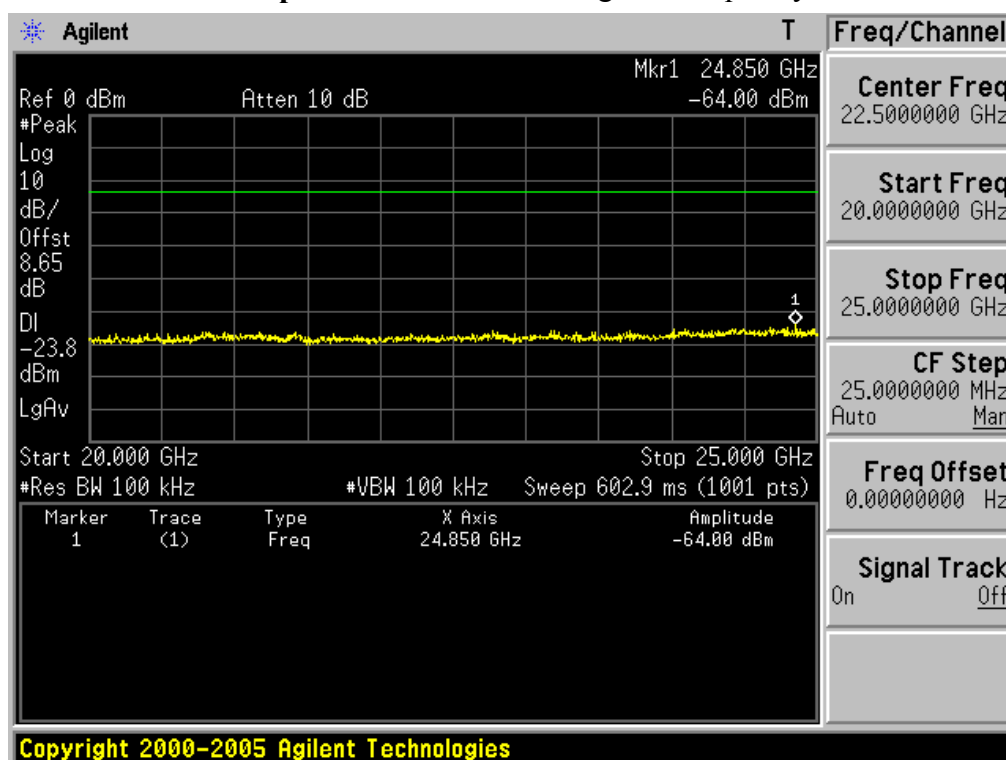
**15GHz ~ 20GHz Conducted Spurious Emissions**   Highest Frequency   &   Data rate: 1Mbps



**20GHz ~ 25GHz Conducted Spurious Emissions**   Highest Frequency   &   Data rate: 1Mbps

## 4.2.7 Radiated Spurious Emissions

**- Procedure:**

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:
Tested frequency =   Low, Middle, High Frequencies
Frequency Range =   30 MHz ~ 10th harmonic.
RBW and VBW =       1. Frequency range: 30MHz ~ 1GHz
                RBW =   120KHz   /   VBW =   $\geq$ RBW
            2. Frequency range: 1GHz ~ $10^{th}$ harmonics
                Peak mode:   RBW =   1MHz   /   VBW =   $\geq$ RBW
                Average mode:   RBW =   1MHz   /   VBW =   10Hz
Detector function =   Peak                            Sweep =   auto
Trace =   max hold

**- Measurement Data: Comply**

Note 1: See next pages for actual measured spectrum plots and data.

**- Minimum Standard:**
▪ **FCC Part 15.209(a) and (b)**

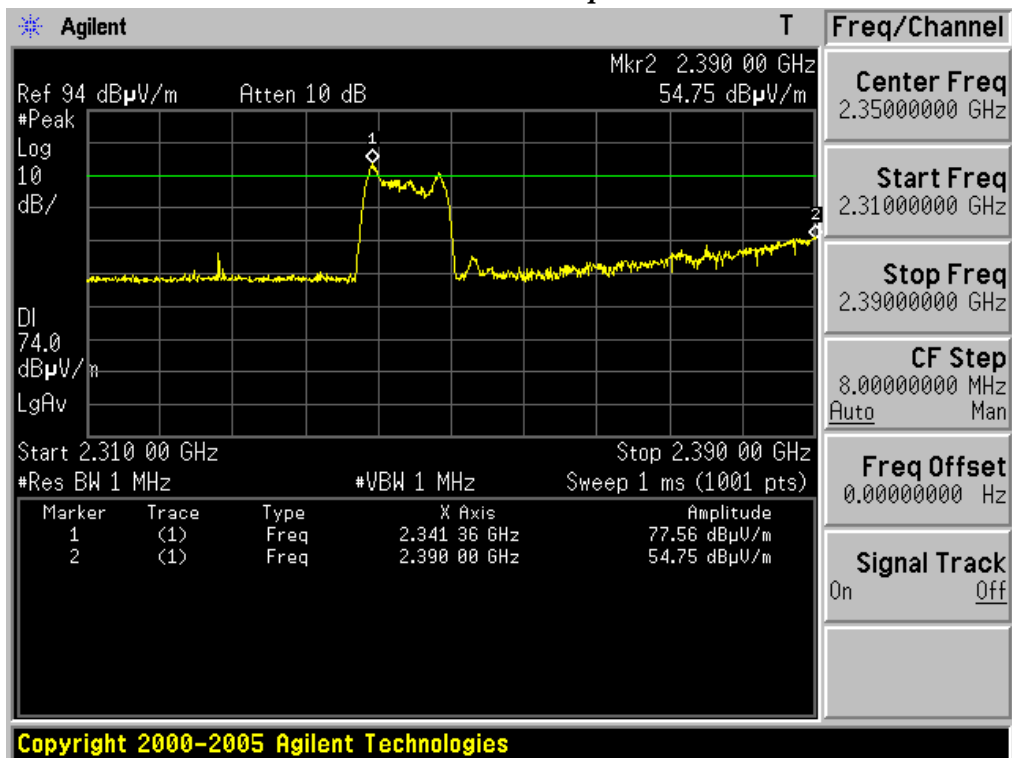| Frequency (MHz) | Limit (uV/m) @ 3m |
|---|---|
| 30 ~ 88 | 100 ** |
| 88 ~ 216 | 150 ** |
| 216 ~ 960 | 200 ** |
| Above 960 | 500 |

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz.   However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | MHz | GHz | GHz |
|---|---|---|---|---|---|
| 0.009 ~ 0.110 | 8.41425 ~ 8.41475 | 108 ~ 121.94 | 1300 ~ 1427 | 3600 ~ 4400 | 14.47 ~ 14.5 |
| 0.495 ~ 0.505 | 12.29 ~ 12.293 | 123 ~ 138 | 1435 ~ 1626.5 | 4.5 ~ 5.15 | 15.35 ~ 16.2 |
| 2.1735 ~ 2.1905 | 12.51975 ~ 12.52025 | 149.9 ~ 150.05 | 1645.5 ~ 1646.5 | 5.35 ~ 5.46 | 17.7 ~ 21.4 |
| 4.125 ~ 4.128 | 12.57675 ~ 12.57725 | 156.52475 ~ 156.52525 | 1660 ~ 1710 | 7.25 ~ 7.75 | 22.01 ~ 23.12 |
| 4.17725 ~ 4.17775 | 13.36 ~ 13.41 | 156.7 ~ 156.9 | 1718.8 ~ 1722.2 | 8.025 ~ 8.5 | 23.6 ~ 24.0 |
| 4.20725 ~ 4.20775 | 16.42 ~ 16.423 | 162.0125 ~ 167.17 | 2200 ~ 2300 | 9.0 ~ 9.2 | 31.2 ~ 31.8 |
| 6.215 ~ 6.218 | 16.69475 ~ 16.69525 | 167.72 ~ 173.2 | 2310 ~ 2390 | 9.3 ~ 9.5 | 36.43 ~ 36.5 |
| 6.26775 ~ 6.26825 | 16.80425 ~ 16.80475 | 240 ~ 285 | 2483.5 ~ 2500 | 10.6 ~ 12.7 | Above 38.6 |
| 6.31175 ~ 6.31225 | 25.5 ~ 25.67 | 322 ~ 335.4 | 2655 ~ 2900 | 13.25 ~ 13.4 | |
| 8.291 ~ 8.294 | 37.5 ~ 38.25 | 399.90 ~ 410 | 3260 ~ 3267 | | |
| 8.362 ~ 8.366 | 73 ~ 74.6 | 608 ~ 614 | 3332 ~ 3339 | | |
| 8.37625 ~ 8.38675 | 74.8 ~ 75.2 | 960 ~ 1240 | 3345.8 ~ 3358 | | |

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

**Restricted Band Edge**     Lowest Frequency   &   Data rate: 1Mbps

*Peak mode / Horizontal polarization*



Marker 1's emissions of the low band edge test plots are emissions from WIMAX downlink signal in Korea.

**Restricted Band Edge**     Lowest Frequency   &   Data rate: 1Mbps

*Average mode / Horizontal polarization*



Marker 1's emissions of the low band edge test plots are emissions from WIMAX downlink signal in Korea.

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**Restricted Band Edge**    Lowest Frequency   &   Data rate: 1Mbps
*Peak mode / Vertical polarization*



Marker 1's emissions of the low band edge test plots are emissions from WIMAX downlink signal in Korea.
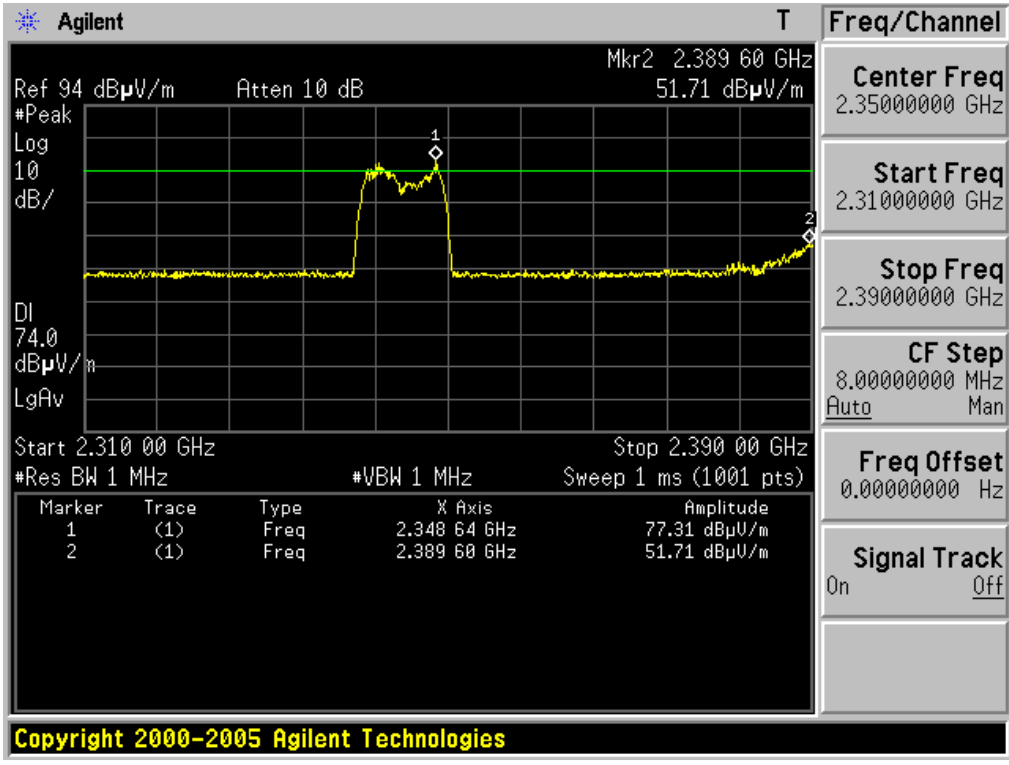
**Restricted Band Edge**    Lowest Frequency   &   Data rate: 1Mbps
*Average mode / Vertical polarization*



Marker 1's emissions of the low band edge test plots are emissions from WIMAX downlink signal in Korea.

**Restricted Band Edge**     Highest Frequency   &   Data rate: 1Mbps

*Peak mode / Horizontal polarization*



**Restricted Band Edge**     Highest Frequency   &   Data rate: 1Mbps

*Average mode / Horizontal polarization*

**Restricted Band Edge**   Highest Frequency   &   Data rate: 1Mbps
*Peak mode / Vertical polarization*



**Restricted Band Edge**   Highest Frequency   &   Data rate: 1Mbps
*Average mode / Vertical polarization*

## 30MHz ~ 1GHz Radiated Spurious Emissions    Lowest Frequency   &   Data rate: 1Mbps

### RADIATED EMISSION

Date : 2010-01-12

| | | | |
|---|---|---|---|
| Model Name | : UBC-100 | Reference No. | : |
| Model No. | : | Power Supply | : 3.7V |
| Serial No. | : Identical prototype | Temp/Humi | : 22'c   46% |
| Test Condition | : TX: 2402MHz | Operator | : D.C.CHA |
| Memo | : | | |

LIMIT : FCC Part15 Subpart.B Class B (3m)
MARGIN: 3 dB

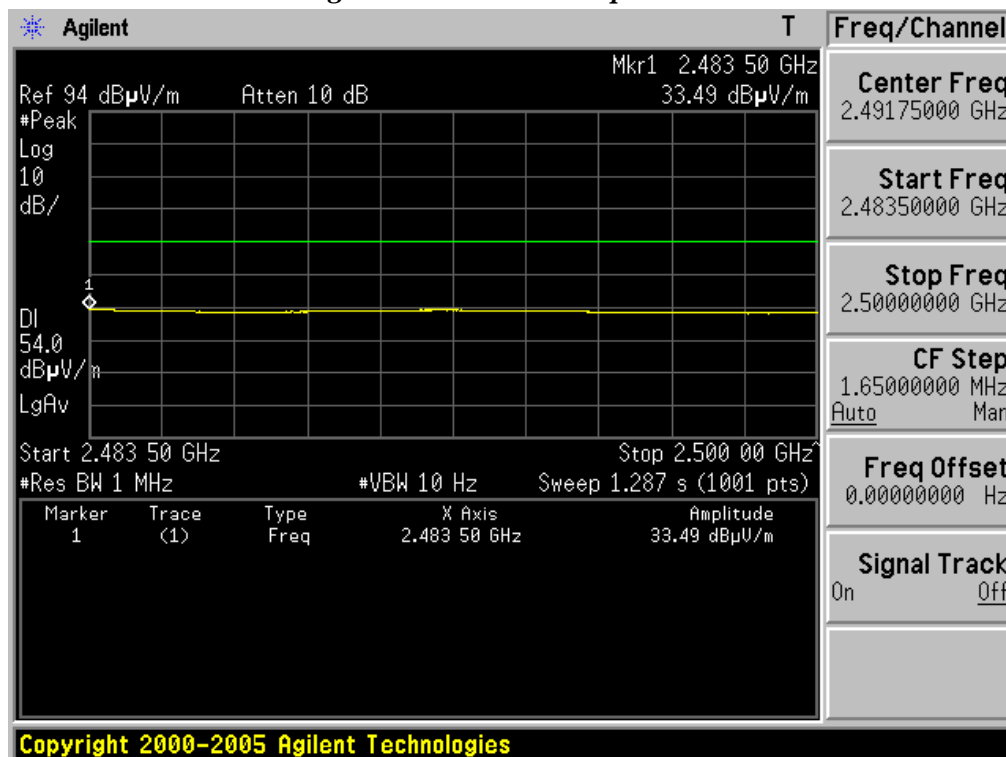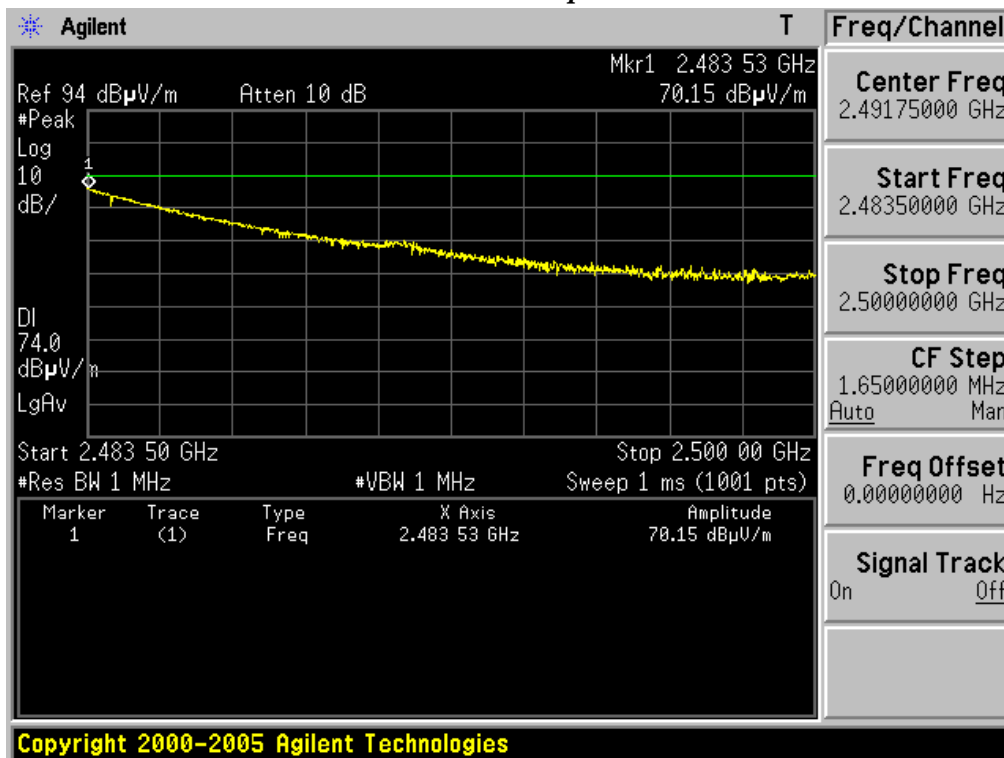[dBuV/m]          <<QP DATA>>                    HORIZONTAL  /  VERTICAL



```
        NO.  FREQ   READING ANT   LOSS  GAIN  RESULT  LIMIT   MARGIN  ANTENNA  TABLE
                    QP      FACTOR
             [MHz]  [dBuV]  [dB]  [dB]  [dB]  [dBuV/m][dBuV/m][dB]    [cm]     [DEG]

----- Horizontal ------

        1   47.099  17.8    10.7  1.0   22.4  7.1     40.0    32.9    200      358
        2  608.280  19.8    19.1  4.0   24.2  18.7    46.0    27.3    200      112

----- Vertical   ------

        3  103.065  18.6    10.8  1.4   22.5  8.3     43.5    35.2    100      358
        4  824.337  19.4    19.7  4.7   23.3  20.5    46.0    25.5    100      358
```

# 30MHz ~ 1GHz Radiated Spurious Emissions    Middle Frequency  &  Data rate: 1Mbps

Digital EMC

## RADIATED EMISSION

Date : 2010-01-12

| | | | | |
|---|---|---|---|---|
| Model Name | : UBC-100 | Reference No. | : | |
| Model No. | : | Power Supply | : 3.7V | |
| Serial No. | : Identical prototype | Temp/Humi | : 22'c  46% | |
| Test Condition | : TX: 2441MHz | Operator | : D.C.CHA | |
| Memo | : | | | |

LIMIT : FCC Part15 Subpart.B Class B (3m)
        MARGIN: 3 dB



| NO. | FREQ<br>[MHz] | READING<br>QP<br>[dBuV] | ANT<br>FACTOR<br>[dB] | LOSS<br>[dB] | GAIN<br>[dB] | RESULT<br>[dBuV/m] | LIMIT<br>[dBuV/m] | MARGIN<br>[dB] | ANTENNA<br>[cm] | TABLE<br>[DEG] |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- Horizontal ------ | | | | | | | | | | |
| 1 | 47.112 | 17.5 | 10.7 | 1.0 | 22.4 | 6.8 | 40.0 | 33.2 | 200 | 169 |
| 2 | 611.388 | 19.8 | 19.1 | 4.0 | 24.2 | 18.7 | 46.0 | 27.3 | 301 | 344 |
| ----- Vertical  ------ | | | | | | | | | | |
| 3 | 47.120 | 19.4 | 10.7 | 1.0 | 22.4 | 8.7 | 40.0 | 31.3 | 400 | 154 |
| 4 | 799.500 | 19.6 | 19.7 | 4.6 | 23.6 | 20.3 | 46.0 | 25.7 | 100 | 223 |

## 30MHz ~ 1GHz Radiated Spurious Emissions    Highest Frequency  &  Data rate: 1Mbps



**RADIATED EMISSION**

Date : 2010-01-12

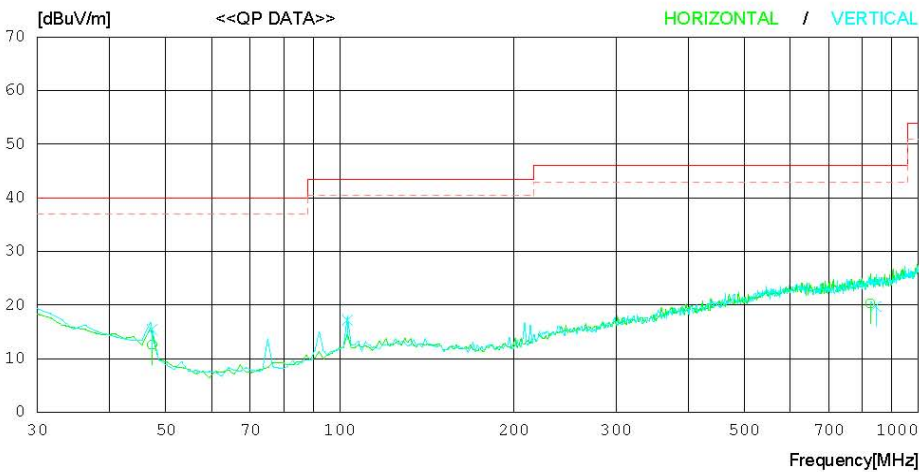| | | | |
|---|---|---|---|
| Model Name | : UBC-100 | Reference No. | : |
| Model No. | : | Power Supply | : 3.7V |
| Serial No. | : Identical prototype | Temp/Humi | : 22'c  46% |
| Test Condition | : TX: 2480MHz | Operator | : D.C.CHA |
| Memo | : | | |

LIMIT : FCC Part15 Subpart.B Class B (3m)
MARGIN: 3 dB

| NO. | FREQ QP [MHz] | READING [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|---|---|---|---|---|---|---|---|---|---|---|
| ----- Horizontal ------ | | | | | | | | | | |
| 1 | 47.379 | 23.6 | 10.4 | 1.0 | 22.4 | 12.6 | 40.0 | 27.4 | 100 | 358 |
| 2 | 825.854 | 19.2 | 19.7 | 4.7 | 23.3 | 20.3 | 46.0 | 25.7 | 301 | 98 |
| ----- Vertical  ------ | | | | | | | | | | |
| 3 | 47.399 | 26.4 | 10.4 | 1.0 | 22.4 | 15.4 | 40.0 | 24.6 | 400 | 7 |
| 4 | 103.211 | 27.5 | 10.8 | 1.4 | 22.5 | 17.2 | 43.5 | 26.3 | 100 | 1 |
| 5 | 844.560 | 18.6 | 19.7 | 4.8 | 23.4 | 19.7 | 46.0 | 26.3 | 100 | 1 |

## 1GHz ~ 25GHz Radiated Spurious Emissions

▪ Lowest Frequency   &   Data rate: 1Mbps

| Frequency (MHz) | ANT Pol | Reading(dBuV) | | T.F (dB) | Result(dBuV/m) | | Limit(dBuV/m) | | Margin(dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PK | AV | | PK | AV | PK | AV | PK | AV |
| 4804 | H | 46.11 | 36.10 | 7.27 | 53.38 | 43.37 | 74.00 | 54.00 | 20.62 | 10.63 |
| 4804 | V | 46.15 | 36.65 | 7.27 | 53.42 | 43.92 | 74.00 | 54.00 | 20.58 | 10.08 |
| - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - |

▪ Middle Frequency   &   Data rate: 1Mbps

| Frequency (MHz) | ANT Pol | Reading(dBuV) | | T.F (dB) | Result(dBuV/m) | | Limit(dBuV/m) | | Margin(dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PK | AV | | PK | AV | PK | AV | PK | AV |
| 4882 | H | 45.47 | 35.27 | 7.65 | 53.12 | 42.92 | 74.00 | 54.00 | 20.88 | 11.08 |
| 4882 | V | 46.74 | 36.19 | 7.65 | 54.39 | 43.84 | 74.00 | 54.00 | 19.61 | 10.16 |
| - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - |

▪ Highest Frequency   &   Data rate: 1Mbps

| Frequency (MHz) | ANT Pol | Reading(dBuV) | | T.F (dB) | Result(dBuV/m) | | Limit(dBuV/m) | | Margin(dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PK | AV | | PK | AV | PK | AV | PK | AV |
| 4960 | H | 44.47 | 33.09 | 7.96 | 52.43 | 41.05 | 74.00 | 54.00 | 21.57 | 12.95 |
| 4960 | V | 44.81 | 34.57 | 7.96 | 52.77 | 42.53 | 74.00 | 54.00 | 21.23 | 11.47 |
| - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - |

**Note.**

1. No other spurious and harmonic emissions were detected at a level greater than 20dB below limit.

2. Sample Calculation.

   Margin = Limit – Result   /   Result = Reading + T.F   /   T.F = AF + CL - AG

   Where, T.F = Total Factor,   AF = Antenna Factor,   CL = Cable Loss,   AG = Amplifier Gain

## 4.2.8 AC Line Conducted Emissions

**- Procedure:**

   The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold.   While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m).   Emissions closest to the limit are measured in the quasi-peak and average detector mode with the tuned receiver using a bandwidth of 9 kHz.   The emissions are maximized further by cable manipulation and Exerciser operation.   The highest emissions relative to the limit are listed.

**- Measurement Data: NA**

   Note : Conducted emission test is not applicable. Because the power of the EUT is supplied from a car battery using a cigar jack adapter.

**- Minimum Standard: FCC Part 15.207(a)/EN 55022**

| Frequency Range | Conducted Limit (dBuV) | |
|---|---|---|
| (MHz) | Quasi-Peak | Average |
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

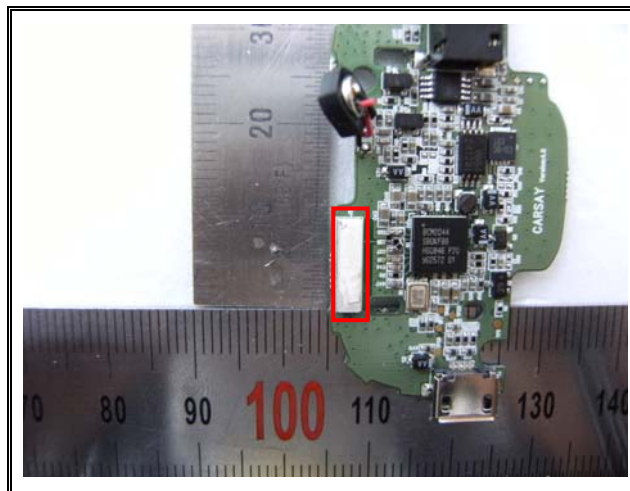 * Decreases with the logarithm of the frequency

## 4.2.9 Antenna Requirements

**- Procedure:**

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

**- Conclusion: Comply**

The Chip antenna is permanently attached on this device.    Because of soldering.



**- Minimum Standard:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.    The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

# APPENDIX

# TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

| | Type | Manufacturer | Model | Cal.Due.Date (dd/mm/yy) | Next.Due.Date (dd/mm/yy) | S/N |
|---|---|---|---|---|---|---|
| ☒ | Spectrum Analyzer | Agilent | E4440A | 25/09/09 | 25/09/10 | MY45304199 |
| ☐ | Spectrum Analyzer | Rohde Schwarz | FSQ26 | 05/06/09 | 05/06/10 | 200445 |
| ☐ | Spectrum Analyzer(RE) | H.P | 8563E | 13/10/09 | 13/10/10 | 3551A04634 |
| ☐ | Power Meter | H.P | EMP-442A | 02/07/09 | 02/07/10 | GB37170413 |
| ☐ | Power Sensor | H.P | 8481A | 02/07/09 | 02/07/10 | 3318A96332 |
| ☐ | Power Divider | Agilent | 11636B | 13/10/09 | 13/10/10 | 56471 |
| ☒ | Power Splitter | Anritsu | K241B | 13/10/09 | 13/10/10 | 20611 |
| ☐ | Power Splitter | Anritsu | K241B | 02/07/09 | 02/07/10 | 017060 |
| ☐ | Frequency Counter | H.P | 5342A | 13/07/09 | 13/07/10 | 2119A04450 |
| ☐ | TEMP & HUMIDITY Chamber | JISCO | KR-100/J-RHC2 | 10/10/09 | 10/10/10 | 30604493/021031 |
| ☒ | Digital Multimeter | H.P | 34401A | 13/03/09 | 13/03/10 | 3146A13475, US36122178 |
| ☐ | Multifuction Synthesizer | HP | 8904A | 06/10/09 | 06/10/10 | 3633A08404 |
| ☒ | Signal Generator | Rohde Schwarz | SMR20 | 13/03/09 | 13/03/10 | 101251 |
| ☐ | Signal Generator | H.P | ESG-3000A | 02/07/09 | 02/07/10 | US37230529 |
| ☐ | Vector Signal Generator | Rohde Schwarz | SMJ100A | 11/01/10 | 11/01/11 | 100148 |
| ☐ | Audio Analyzer | H.P | 8903B | 02/07/09 | 02/07/10 | 3011A09448 |
| ☐ | Modulation Analyzer | H.P | 8901B | 02/07/09 | 02/07/10 | 3028A03029 |
| ☐ | 8960 Series 10 Wireless Comms. Test Set | Agilent | E5515C | 02/07/09 | 02/07/10 | GB43461134 |
| ☐ | Universal Radio communication Tester | Rohde Schwarz | CMU 200 | 19/05/09 | 19/05/10 | 106760 |
| ☒ | Bluetooth Tester | TESCOM | TC-3000B | 02/07/09 | 02/07/10 | 3000B000268 |
| ☐ | Thermo hygrometer | BODYCOM | BJ5478 | 06/02/09 | 06/02/10 | 090205-3 |
| ☐ | Thermo hygrometer | BODYCOM | BJ5478 | 06/02/09 | 06/02/10 | 090205-2 |
| ☒ | Thermo hygrometer | BODYCOM | BJ5478 | 06/02/09 | 06/02/10 | 090205-4 |
| ☐ | AC Power supply | DAEKWANG | 5KVA | 13/03/09 | 13/03/10 | 20060321-1 |
| ☒ | DC Power Supply | HP | 6622A | 13/03/09 | 13/03/10 | 3448A03760 |
| ☐ | DC Power Supply | HP | 6633A | 13/03/09 | 13/03/10 | 3524A06634 |
| ☐ | BAND Reject Filter | Microwave Circuits | N0308372 | 06/10/09 | 06/10/10 | 3125-01DC0352 |
| ☐ | BAND Reject Filter | Wainwright | WRCG1750 | 06/10/09 | 06/10/10 | 2 |
| ☐ | High-Pass Filter | ANRITSU | MP526D | 06/10/09 | 06/10/10 | M27756 |
| ☐ | High-pass filter | Wainwright | WHKX2.1 | N/A | N/A | 1 |
| ☒ | High-Pass Filter | Wainwright | WHKX3.0 | N/A | N/A | 9 |
| ☐ | Tunable Notch Filter | Wainwright | WRCT800.0 /960.0-0.2/40-8SSK | N/A | N/A | 10 |
| ☐ | Tunable Notch Filter | Wainwright | WRCD1700.0 /2000.0-0.2/40-10SSK | N/A | N/A | 27 |
| ☐ | Tunable Notch Filter | Wainwright | WRCT1900.0/ 2200.0-5/40-10SSK | N/A | N/A | 7 |
| ☒ | HORN ANT | ETS | 3115 | 17/06/09 | 17/06/10 | 6419 |
| ☐ | HORN ANT | ETS | 3115 | 23/09/09 | 23/09/10 | 21097 |
| ☒ | HORN ANT | A.H.Systems | SAS-574 | 10/06/09 | 10/06/10 | 154 |
| ☐ | HORN ANT | A.H.Systems | SAS-574 | 10/06/09 | 10/06/10 | 155 |

| | Type | Manufacturer | Model | Cal.Due.Date (dd/mm/yy) | Next.Due.Date (dd/mm/yy) | S/N |
|---|---|---|---|---|---|---|
| ☐ | Dipole Antenna | Schwarzbeck | VHA9103 | 06/10/09 | 06/10/10 | 2116 |
| ☐ | Dipole Antenna | Schwarzbeck | VHA9103 | 06/10/09 | 06/10/10 | 2117 |
| ☐ | Dipole Antenna | Schwarzbeck | UHA9105 | 05/10/09 | 05/10/10 | 2261 |
| ☐ | Dipole Antenna | Schwarzbeck | UHA9105 | 05/10/09 | 05/10/10 | 2262 |
| ☐ | LOOP Antenna | ETS | 6502 | 14/09/09 | 14/09/10 | 3471 |
| ☐ | Coaxial Fixed Attenuators | Agilent | 8491B | 02/07/09 | 02/07/10 | MY39260700 |
| ☐ | Attenuator (3dB) | WEINSCHEL | 56-3 | 16/12/09 | 16/12/10 | Y2342 |
| ☐ | Attenuator (3dB) | WEINSCHEL | 56-3 | 16/12/09 | 16/12/10 | Y2370 |
| ☐ | Attenuator (10dB) | WEINSCHEL | 23-10-34 | 01/10/09 | 01/10/10 | BP4386 |
| ☐ | Attenuator (10dB) | WEINSCHEL | 23-10-34 | 11/01/10 | 11/01/11 | BP4387 |
| ☐ | Attenuator (20dB) | WEINSCHEL | 86-20-11 | 06/10/09 | 06/10/10 | 432 |
| ☐ | Attenuator (10dB) | WEINSCHEL | 31696 | 06/10/09 | 06/10/10 | 446 |
| ☐ | Attenuator (10dB) | WEINSCHEL | 31696 | 06/10/09 | 06/10/10 | 408 |
| ☐ | Attenuator (40dB) | WEINSCHEL | 57-40-33 | 01/10/09 | 01/10/10 | NN837 |
| ☐ | Attenuator (30dB) | JFW | 50FH-030-300 | 13/03/09 | 13/03/10 | 060320-1 |
| ☐ | Type N Coaxial CIRCULATOR | NOVA MICROWAVE | 0088CAN | 02/07/09 | 02/07/10 | 788 |
| ☐ | Type N Coaxial CIRCULATOR | NOVA MICROWAVE | 0185CAN | 02/07/09 | 02/07/10 | 790 |
| ☐ | Type N Coaxial CIRCULATOR | NOVA MICROWAVE | 0215CAN | 02/07/09 | 02/07/10 | 112 |
| ☒ | Amplifier (30dB) | Agilent | 8449B | 10/10/09 | 10/10/10 | 3008A01590 |
| ☐ | Amplifier | EMPOWER | BBS3Q7ELU | 02/02/09 | 02/02/10 | 1020 |
| ☐ | RF Power Amplifier | OPHIRRF | 5069F | 02/07/09 | 02/07/10 | 1006 |
| ☒ | EMI TEST RECEIVER | R&S | ESU | 02/02/09 | 02/02/10 | 100014 |
| ☒ | BILOG ANTENNA | SCHAFFNER | CBL6112B | 02/06/09 | 02/06/10 | 2737 |
| ☒ | Amplifier (22dB) | H.P | 8447E | 05/02/09 | 05/02/10 | 2945A02865 |
| ☐ | EMI TEST RECEIVER | R&S | ESCI | 12/05/09 | 12/05/10 | 100364 |
| ☐ | LOG-PERIODIC ANT. | Schwarzbeck | UHALP9108A | 30/05/09 | 30/05/10 | 590 |
| ☐ | BICONICAL ANT. | Schwarzbeck | VHA 9103 | 02/06/09 | 02/06/10 | 2233 |
| ☐ | LOG-PERIODIC ANT. | Schwarzbeck | UHALP9108A1 | 07/10/09 | 07/10/10 | 1098 |
| ☐ | BICONICAL ANT. | Schwarzbeck | VHA 9103 | 06/10/09 | 06/10/10 | 91031946 |
| ☐ | Low Noise Pre Amplifier | TSJ | MLA-100K01-B01-2 | 13/03/09 | 13/03/10 | 1252741 |
| ☐ | Amplifier (25dB) | Agilent | 8447D | 12/05/09 | 12/05/10 | 2944A10144 |
| ☐ | Amplifier (25dB) | Agilent | 8447D | 03/07/09 | 03/07/10 | 2648A04922 |
| ☐ | Spectrum Analyzer(CE) | H.P | 8591E | 26/04/09 | 26/04/10 | 3649A05889 |
| ☐ | LISN | Kyoritsu | KNW-407 | 03/07/09 | 03/07/10 | 8-317-8 |
| ☐ | LISN | Kyoritsu | KNW-242 | 13/10/09 | 13/10/10 | 8-654-15 |
| ☐ | CVCF | NF Electronic | 4420 | 13/03/09 | 13/03/10 | 304935/337980 |
| ☐ | DC BLOCK | Hyuplip | KEL-007 | N/A | N/A | 7-1581-5 |
| ☐ | 50 ohm Terminator | HME | CT-01 | 12/01/10 | 12/01/11 | N/A |
| ☐ | RFI/FIELD Intensity Meter | Kyoritsu | KNM-2402 | 03/07/09 | 03/07/10 | 4N-170-3 |