# FCC PART 15.247

# EMI MEASUREMENT AND TEST REPORT

For

## VTech Telecommunications Ltd.

23/F Tai Ping Ind Center Block 1, 57 Ting Kok Rd, Tai Po NT

**FCC ID: EW780-5744-10**

| This Report Concerns: | Equipment Type: |
|---|---|
| ☒ Original Report | 900MHZ / 2.4 GHz Cordless Phone |

| | |
|---|---|
| **Test Engineer:** | Daniel Deng |
| **Report No.:** | R0511071(B)-b |
| **Report Date:** | 2005-12-20 |
| **Reviewed By:** | Richard Lee |
| **Prepared By:** | Bay Area Compliance Laboratory Corporation (BACL)<br>230 Commercial Street<br>Sunnyvale, CA 94085<br>Tel: (408) 732-9162<br>Fax: (408) 732 9164 |

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# GENERAL INFORMATION

**Product Description for Equipment Under Test (EUT)**

The *VTech Telecommunications Ltd.'s* product, FCC ID: *EW780-5744-10,* Model: *E2116/E2126* or the "EUT" as referred to this report is a 900MHz / 2.4 GHz Cordless Phone, which measures approximately 180mmL x 140mmW x 70mmH. The EUT operates at the frequency range of 2400.9~2405.1MHz (Tx) and 921.4~927.2MHZ (Rx).

** The test data gathered are from typical production sample, serial number: E2126000011 provided by the manufacturer.*

**Objective**

This type approval report is prepared on behalf of *VTech Telecommunications Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A , B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for Output Power, Antenna Requirements, 6 dB Bandwidth, power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emission, Conducted and Spurious Radiated Emission.

**Related Submittal(s)/Grant(s)**

No Related Submittals.

**Test Methodology**

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

**Test Facility**

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

# SYSTEM TEST CONFIGURATION

### Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

### EUT Exercise Software

Engineering software for RF testing

### Special Accessories

As shown in following test block diagram, all interface cables used for compliance testing are shielded.

### Schematics / Block Diagram

Please refer to Appendix A.

### Equipment Modifications

No modifications were made to the EUT.

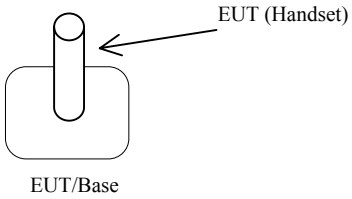
### Power Supply

| Manufacturer | Description | Model | Serial Number | FCC ID |
|---|---|---|---|---|
| COMPONENT TELEPHONE | AC Adapter | U090030D1201 | N/A | N/A |

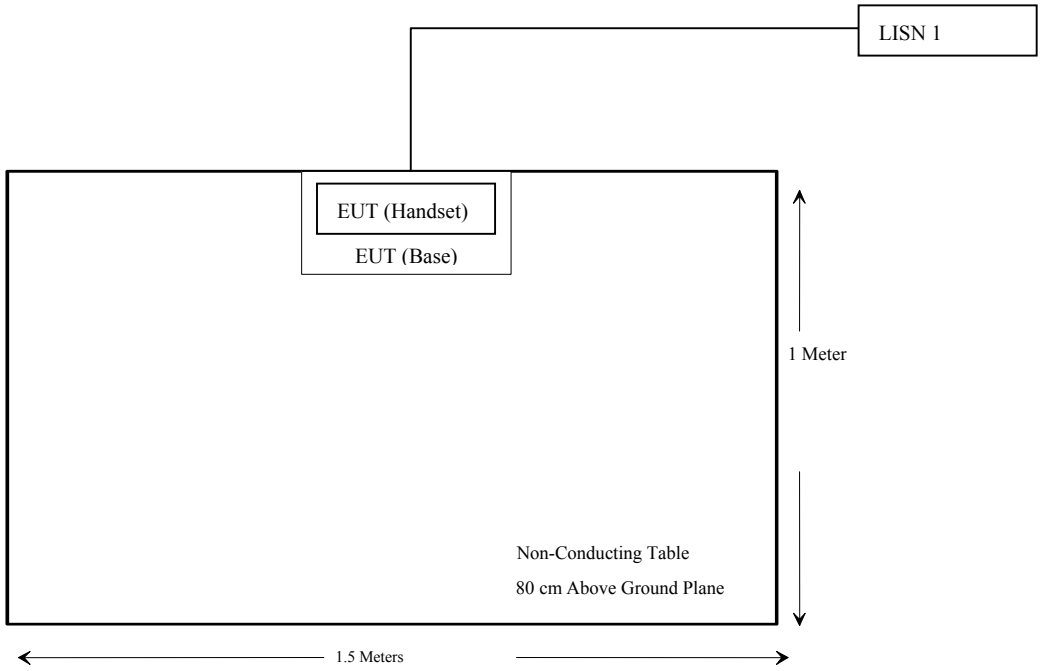
### Interface Ports and Cabling

| Cable Description | Length (M) | From | To |
|---|---|---|---|
| Shielded AC Power Cable | 1.50 | EUT | AC Power |

## Configuration of Test System




## Test Setup Block Diagram



# SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

| FCC RULES | DESCRIPTION OF TEST | RESULT |
|---|---|---|
| §2.1091 | RF Exposure | Pass |
| §15.203 | Antenna Requirement | Pass |
| §15.205 | Restricted Band | Pass |
| § 15.207 (a) | Conducted Emissions | N/A |
| §2.1051 & §15.247(c) | Spurious Emission at Antenna Port | Pass |
| §15.209 (a) & §15.247(c) | Radiated Emission | Pass* |
| §15.247 (a)(2) | 6 dB Bandwidth | Pass |
| §15.247 (b)(3) | Maximum Peak Output Power | Pass |
| § 15.247 (c) | 100 kHz Bandwidth of Frequency Band Edge | Pass |
| §15.247 (d) | Peak Power Spectral Density | Pass |

* test data are within the measurement uncertainty

# §1.1307(b)(1) & §2.1091 - RF EXPOSURE

According to §15.247(b)(5) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density ($mW/cm^2$) | Averaging Time (minute) |
|---|---|---|---|---|
| Limits for General Population/Uncontrolled Exposure | | | | |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 824/f | 2.19/f | *($180/f^2$) | 30 |
| 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

**MPE Prediction**

Predication of MPE limit at a given distance

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

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

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 13.21(dBm)
Maximum peak output power at antenna input terminal: 20.94 (mW)
Prediction distance: 20 (cm)
Predication frequency: 2400 (MHz)
Antenna Gain (typical): 0 (dBi)
antenna gain: 1 (numeric)
Power density at predication frequency at 20 cm: 0.004($mW/cm^2$)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 ($mW/cm^2$)

**Test Result**

The EUT is a mobile device. The power density level at 20 cm is 0.004mW/cm², which is below the uncontrolled exposure limit of 1.0mW/cm² at 2400 MHz.

# §15.203 - ANTENNA REQUIREMENT

**Standard Applicable**

According to § 15.203, 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.

And according to § 15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The antenna for this device is an integral antenna with gain of 0 dBi.

# §15.207 (a)- CONDUCTED EMISSION

**Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are receiver, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

**Test Setup**

The measurement was performed at shield room, using the same setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with LISN-1.

**Receiver Setup**

The EMI receiver was set to investigate the spectrum from 150 kHz to 30MHz.

**Test Equipment List and Details**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| R&S | Receiver, EMI Test | ESCS30 | 100176 | 2005-09-15 |
| R&S | Artificial Mains Network | ESH2-Z5 | 871884/039 | 2005-08-16 |

*** Statement of Traceability : BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

**Test Procedure**

During the conducted emission test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Qusi-Peak readings are distinguished with an "QP". Average readings are distinguished with an "Ave".

**Environmental Conditions**

| | |
|---|---|
| Temperature: | 25° C |
| Relative Humidity: | 45% |
| ATM Pressure: | 1016 mbar |

**The testing was performed by Daniel Deng on 2005-11-18.*

**Summary of Test Results**

According to the recorded data in following table, the EUT complied with the FCC Conducted limit for a Class B device, with the *worst* margin reading of:

E2116: **-23.6 dB** at **0.300 MHz** in the **Line** conductor

**Conducted Emissions Test Data**

Model: E2116

| LINE CONDUCTED EMISSIONS | | | | FCC CLASS B | |
|---|---|---|---|---|---|
| Frequency MHz | Amplitude dBμV | Detector Qp/Ave/Peak | Phase Line/Neutral | Limit dBμV | Margin dB |
| 0.300 | 36.6 | QP | Line | 60.24 | -23.6 |
| 0.310 | 35.3 | QP | Neutral | 59.97 | -24.7 |
| 0.810 | 20.9 | Ave | Line | 46.00 | -25.1 |
| 0.810 | 20.5 | Ave | Neutral | 46.00 | -25.5 |
| 0.150 | 38.8 | QP | Line | 66.00 | -27.2 |
| 0.150 | 38.4 | QP | Neutral | 66.00 | -27.6 |
| 0.810 | 24.1 | QP | Line | 56.00 | -31.9 |
| 0.810 | 23.3 | QP | Neutral | 56.00 | -32.7 |
| 0.300 | 9.3 | Ave | Line | 50.24 | -40.9 |
| 0.310 | 8.4 | Ave | Neutral | 49.97 | -41.6 |
| 0.150 | 10.6 | Ave | Line | 56.00 | -45.4 |
| 0.150 | 10.3 | Ave | Neutral | 56.00 | -45.7 |

**Plot of Conducted Emissions Test Data**

Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.

Bay Area Compliance Laboratory Corp 18. Nov 05 12:52

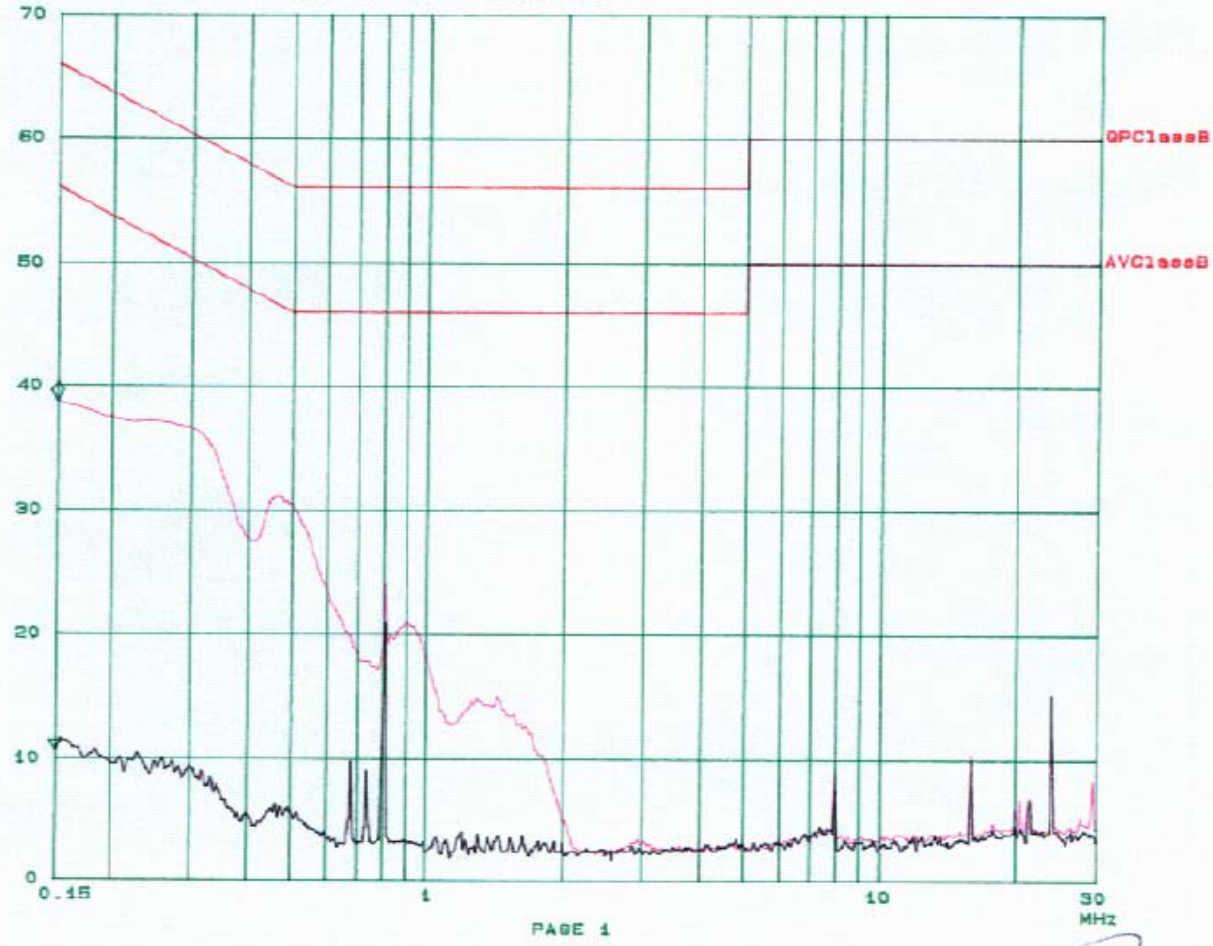
Class B

EUT: CORDLESS PHONE
Manuf: Vtech
Op Cond: Normal
Operator: Daniel
Comment: L
120VAC

Scan Settings (3 Ranges)

| Frequencies | | | Receiver Settings | | | | |
|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp |
| 150k | 1M | 5k | 9k | QP+AV | 20ms | 15dBLN | OFF |
| 1M | 5M | 10k | 9k | QP+AV | 1ms | 15dBLN | OFF |
| 5M | 30M | 100k | 9k | QP+AV | 1ms | 15dBLN | OFF |

◊ Mkr : 150.00 kHz 38.8 dBuV
▽ Mkr : 150.00 kHz 10.6 dBuV




PAGE 1

2005-11-18

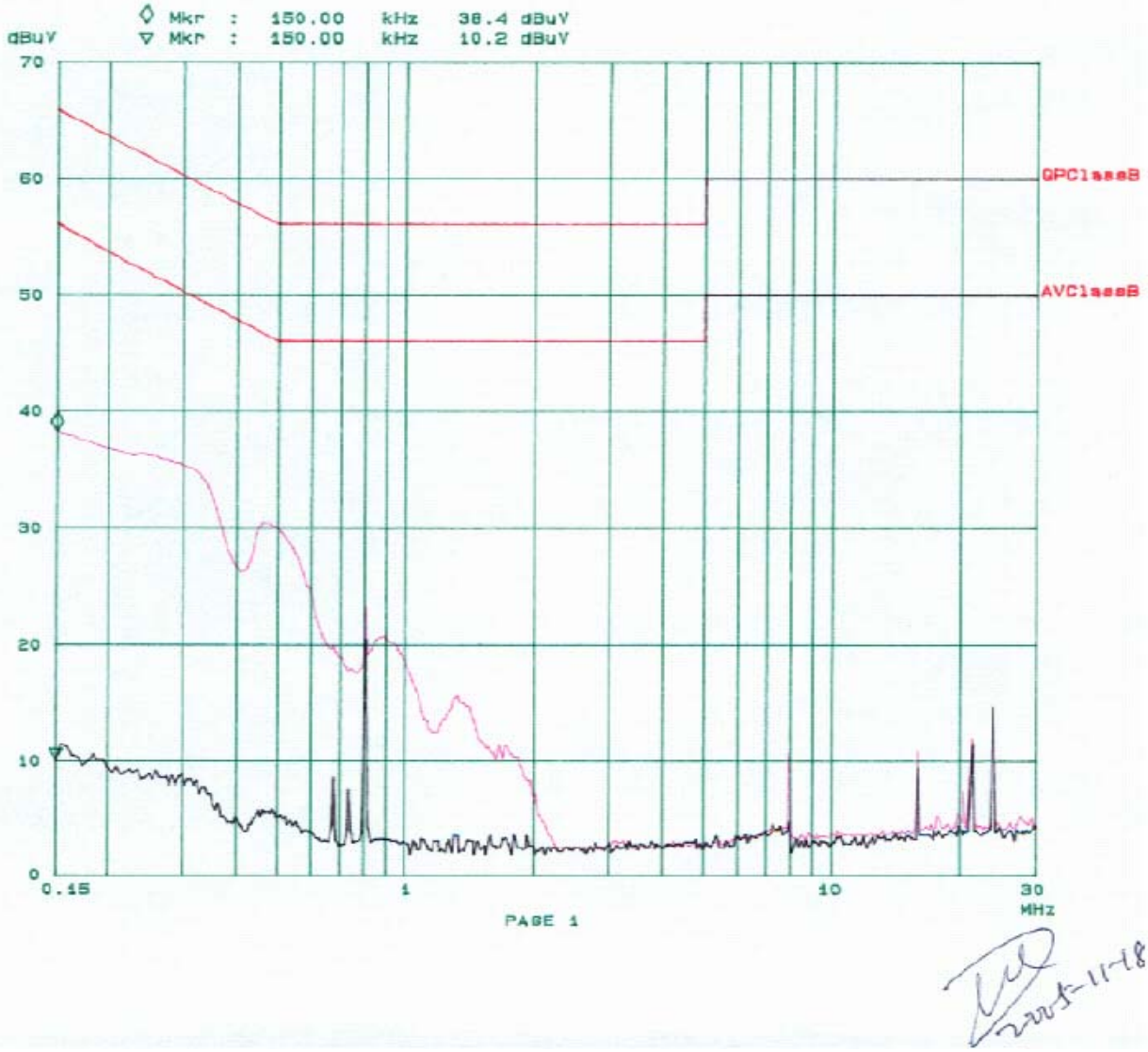
Bay Area Compliance Laboratory Corp 18. Nov 05 12:29

Class B

EUT: CORDLESS PHONE
Manuf: Vtech
Op Cond: Normal
Operator: Daniel
Comment: N
120VAC

Scan Settings (3 Ranges)

| Frequencies | | | Receiver Settings | | | | |
|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp |
| 150k | 1M | 5k | 9k | QP+AV | 20ms | 15dBLN | OFF |
| 1M | 5M | 10k | 9k | QP+AV | 1ms | 15dBLN | OFF |
| 5M | 30M | 100k | 9k | QP+AV | 1ms | 15dBLN | OFF |




2005-11-18

# §2.1051 & §15.247(c) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

**Standard Applicable**

Requirements: CFR 47, § 2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

**Measurement Procedure**

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to $10^{th}$ harmonic.

**Equipment Lists**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 11/10/2005 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

**Measurement Result**

Please refer to following pages for plots of spurious emission.

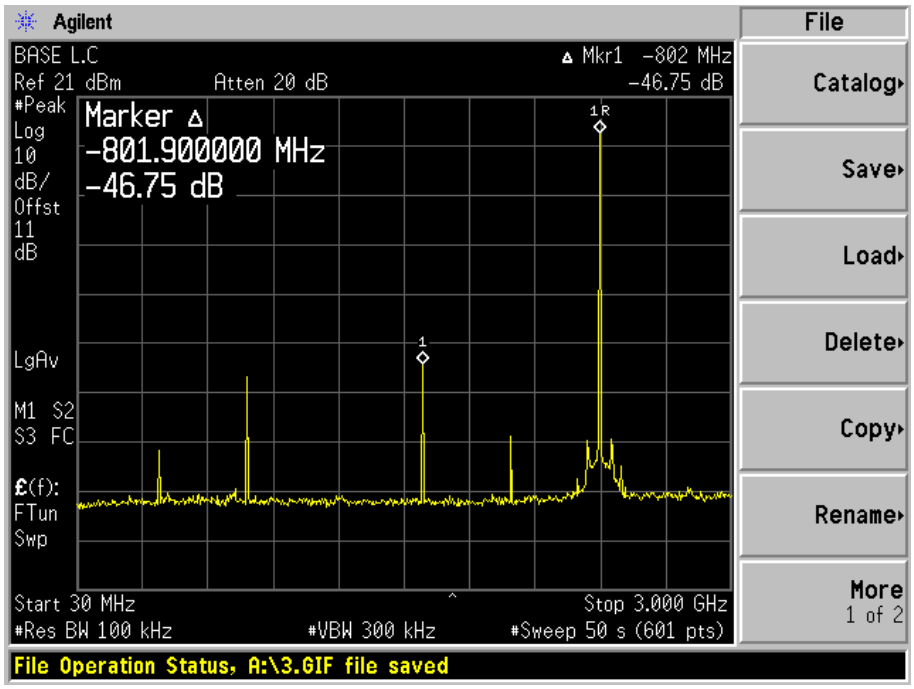
**Environmental Conditions**

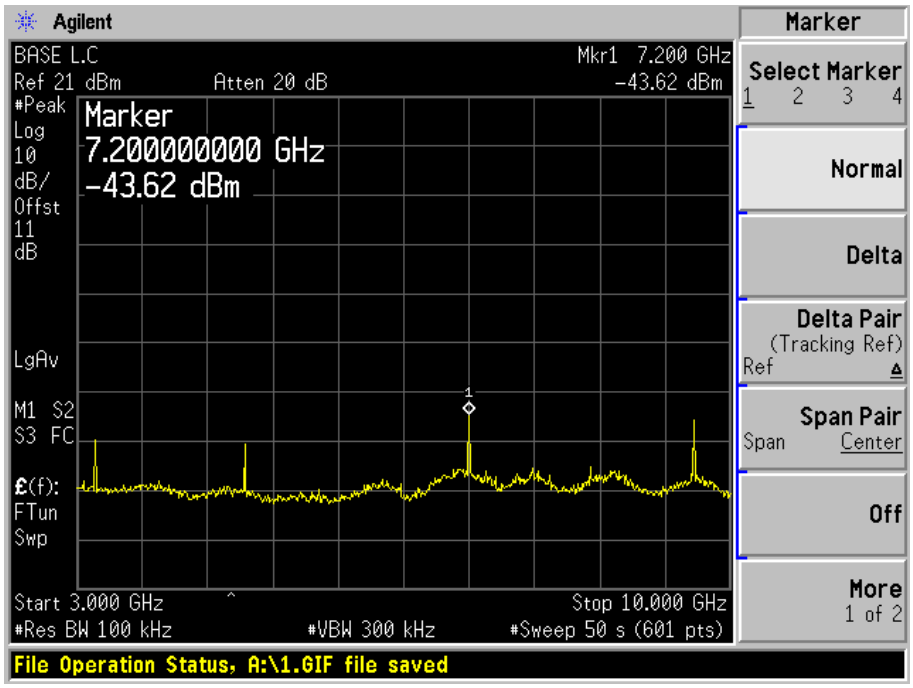
| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 43% |
| ATM Pressure: | 1022 mbar |

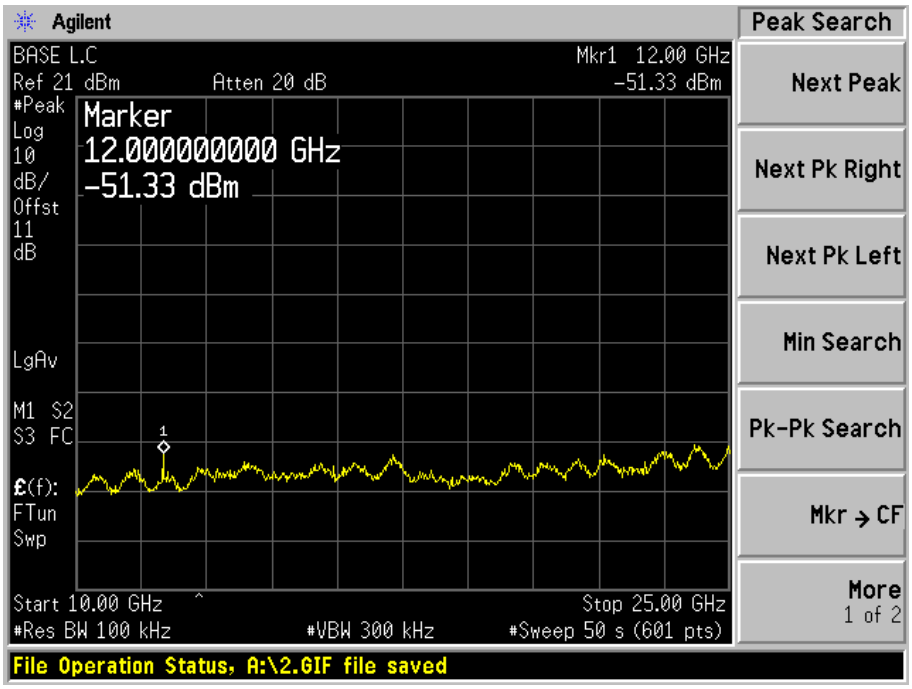
*The testing was performed by Daniel Deng on 2005-11-18.*

*Model: E2116/E2126*

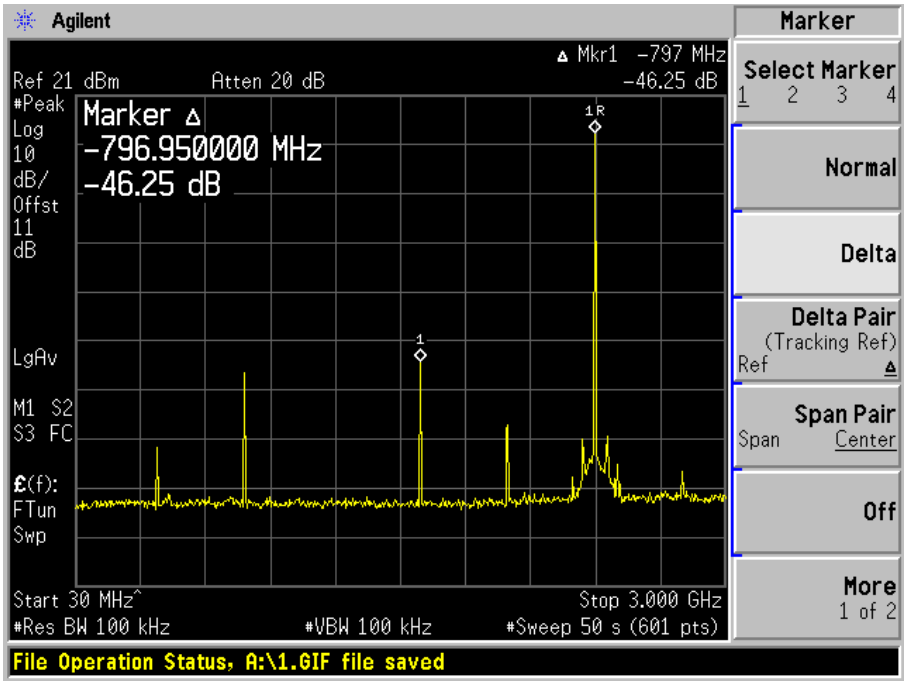
*Low Channel*

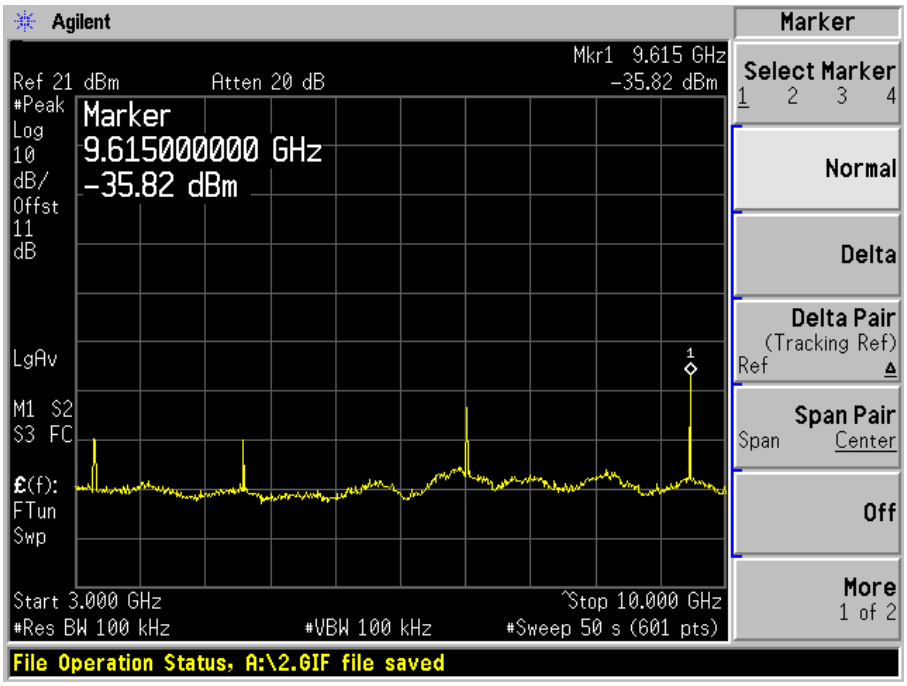


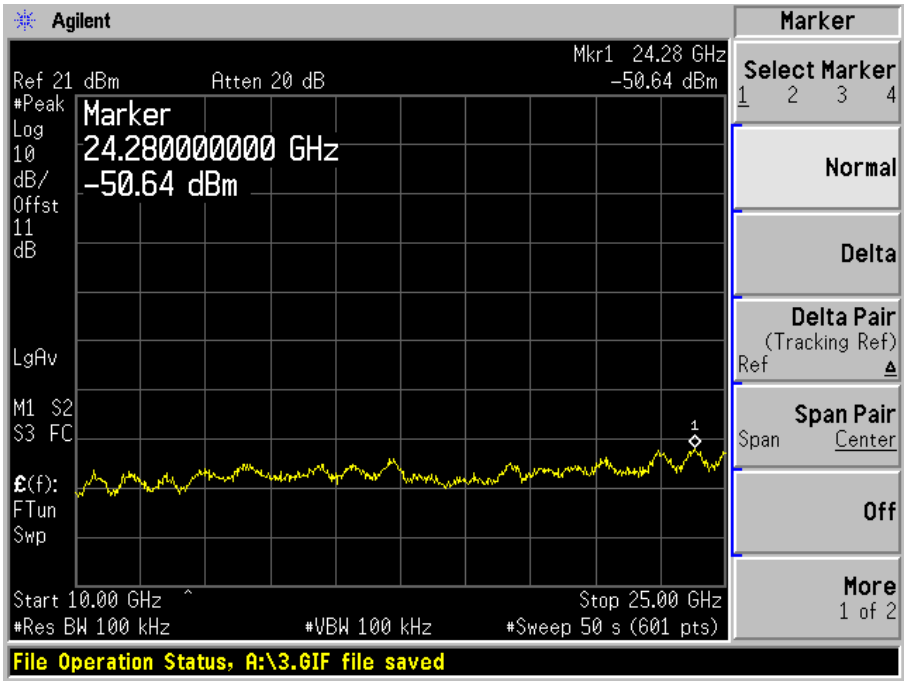




Agilent
Peak Search
BASE L.C
Mkr1 12.00 GHz
Ref 21 dBm
Atten 20 dB
-51.33 dBm
#Peak
Log
10
dB/
Offst
11
dB
Marker
12.000000000 GHz
-51.33 dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 10.00 GHz
Stop 25.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
#Sweep 50 s (601 pts)
File Operation Status, A:\2.GIF file saved

*Mid Channel*


Agilent
Marker
Δ Mkr1 -797 MHz
Ref 21 dBm
Atten 20 dB
-46.25 dB
#Peak
Log
10
dB/
Offst
11
dB
Marker Δ
-796.950000 MHz
-46.25 dB
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Δ
Span Pair
Span Center
Off
More
1 of 2
Start 30 MHz
Stop 3.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
#Sweep 50 s (601 pts)
File Operation Status, A:\1.GIF file saved


Agilent
Marker
Mkr1 9.615 GHz
Ref 21 dBm
Atten 20 dB
-35.82 dBm
#Peak
Log
10
dB/
Offst
11
dB
Marker
9.615000000 GHz
-35.82 dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Start 3.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 10.000 GHz
#Sweep 50 s (601 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref
Span Pair
Span Center
Off
More
1 of 2
File Operation Status, A:\2.GIF file saved


Agilent
Marker
Mkr1 24.28 GHz
Ref 21 dBm
Atten 20 dB
-50.64 dBm
#Peak
Log
10
dB/
Offst
11
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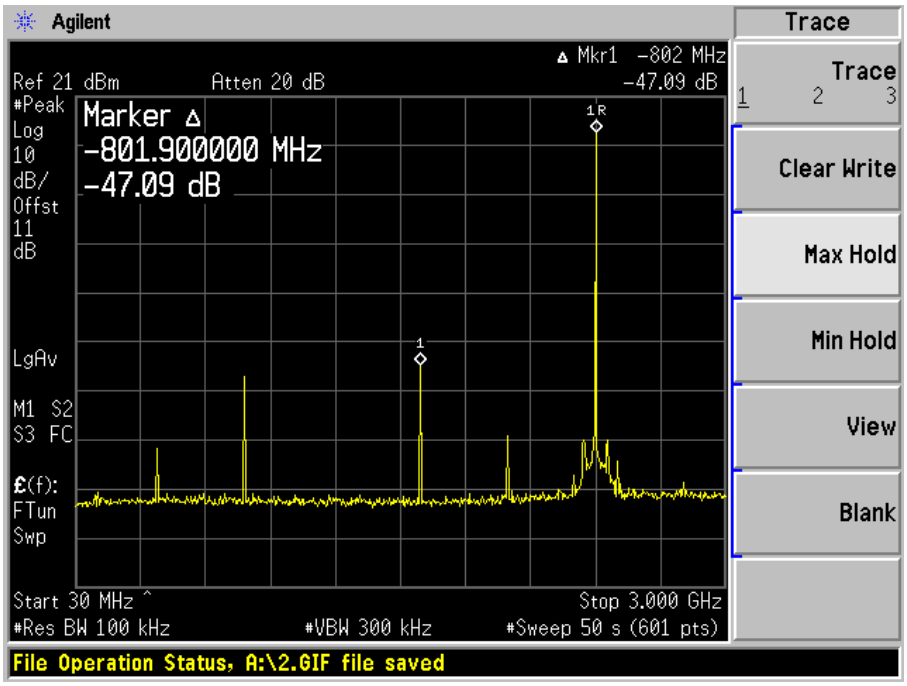
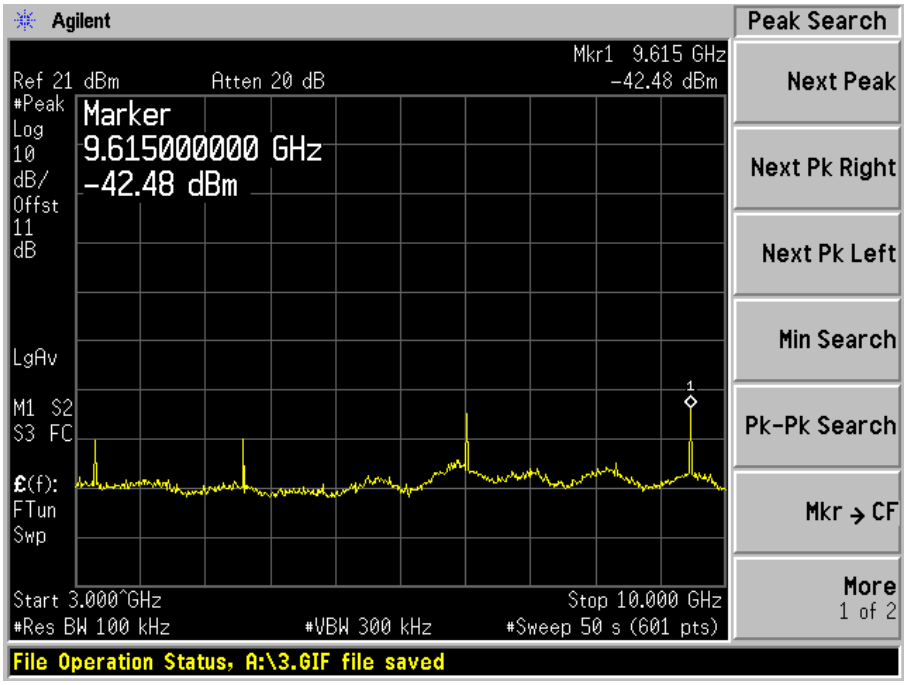
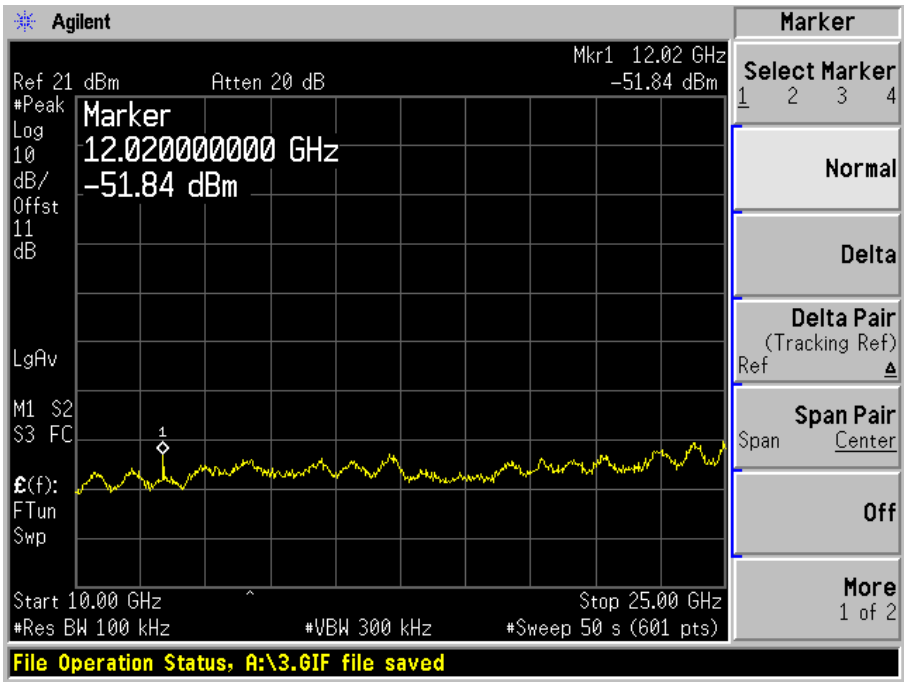
Marker
24.280000000 GHz
-50.64 dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Start 10.00 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 25.00 GHz
#Sweep 50 s (601 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref
Span Pair
Span Center
Off
More
1 of 2
File Operation Status, A:\3.GIF file saved

*High Channel*




Agilent
Marker
Mkr1 12.02 GHz
Ref 21 dBm
Atten 20 dB
-51.84 dBm
#Peak
Log
10
dB/
Offst
11
dB
Marker
12.020000000 GHz
-51.84 dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Start 10.00 GHz
Stop 25.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
#Sweep 50 s (601 pts)
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref
Span Pair
Span Center
Off
More
1 of 2
File Operation Status, A:\3.GIF file saved

# §15.205 & §15.209 & §15.247(c) - SPURIOUS RADIATED EMISSION

**Measurement Uncertainty**

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is $\pm$4.0 dB.

According to §15.205, 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 |
| [1]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 – 12.57725 | 240 – 285 | 3345.8 – 3358 | 36.43 – 36.5 |
| 13.36 – 13.41 | 322 – 335.4 | 3600 – 4400 | ([2]) |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510MHz
[2] Above 38.6

Except as provided in paragraph (d) and (e), the filed 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 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, 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.

According to §15.209, the device shall meet radiated emission general requirements.

Except for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency of Emission (MHz) | Field Strength (Microvolts/meter) | (dBμV/meter) |
|---|---|---|
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

**EUT Setup**

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

**Spectrum Analyzer Setup**

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 30 to 25000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

| ***Frequency Range*** | ***RBW*** | ***Video B/W*** |
|---|---|---|
| Below 30MHz | 10kHz | 10kHz |
| 30 – 1000MHz | 100kHz | 100kHz |
| Above 1000MHz | 1MHz | 1MHz |

For Average measurement: RBW = 1MHz, VBW = 10Hz (above 1000MHz)

**Test Equipment List and Details**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| HP | Amplifier, Pre (.1 ~1300MHz) | 8447D | 2944A10198 | 08/17/2005 |
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 11/10/2005 |
| ETS | Antenna, Log-Periodic | 3148 | 4-1155 | 12/14/2004 |
| ETS | Antenna, Biconical | 3110B | 9603-2315 | 12/14/2004 |
| A. H. Systems | Antenna, Horn, DRG | SAS-200/571 | 261 | 04/20/2005 |
| HP | Pre, Amplifier (1 ~ 26.5 GHz) | 8449B | 3147A00400 | 03/14/2005 |
| Sunol Science | 30MHz – 2 GHz Antenna | JB1 | A03105-3 | 02/11/2005 |

*** Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

**Test Procedure**

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "**Qp**" in the data table.

**Corrected Amplitude & Margin Calculation**

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corr. Ampl. - FCC 15.247 Limit

**Environmental Conditions**

| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 43% |
| ATM Pressure: | 1022 mbar |

*The testing was performed by Daniel Deng on 2005-11-18, 2005-12-12*

**Summary of Test Results**

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

For E2116/E2126: **-9.4 dB** at **4801.4 MHz** in the **Horizontal** polarization, Low Channel

For E2116/E2126: **-9.6 dB** at **4805.8 MHz** in the **Horizontal** polarization, Middle Channel

For E2116/E2126: **-9.3 dB** at **4810.2 MHz** in the **Horizontal** polarization, High Channel

For E2116: **-4.2 dB** at **798.24 MHz** in the **Horizontal** polarization, Unintentional Emission

For E2126: **-4.3dB** at **797.27 MHz** in the **Horizontal** polarization, Unintentional Emission

(test data are within the measurement uncertainty ±4.0dB)

**Radiated Emission Test Result**

For Low Channel, 1-25GHz

Model: E2116/E2126

| INDICATED | | | TABLE | ANTENNA | | CORRECTION FACTOR | | | CORRECTED AMPLITUDE | FCC 15 SUBPART C | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency MHz | Ampl. dBμV/m | Comments | Angle Degree | Height Meter | Polar H/ V | Antenna dB | Cable dB | Amp. dB | Corr. Ampl. dBμV/m | Limit dBμV/m | Margin dB |
| 4801.4000 | 43.8 | Ave | 250 | 1.8 | h | 32.5 | 3.1 | 34.8 | 44.6 | 54 | -9.4 |
| 4801.4000 | 43.5 | Ave | 0 | 1.5 | v | 32.5 | 3.1 | 34.8 | 44.3 | 54 | -9.7 |
| 3201.2800 | 46.0 | Ave | 0 | 1.8 | v | 29.8 | 2.5 | 35.2 | 43.2 | 54 | -10.8 |
| 3201.2800 | 44.5 | Ave | 270 | 2.2 | h | 29.8 | 2.5 | 35.2 | 41.7 | 54 | -12.3 |
| 7202.1000 | 34.3 | Ave | 0 | 1.6 | v | 36.7 | 4.3 | 34.7 | 40.7 | 54 | -13.3 |
| 7202.1000 | 32.1 | Ave | 0 | 1.5 | h | 36.7 | 4.3 | 34.7 | 38.4 | 54 | -15.6 |
| 800.2400 | 61.0 | Peak | 90 | 1.8 | v | 22.3 | 0.8 | 28.7 | 55.4 | 74 | -18.6 |
| 800.2400 | 58.9 | Peak | 0 | 1.8 | h | 22.3 | 0.8 | 28.7 | 53.3 | 74 | -20.7 |
| 1600.5500 | 42.7 | Ave | 60 | 1.8 | h | 24.8 | 1.9 | 36.3 | 33.0 | 54 | -21.0 |
| 1600.5500 | 41.8 | Ave | 270 | 1.3 | v | 24.8 | 1.9 | 36.3 | 32.1 | 54 | -21.9 |
| 7202.1000 | 44.8 | Peak | 0 | 1.6 | v | 36.7 | 4.3 | 34.7 | 51.2 | 74 | -22.8 |
| 4801.4000 | 50.0 | Peak | 250 | 1.8 | h | 32.5 | 3.1 | 34.8 | 50.8 | 74 | -23.2 |
| 4801.4000 | 49.8 | Peak | 0 | 1.5 | v | 32.5 | 3.1 | 34.8 | 50.6 | 74 | -23.4 |
| 7202.1000 | 42.5 | Peak | 0 | 1.5 | h | 36.7 | 4.3 | 34.7 | 48.8 | 74 | -25.2 |
| 3201.2800 | 51.3 | Peak | 0 | 1.8 | v | 29.8 | 2.5 | 35.2 | 48.5 | 74 | -25.5 |
| 3201.2800 | 50.7 | Peak | 270 | 2.2 | h | 29.8 | 2.5 | 35.2 | 47.8 | 74 | -26.2 |
| 1600.5500 | 51.2 | Peak | 60 | 1.8 | h | 24.8 | 1.9 | 36.3 | 41.5 | 74 | -32.5 |
| 1600.5500 | 50.8 | Peak | 270 | 1.3 | v | 24.8 | 1.9 | 36.3 | 41.1 | 74 | -32.9 |

For Middle Channel, 1-25GHz

Model: E2116/E2126

| INDICATED | | | TABLE | ANTENNA | | CORRECTION FACTOR | | | CORRECTED AMPLITUDE | FCC 15 SUBPART C | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency MHz | Ampl. dBμV/m | Comments | Angle Degree | Height Meter | Polar H/ V | Antenna dB | Cable dB | Amp. dB | Corr. Ampl. dBμV/m | Limit dBμV/m | Margin dB |
| 4805.8000 | 43.6 | Ave | 270 | 1.7 | h | 32.5 | 3.1 | 34.8 | 44.4 | 54 | -9.6 |
| 4805.8000 | 43.3 | Ave | 0 | 1.5 | v | 32.5 | 3.1 | 34.8 | 44.1 | 54 | -9.9 |
| 3203.5500 | 46.2 | Ave | 270 | 1.6 | v | 29.8 | 2.5 | 35.2 | 43.4 | 54 | -10.6 |
| 3203.5500 | 44.6 | Ave | 270 | 1.8 | h | 29.8 | 2.5 | 35.2 | 41.8 | 54 | -12.2 |
| 7209.2000 | 34.2 | Ave | 0 | 1.5 | v | 36.7 | 4.3 | 34.7 | 40.5 | 54 | -13.5 |
| 7209.2000 | 32.1 | Ave | 270 | 1.5 | h | 36.7 | 4.3 | 34.7 | 38.4 | 54 | -15.6 |
| 800.8500 | 62.1 | Peak | 60 | 1.6 | v | 22.3 | 0.8 | 28.7 | 56.5 | 74 | -17.5 |
| 800.8500 | 59.9 | Peak | 0 | 1.6 | h | 22.3 | 0.8 | 28.7 | 54.3 | 74 | -19.7 |
| 1602.3000 | 42.6 | Ave | 45 | 1.6 | h | 24.8 | 1.9 | 36.3 | 32.9 | 54 | -21.1 |
| 1602.3000 | 42.2 | Ave | 0 | 1.4 | v | 24.8 | 1.9 | 36.3 | 32.5 | 54 | -21.5 |
| 7209.2000 | 44.5 | Peak | 0 | 1.5 | v | 36.7 | 4.3 | 34.7 | 50.8 | 74 | -23.2 |
| 4805.8000 | 49.7 | Peak | 270 | 1.7 | h | 32.5 | 3.1 | 34.8 | 50.5 | 74 | -23.5 |
| 4805.8000 | 49.6 | Peak | 0 | 1.5 | v | 32.5 | 3.1 | 34.8 | 50.4 | 74 | -23.6 |
| 7209.2000 | 42.6 | Peak | 270 | 1.5 | h | 36.7 | 4.3 | 34.7 | 48.9 | 74 | -25.1 |
| 3203.5500 | 51.6 | Peak | 270 | 1.6 | v | 29.8 | 2.5 | 35.2 | 48.8 | 74 | -25.2 |
| 3203.5500 | 50.9 | Peak | 270 | 1.8 | h | 29.8 | 2.5 | 35.2 | 48.1 | 74 | -25.9 |
| 1602.3000 | 51.8 | Peak | 45 | 1.6 | h | 24.8 | 1.9 | 36.3 | 42.1 | 74 | -31.9 |
| 1602.3000 | 51.3 | Peak | 0 | 1.4 | v | 24.8 | 1.9 | 36.3 | 41.6 | 74 | -32.4 |

For High Channel, 1-25GHz

Model: E2116/E2126

| INDICATED | | | TABLE | ANTENNA | | CORRECTION FACTOR | | | CORRECTED AMPLITUDE | FCC 15 SUBPART C | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency MHz | Ampl. dBμV/m | Comments | Angle Degree | Height Meter | Polar H/ V | Antenna dB | Cable dB | Amp. dB | Corr. Ampl. dBμV/m | Limit dBμV/m | Margin dB |
| 4810.2000 | 43.9 | Ave | 270 | 1.7 | h | 32.5 | 3.1 | 34.8 | 44.7 | 54 | -9.3 |
| 4810.2000 | 43.6 | Ave | 90 | 1.4 | v | 32.5 | 3.1 | 34.8 | 44.4 | 54 | -9.6 |
| 3206.9500 | 46.8 | Ave | 180 | 1.8 | v | 29.8 | 2.5 | 35.2 | 44.0 | 54 | -10.0 |
| 3206.9500 | 45.8 | Ave | 180 | 1.7 | h | 29.8 | 2.5 | 35.2 | 43.0 | 54 | -11.0 |
| 7215.3000 | 34.3 | Ave | 0 | 1.5 | v | 36.7 | 4.3 | 34.7 | 40.7 | 54 | -13.3 |
| 7215.3000 | 33.1 | Ave | 90 | 1.7 | h | 36.7 | 4.3 | 34.7 | 39.4 | 54 | -14.6 |
| 801.5500 | 61.2 | Peak | 90 | 1.6 | v | 22.3 | 0.8 | 28.7 | 55.6 | 74 | -18.4 |
| 801.5500 | 59.4 | Peak | 90 | 1.5 | h | 22.3 | 0.8 | 28.7 | 53.8 | 74 | -20.2 |
| 1603.3300 | 42.3 | Ave | 0 | 1.7 | h | 24.8 | 1.9 | 36.3 | 32.6 | 54 | -21.4 |
| 1603.3300 | 41.8 | Ave | 200 | 1.8 | v | 24.8 | 1.9 | 36.3 | 32.1 | 54 | -21.9 |
| 4810.2000 | 50.4 | Peak | 270 | 1.7 | h | 32.5 | 3.1 | 34.8 | 51.2 | 74 | -22.8 |
| 7215.3000 | 44.9 | Peak | 0 | 1.5 | v | 36.7 | 4.3 | 34.7 | 51.2 | 74 | -22.8 |
| 4810.2000 | 50.1 | Peak | 90 | 1.4 | v | 32.5 | 3.1 | 34.8 | 50.9 | 74 | -23.1 |
| 7215.3000 | 43.2 | Peak | 90 | 1.7 | h | 36.7 | 4.3 | 34.7 | 49.5 | 74 | -24.5 |
| 3206.9500 | 52.2 | Peak | 180 | 1.8 | v | 29.8 | 2.5 | 35.2 | 49.3 | 74 | -24.7 |
| 3206.9500 | 51.1 | Peak | 180 | 1.7 | h | 29.8 | 2.5 | 35.2 | 48.3 | 74 | -25.7 |
| 1603.3300 | 51.6 | Peak | 0 | 1.7 | h | 24.8 | 1.9 | 36.3 | 41.9 | 74 | -32.1 |
| 1603.3300 | 50.5 | Peak | 200 | 1.8 | v | 24.8 | 1.9 | 36.3 | 40.8 | 74 | -33.2 |

*30MHz – 1GHz*

Model: E2116

| Indicated | | | Table | Antenna | | Correction Factor | | | FCC 15 Subpart B | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | Ampl. | Direction | Height | Polar | Antenna | Cable Loss | Amp. | Corr. Ampl. | Limit | Margin |
| MHz | dBμV/m | Degree | Meter | H/V | dB | dB | dB | dBμV/m | dBμV/m | dB |
| 798.24 | 43.2 | 0 | 1.1 | H | 20.5 | 6.2 | 28.1 | 41.8 | 46 | -4.2 |
| 798.24 | 41.6 | 0 | 1.2 | V | 20.5 | 6.2 | 28.1 | 40.2 | 46 | -5.8 |
| 336.00 | 43.9 | 250 | 1.2 | V | 14.2 | 3.9 | 27.5 | 34.5 | 46 | -11.5 |
| 398.62 | 42.9 | 90 | 1.2 | H | 15.2 | 4.3 | 28.1 | 34.3 | 46 | -11.7 |
| 57.19 | 47.8 | 270 | 1.1 | V | 7.3 | 1.6 | 28.5 | 28.2 | 40 | -11.8 |
| 398.62 | 42.6 | 180 | 1.3 | V | 15.2 | 4.3 | 28.1 | 34.0 | 46 | -12.0 |
| 312.00 | 43.9 | 270 | 1.3 | V | 13.8 | 3.8 | 27.5 | 34.0 | 46 | -12.0 |
| 336.00 | 42.8 | 300 | 1.5 | H | 14.2 | 3.9 | 27.5 | 33.4 | 46 | -12.6 |
| 454.77 | 39.9 | 0 | 1.2 | H | 16.9 | 4.6 | 28.4 | 33.0 | 46 | -13.0 |
| 914.06 | 30.1 | 180 | 1.2 | H | 22.4 | 6.7 | 27.3 | 31.9 | 46 | -14.1 |
| 454.77 | 38.3 | 0 | 1.2 | V | 16.9 | 4.6 | 28.4 | 31.4 | 46 | -14.6 |
| 312.00 | 41.2 | 90 | 1.6 | H | 13.8 | 3.8 | 27.5 | 31.3 | 46 | -14.7 |

Model: E2126

| Indicated | | | Table | Antenna | | Correction Factor | | | FCC 15 Subpart B | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | Ampl. | Direction | Height | Polar | Antenna | Cable Loss | Amp. | Corr. Ampl. | Limit | Margin |
| MHz | dBμV/m | Degree | Meter | H/V | dB | dB | dB | dBμV/m | dBμV/m | dB |
| 797.27 | 43.1 | 0 | 1.1 | H | 20.5 | 6.2 | 28.1 | 41.7 | 46 | -4.3 |
| 672.14 | 44.7 | 180 | 1.5 | H | 19.4 | 5.7 | 28.5 | 41.3 | 46 | -4.7 |
| 799.21 | 42.6 | 60 | 1.3 | V | 20.5 | 6.2 | 28.1 | 41.2 | 46 | -4.8 |
| 799.21 | 42.1 | 90 | 1.1 | V | 20.5 | 6.2 | 28.1 | 40.7 | 46 | -5.3 |
| 469.24 | 41.2 | 270 | 1.3 | V | 17.2 | 4.7 | 28.5 | 34.6 | 46 | -11.4 |
| 467.36 | 38.8 | 90 | 1.2 | H | 17.2 | 4.7 | 28.5 | 32.2 | 46 | -13.8 |
| 869.61 | 31.6 | 180 | 1.1 | V | 21.4 | 6.3 | 28.0 | 31.3 | 46 | -14.7 |
| 464.00 | 35.9 | 280 | 2.8 | H | 17.2 | 4.7 | 28.5 | 29.3 | 46 | -16.7 |

AVG = average

# §15.247(a)(2) – 6 dB BANDWIDTH

**Standard Applicable**

According to §15.247(a)(2), for digital modulation techniques, the minimum 6dB bandwidth shall be at least 500 kHz.

**Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

**Equipment Lists**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 11/10/2005 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

**Measurement Result**

**Environmental Conditions**

| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 43% |
| ATM Pressure: | 1022 mbar |

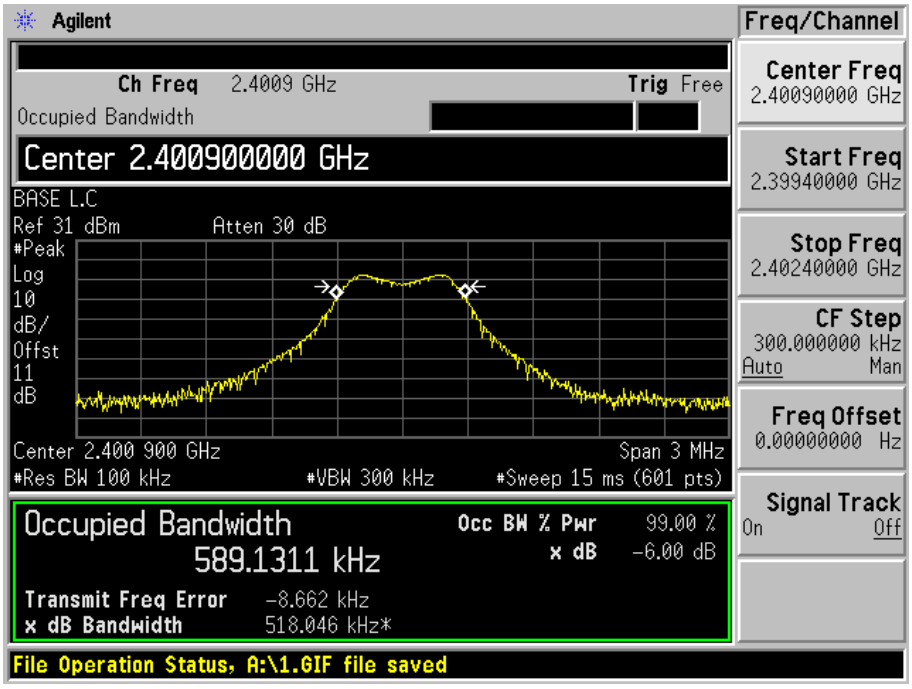
*The testing was performed by Daniel Deng on 2005-11-18.*

**Test Result**

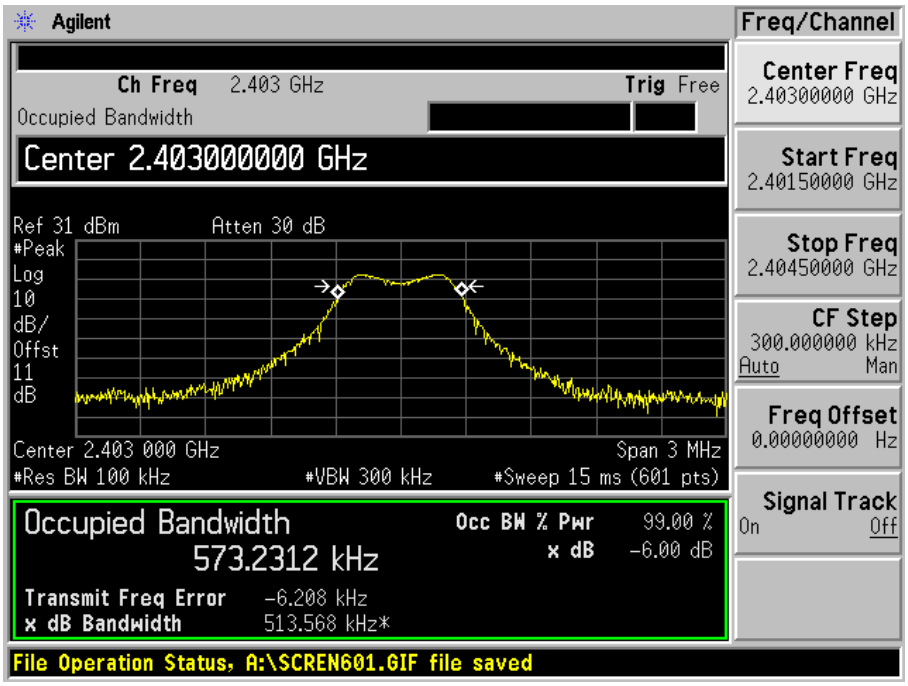
Model: E2116/E2126

| Channel | Frequency MHz | Channel Bandwidth (KHz) | Limit | Result |
|---|---|---|---|---|
| Low | 2400.9 | 518.0 | > 500 kHz | Pass |
| Mid | 2403.0 | 513.6 | > 500 kHz | Pass |
| High | 2405.1 | 520.4 | > 500 kHz | Pass |

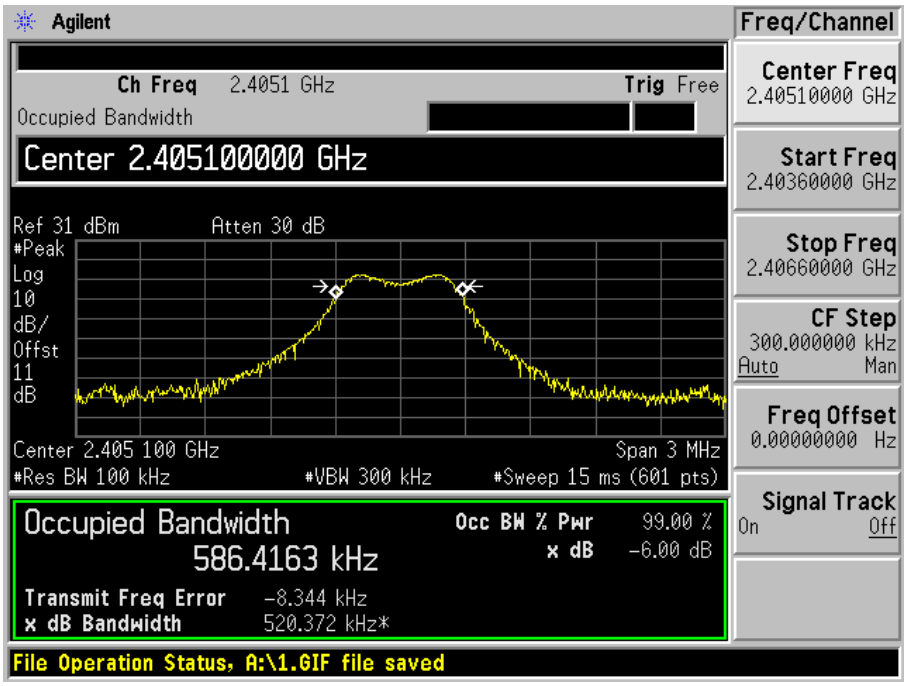
Low Channel




Mid. Channel



High Channel



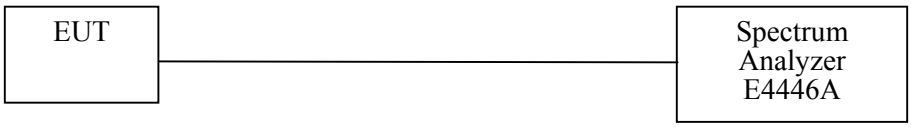
# §15.247(b)(3) - PEAK OUTPUT POWER MEASUREMENT

**Standard Applicable**

According to §15.247(b) (3), for systems using digital modulation in 2400-2483.5 MHz: 1 Watt

**Measurement Procedure**

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.




**Equipment Lists**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 11/10/2005 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

**Measurement Result**

**Environmental Conditions**

| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 43% |
| ATM Pressure: | 1022 mbar |

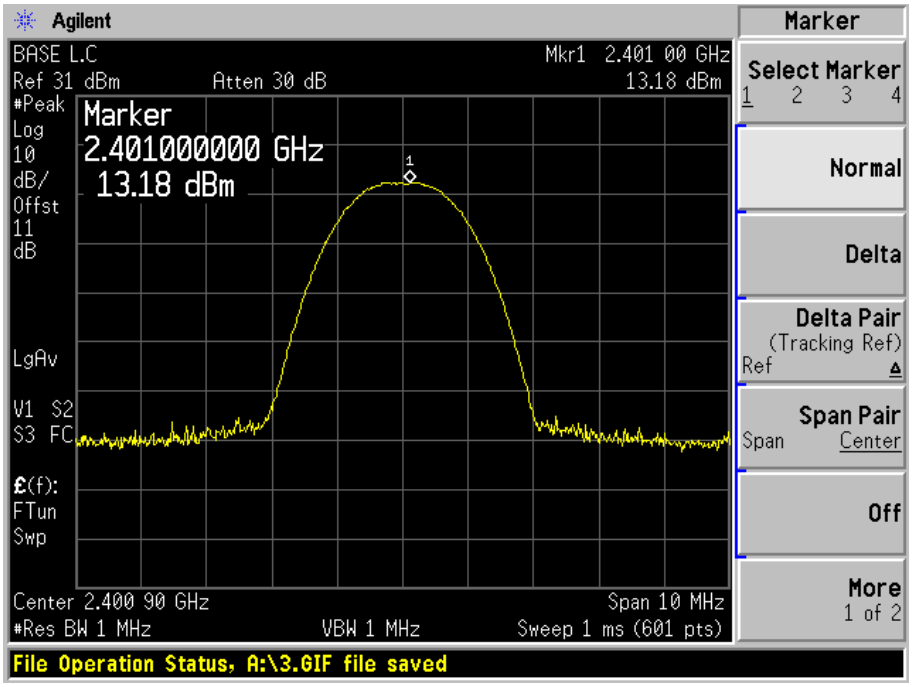
*The testing was performed by Daniel Deng on 2005-11-18.*

**Output Power**

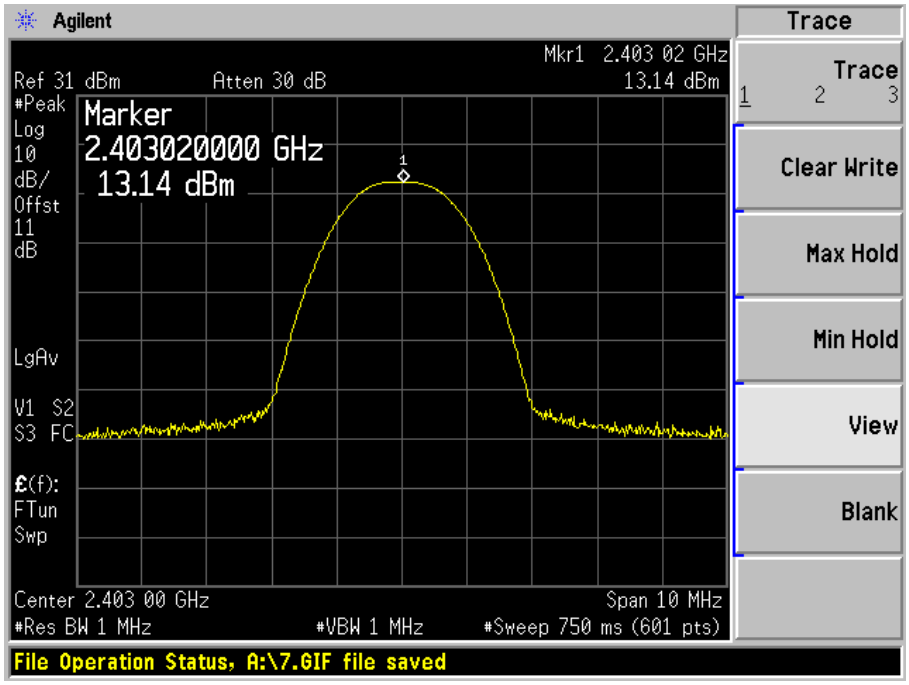
Model: E2116/E2126

| Channel | Frequency | Max Peak Output Power | | Limit | Result |
|---|---|---|---|---|---|
| | MHz | (dBm) | (mW) | (mW) | |
| Low | 2400.9 | 13.18 | 20.80 | 1000 | pass |
| Mid | 2403.0 | 13.14 | 20.94 | 1000 | pass |
| High | 2405.1 | 13.21 | 20.65 | 1000 | pass |

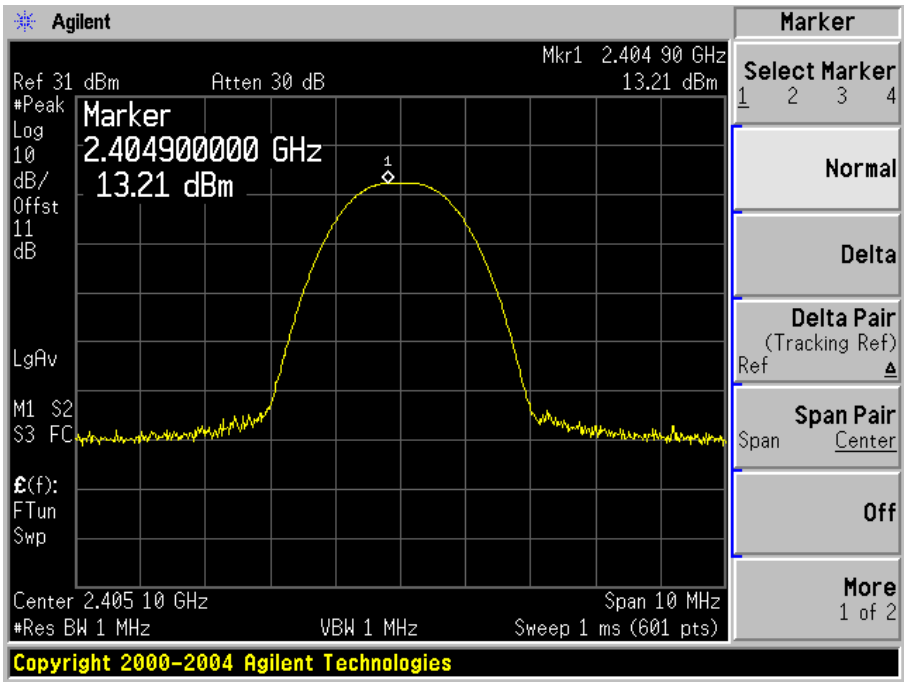
Low Channel




Mid. Channel



High Channel



# §15.247(c) - 100 KHZ BANDWIDTH OF BAND EDGES

**Standard Applicable**

According to §15.247(c), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 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. 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)).

**Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

**Equipment Lists**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 11/10/2004 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

**Measurement Result**

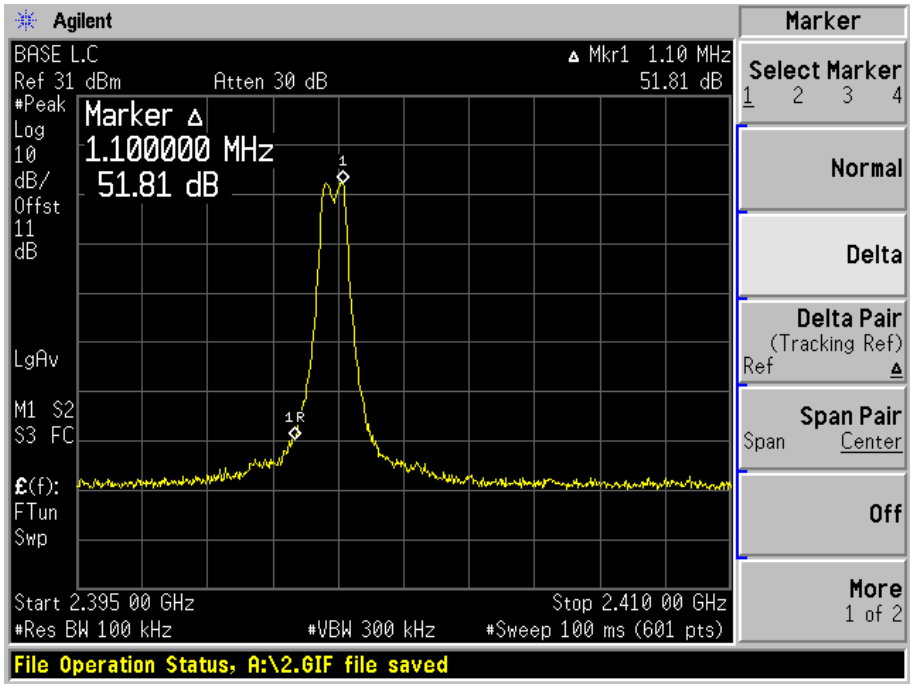
**Environmental Conditions**

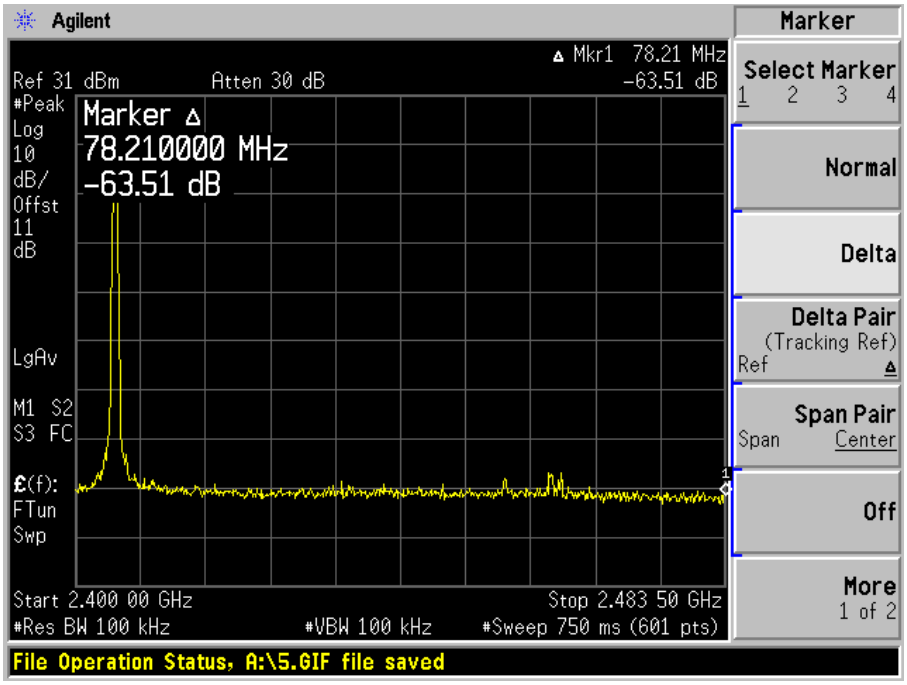
| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 43% |
| ATM Pressure: | 1022 mbar |

*The testing was performed by Daniel Deng on 2005-11-18.*

Please refer to following pages for plots of band edge.

Model: E2116/E2126



# §15.247(d) - POWER SPECTRAL DENSITY

**Standard Applicable**

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

**Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.

**Equipment Lists**

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 11/10/2005 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

**Measurement Result**

**Environmental Conditions**

| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 43% |
| ATM Pressure: | 1022 mbar |

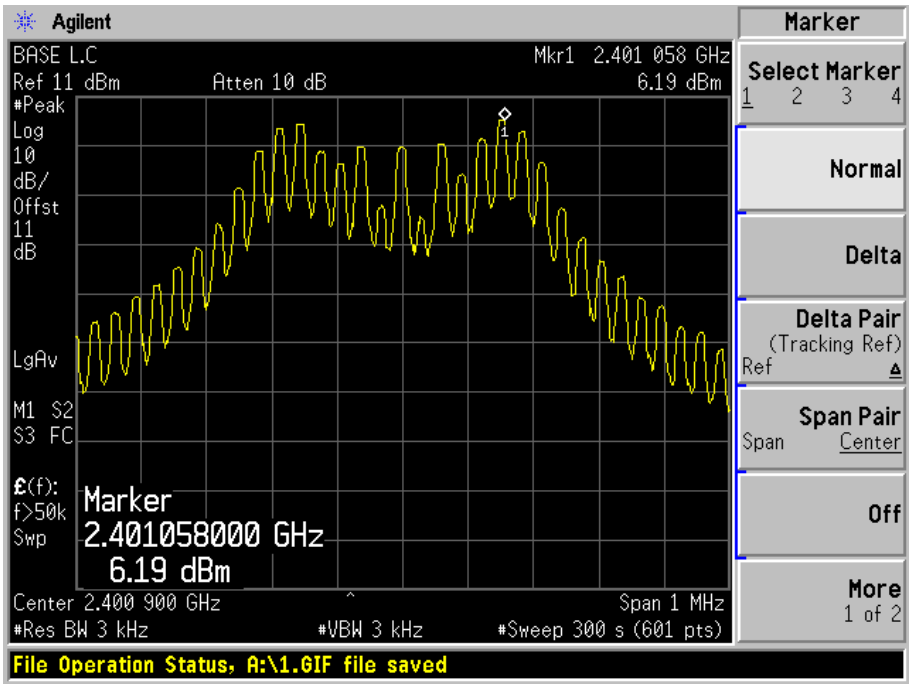
*The testing was performed by Daniel Deng on 2005-11-18.*

**Test Result**

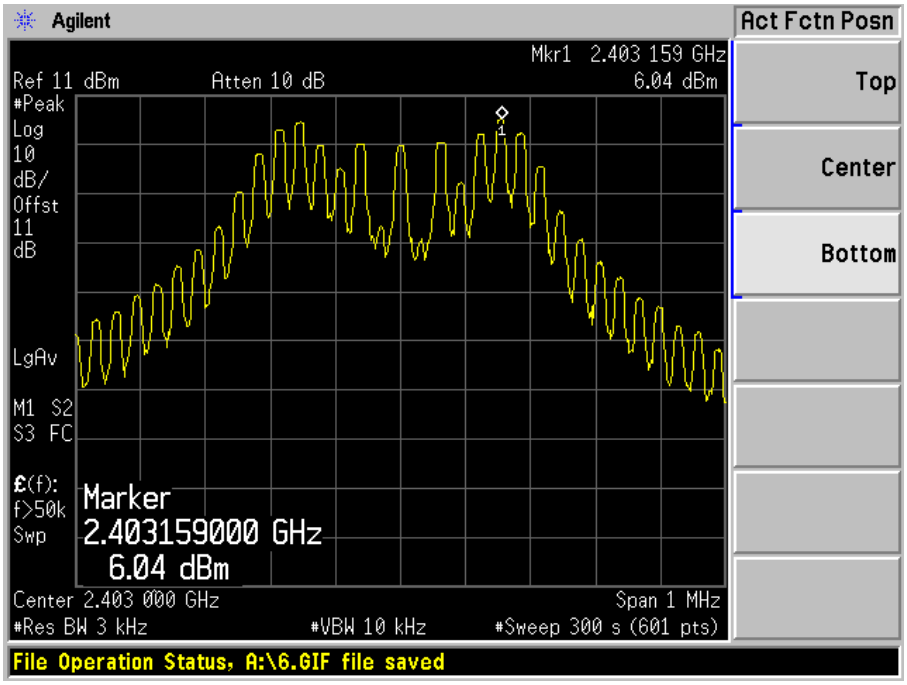
Model: E2116/E2126

| Channel | Frequency MHz | PSD dBm | Limit dBm/3KHZ | Result |
|---|---|---|---|---|
| Low | 2400.9 | 6.19 | 8 | Pass |
| Mid | 2403.0 | 6.04 | 8 | Pass |
| High | 2405.1 | 6.31 | 8 | Pass |

Low Channel




Mid. Channel



High Channel