

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: ☒ Original Report	Equipment Type: 900MHZ / 2.4 GHz Cordless Phone
Test Engineer: Daniel Deng	
Report No.: R0511071(B)-b	
Report Date: 2005-12-20	
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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.

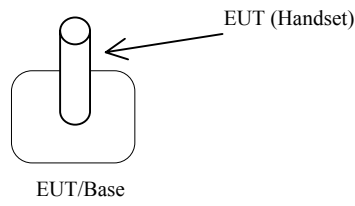
Power Supply

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

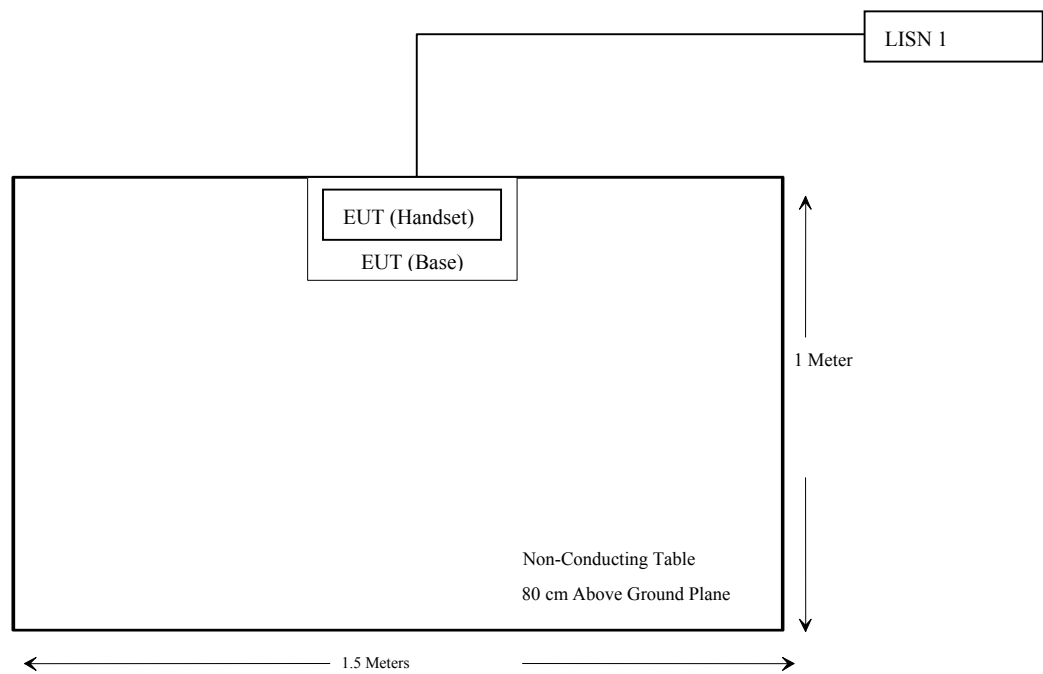
Interface Ports and Cabling

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/cm²)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm²)

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 ± 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.

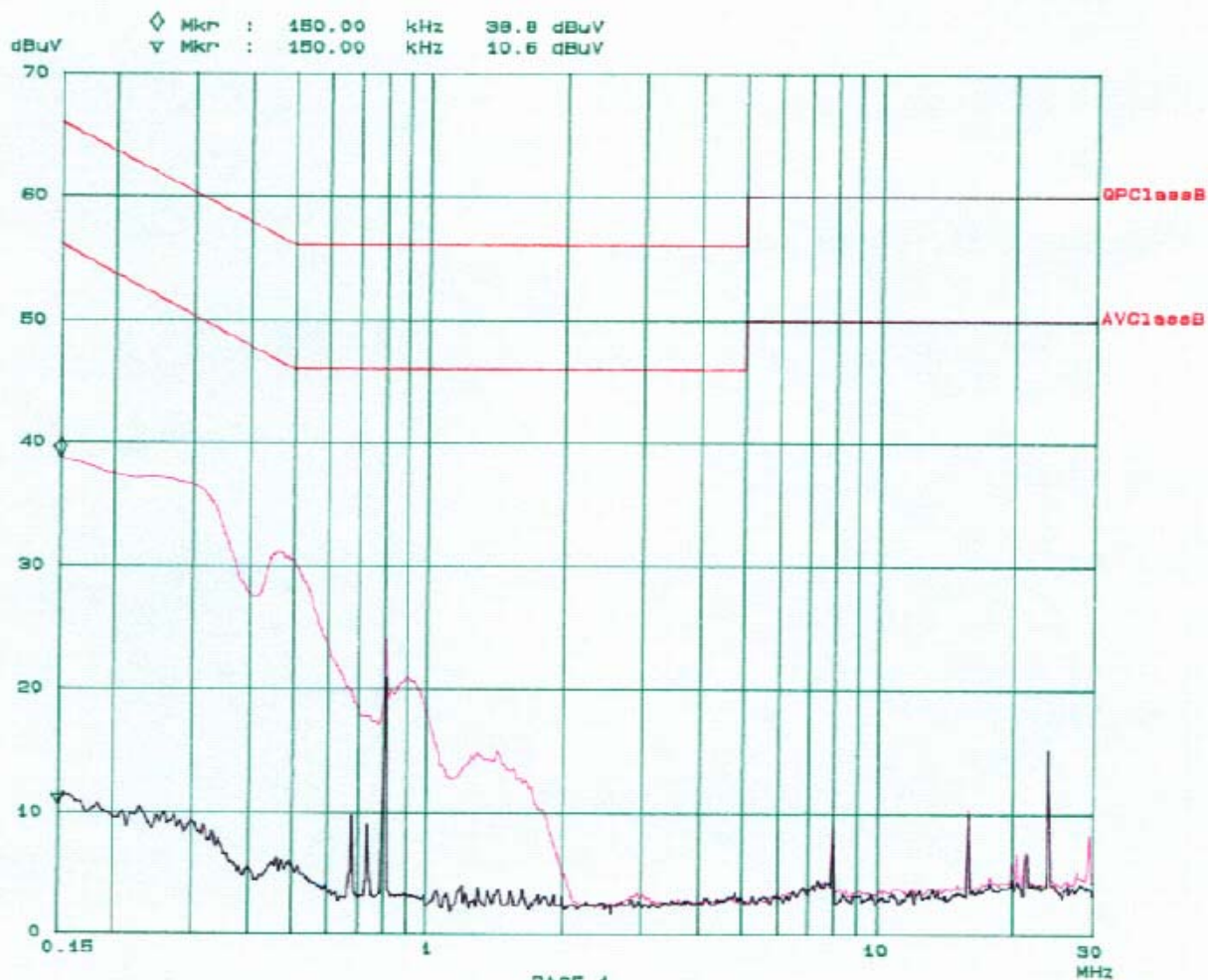
Day Area Compliance Laboratory Corp
Class B

18. Nov 05 12:52

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	15dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF



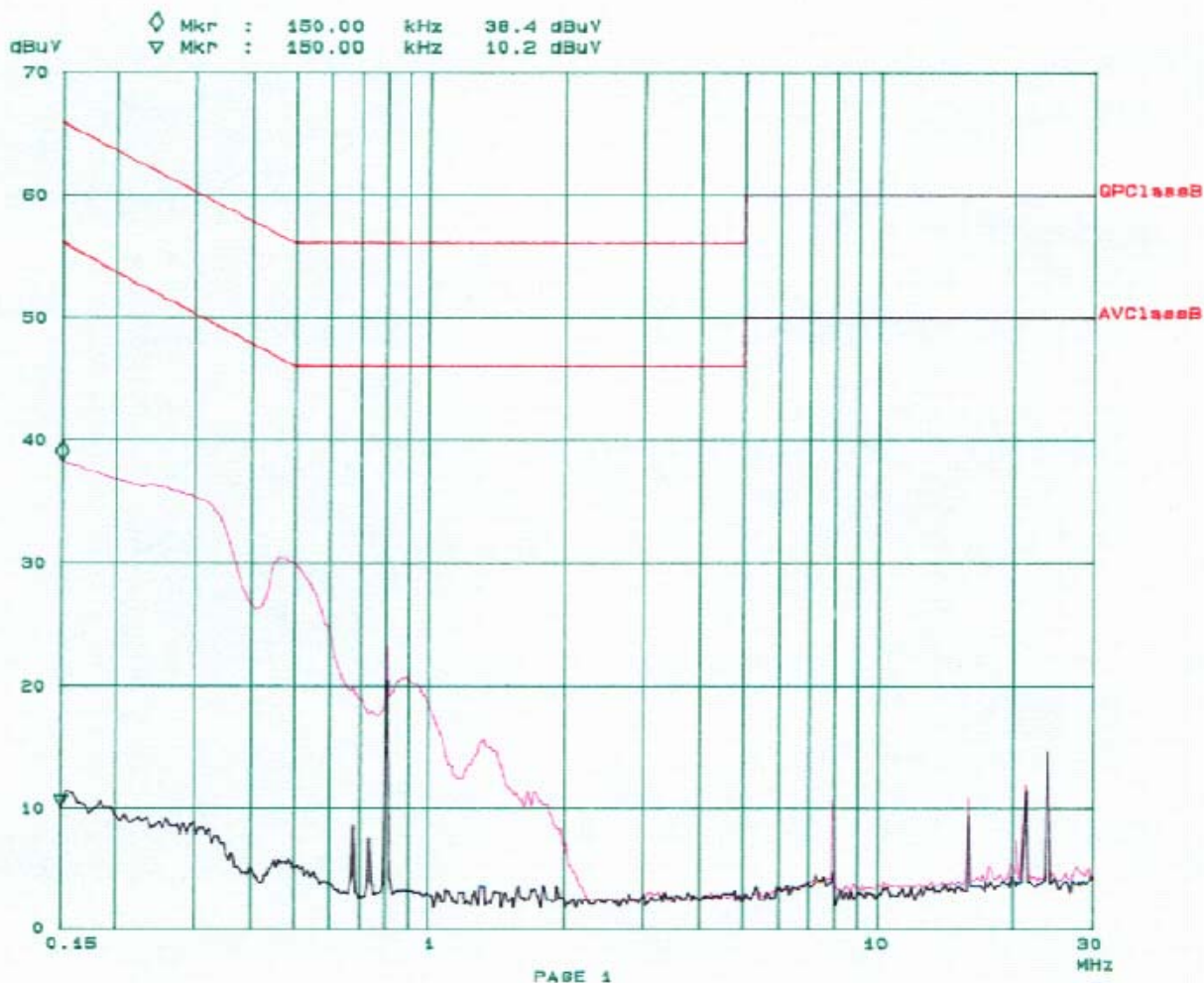
Bay Area Compliance Laboratory Corp
Class B

18, Nov 05 12:29

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	15dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF



Signature
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 10th 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.

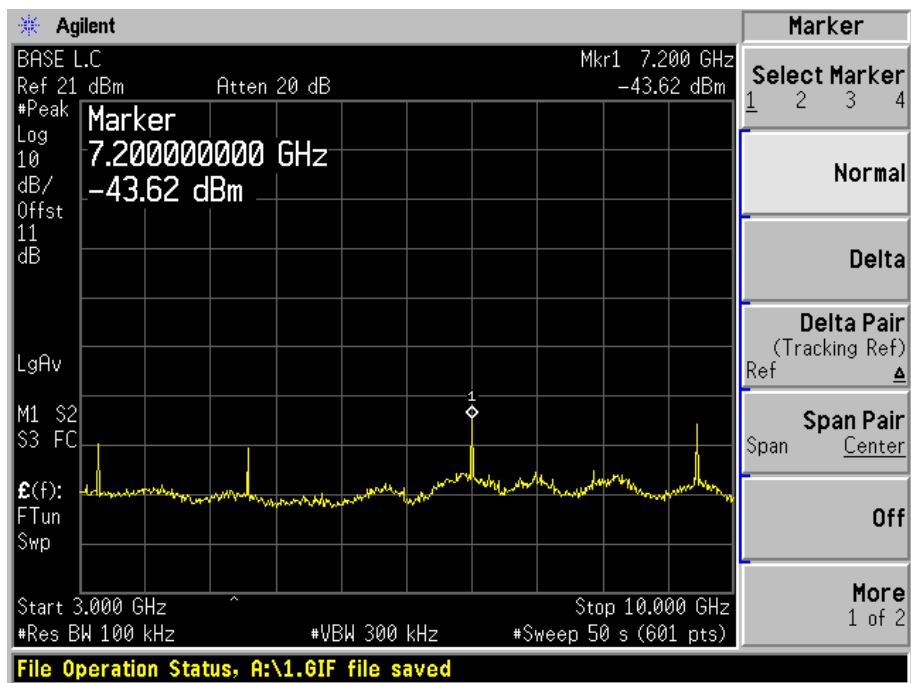
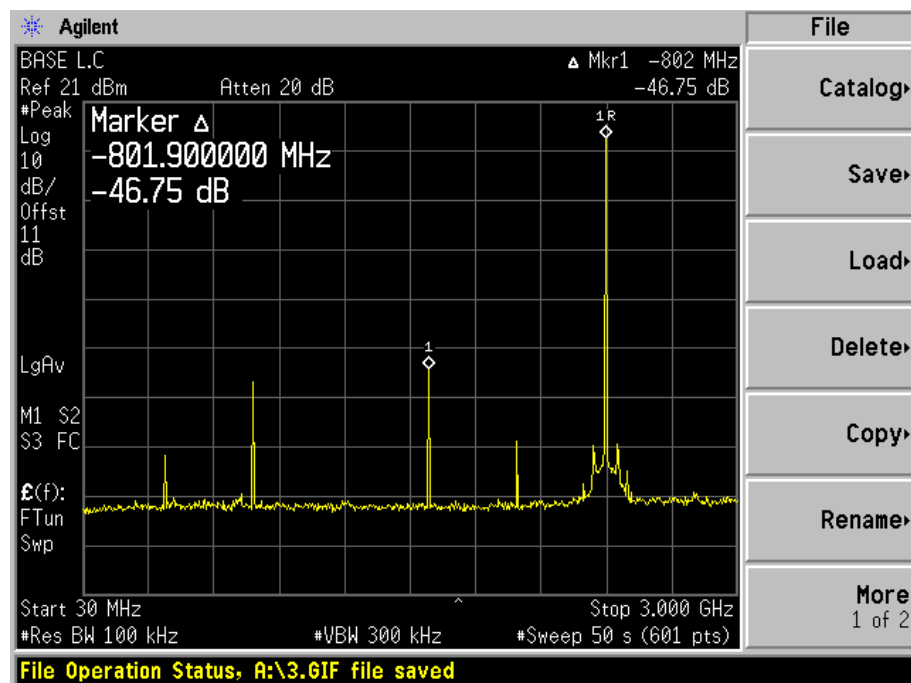
Measurement Result

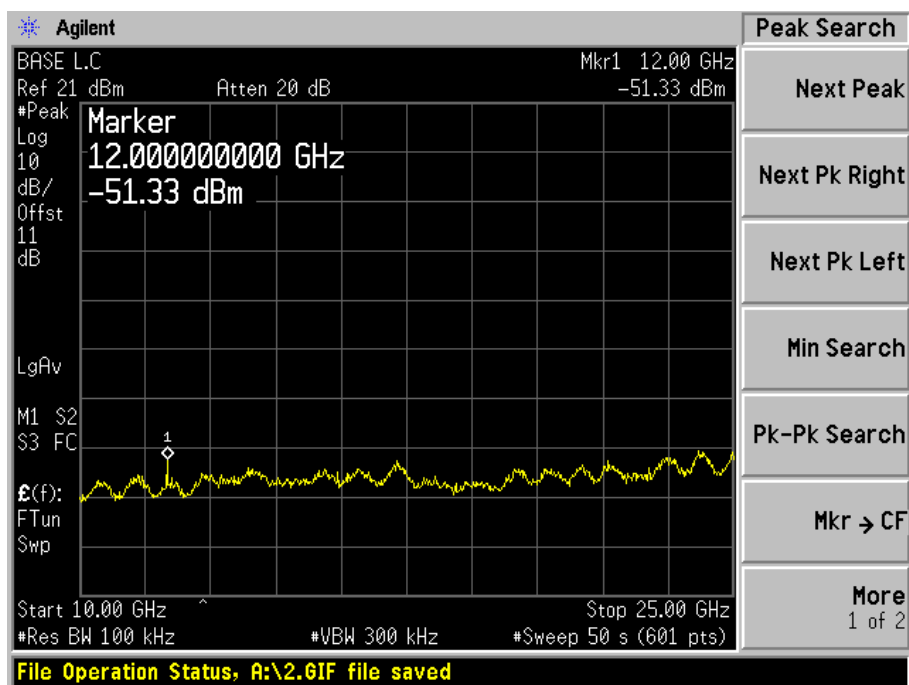
Please refer to following pages for plots of spurious emission.

Environmental Conditions

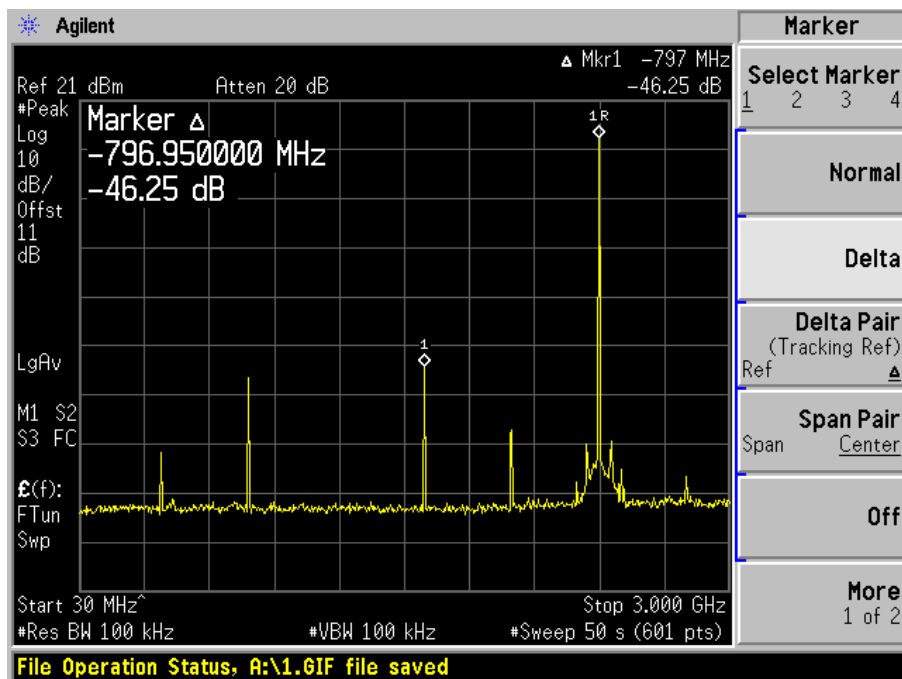
Temperature:	26° C
Relative Humidity:	43%
ATM Pressure:	1022 mbar

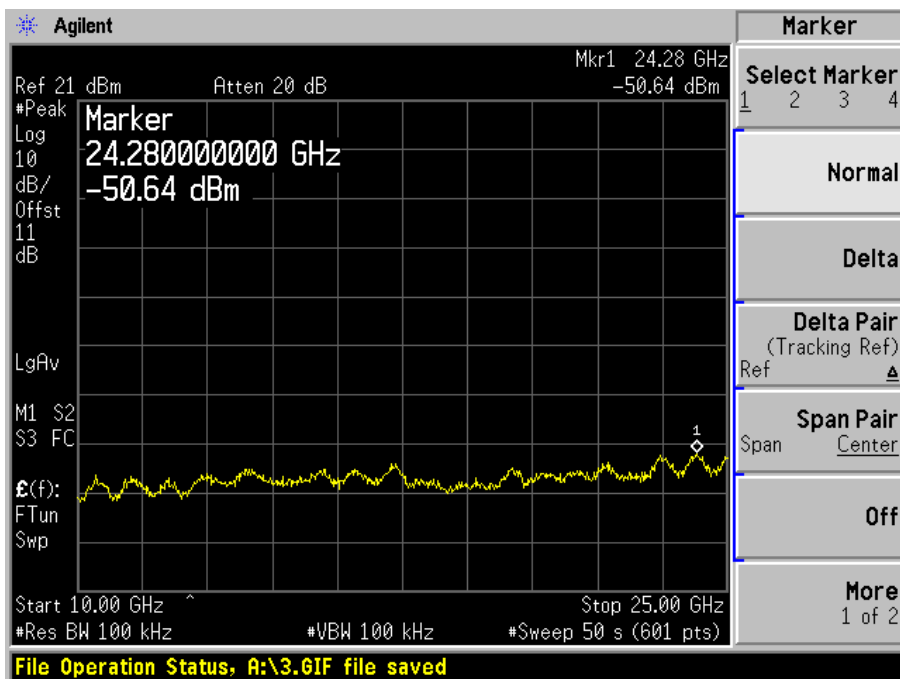
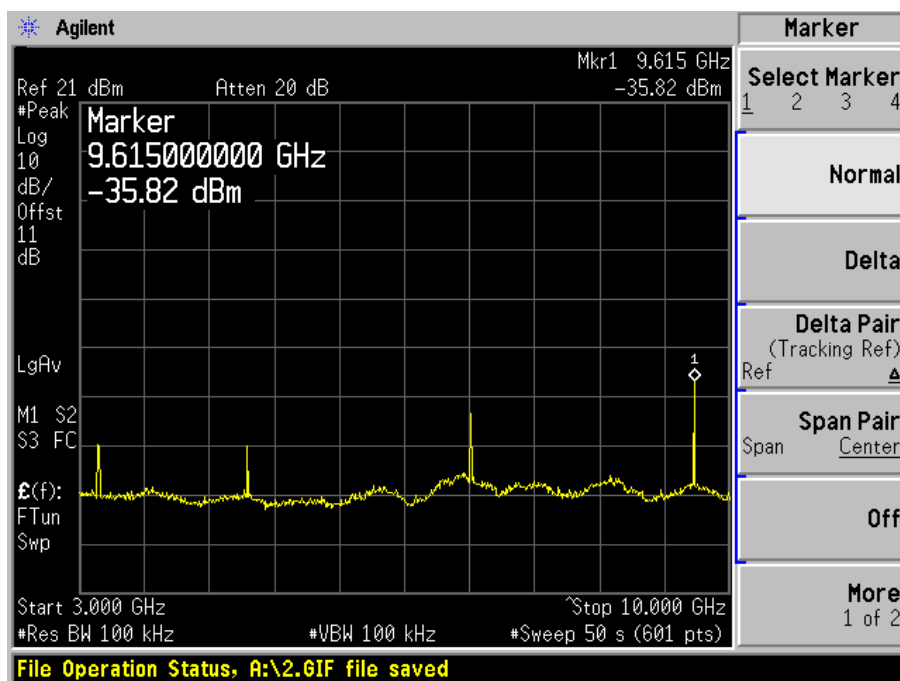
The testing was performed by Daniel Deng on 2005-11-18.

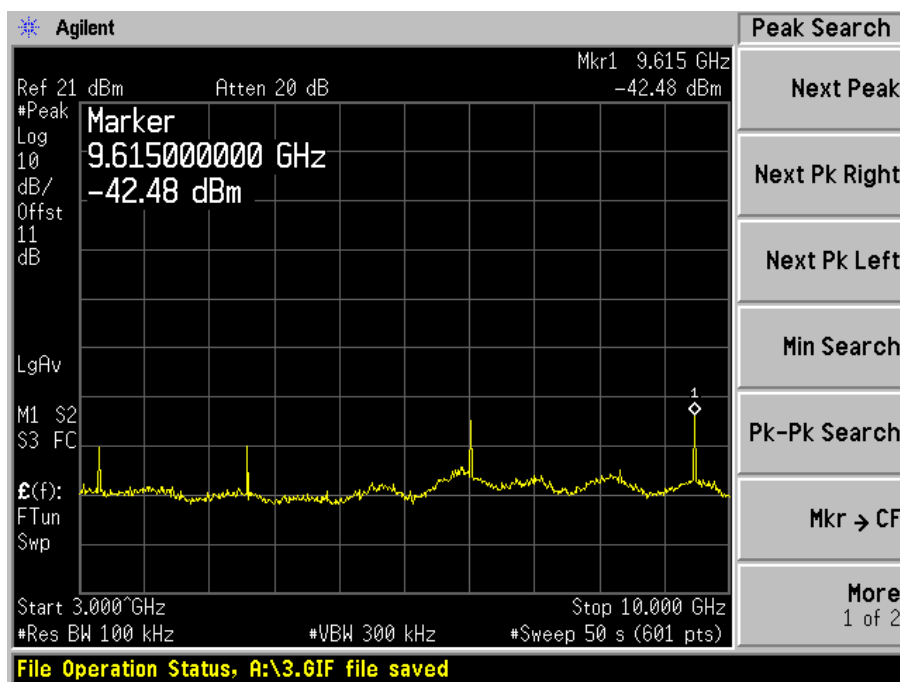
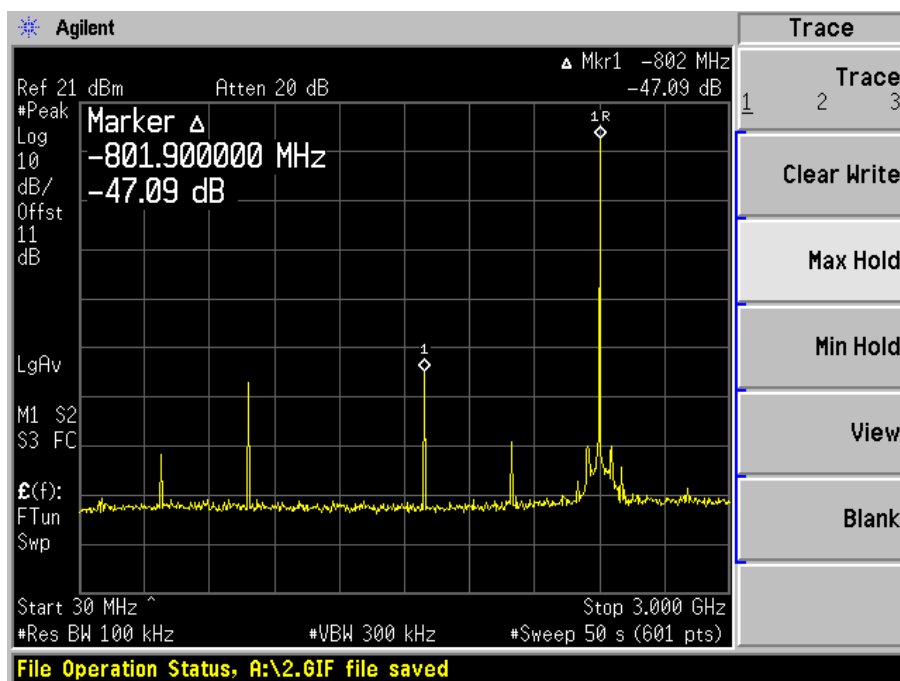
*Model: E2116/E2126**Low Channel*

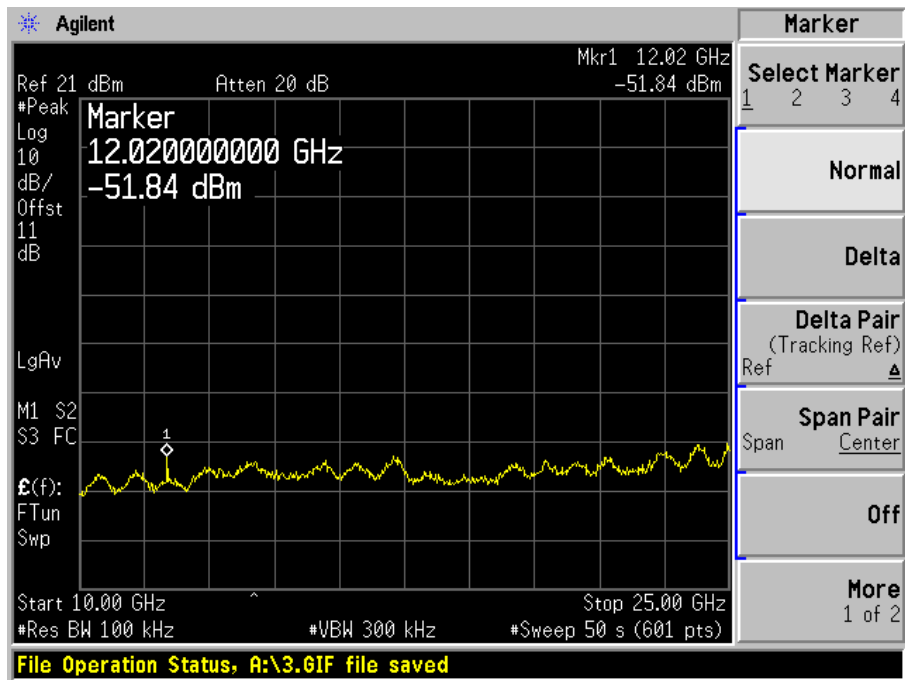


Mid Channel





High Channel



§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 ± 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)	(dB μ V/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:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
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 dB μ V 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC 15.247 Limit}$$

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 $\pm 4.0\text{dB}$)

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. dB μ V/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dB	Cable dB	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/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 Corr. Ampl. dB μ V/m	FCC 15 SUBPART C	
Frequency MHz	Ampl. dB μ V/m	Comments		Height Meter	Polar H/ V	Antenna dB	Cable dB	Amp. dB		Limit dB μ V/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 Angle Degree	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE Corr. Ampl. dBμV/m	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/m	Comments		Height Meter	Polar H/ V	Antenna dB	Cable dB	Amp. dB		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

Frequency MHz	Indicated		Table Height Meter	Antenna		Correction Factor			FCC 15 Subpart B	
	Ampl. dBμV/m	Direction Degree		Polar H/V	Antenna dB	Cable Loss dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin 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

Frequency MHz	Indicated		Table Height Meter	Antenna		Correction Factor			FCC 15 Subpart B	
	Ampl. dBμV/m	Direction Degree		Polar H/V	Antenna dB	Cable Loss dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin 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

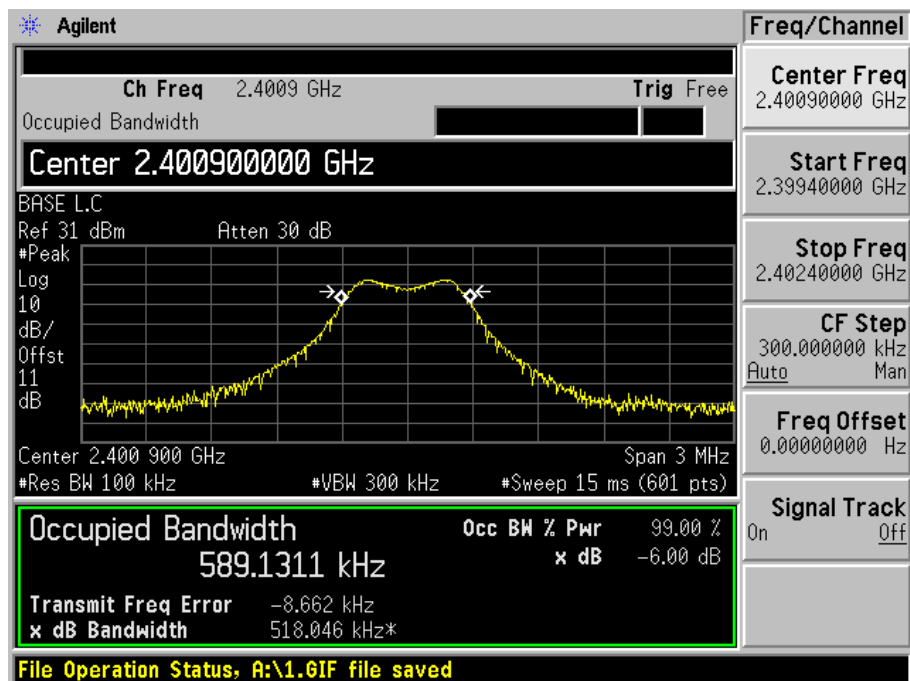
The testing was performed by Daniel Deng on 2005-11-18.

Test Result

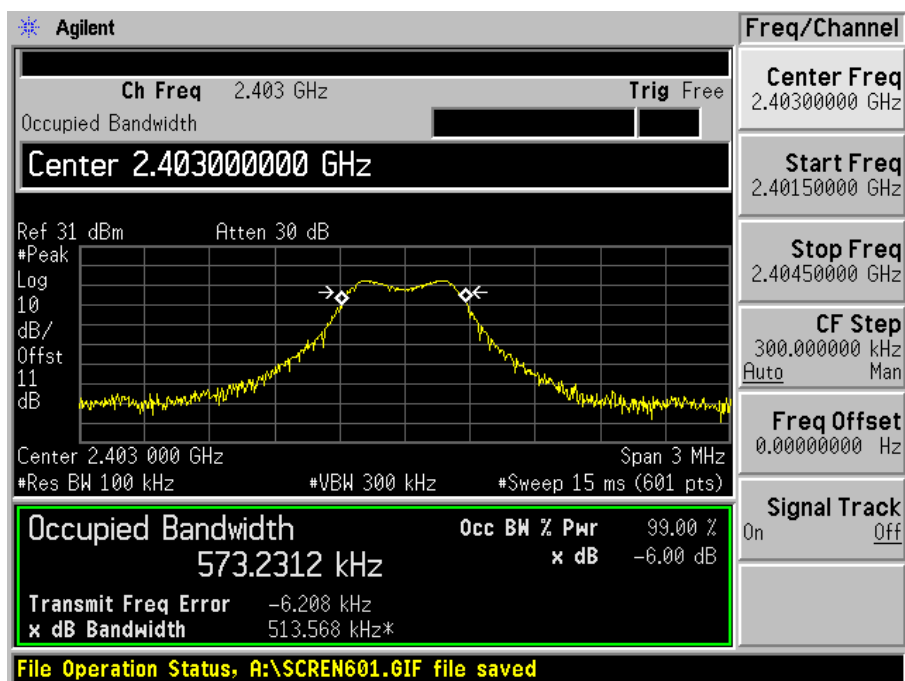
Model: E2116/E2126

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

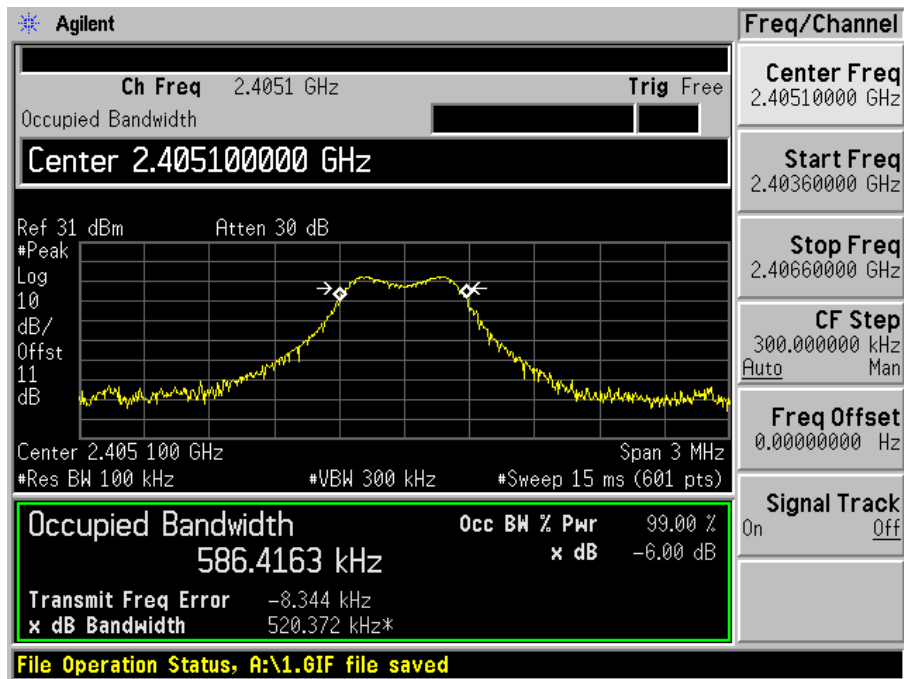
Low Channel



Mid. Channel



High Channel



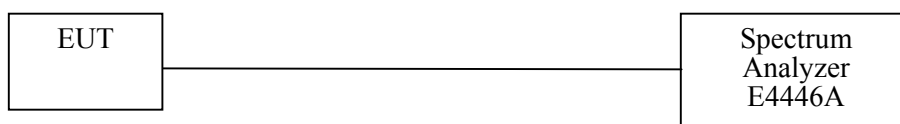
§15.247(b)(3) - PEAK OUTPUT POWER MEASUREMENT

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

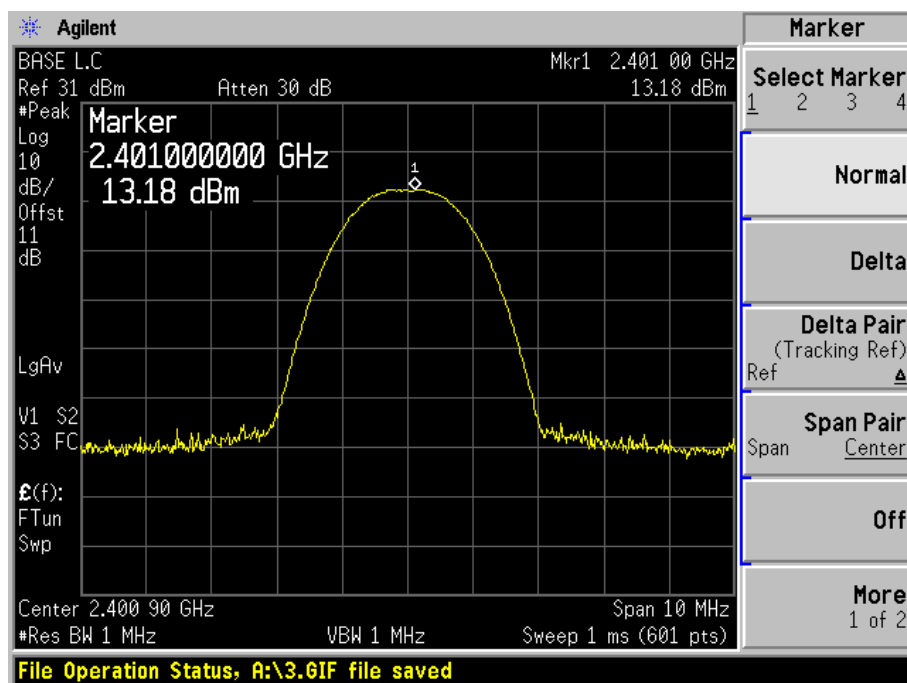
The testing was performed by Daniel Deng on 2005-11-18.

Output Power

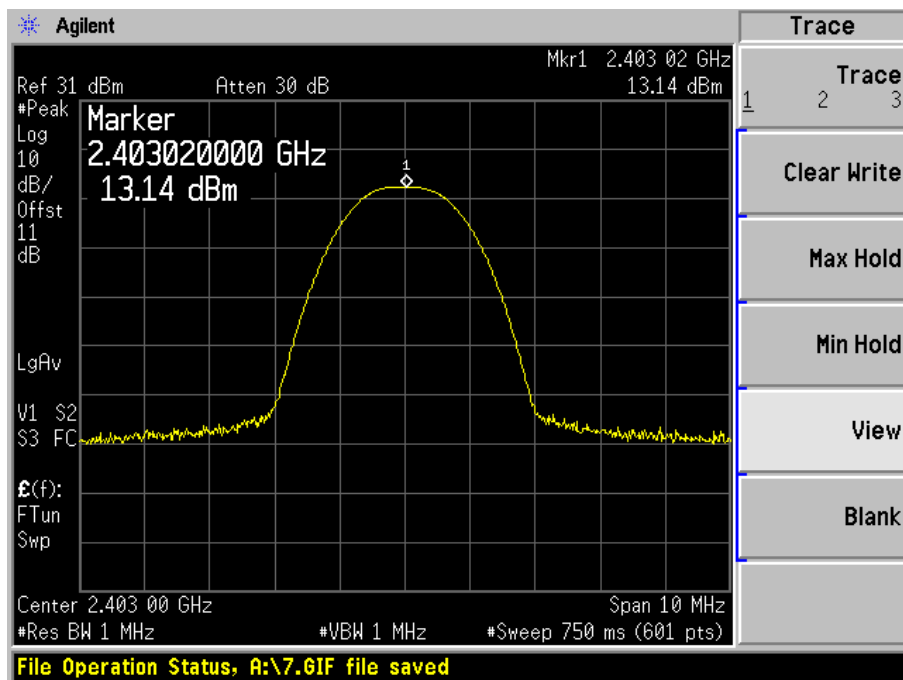
Model: E2116/E2126

Channel	Frequency MHz	Max Peak Output Power		Limit (mW)	Result
		(dBm)	(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

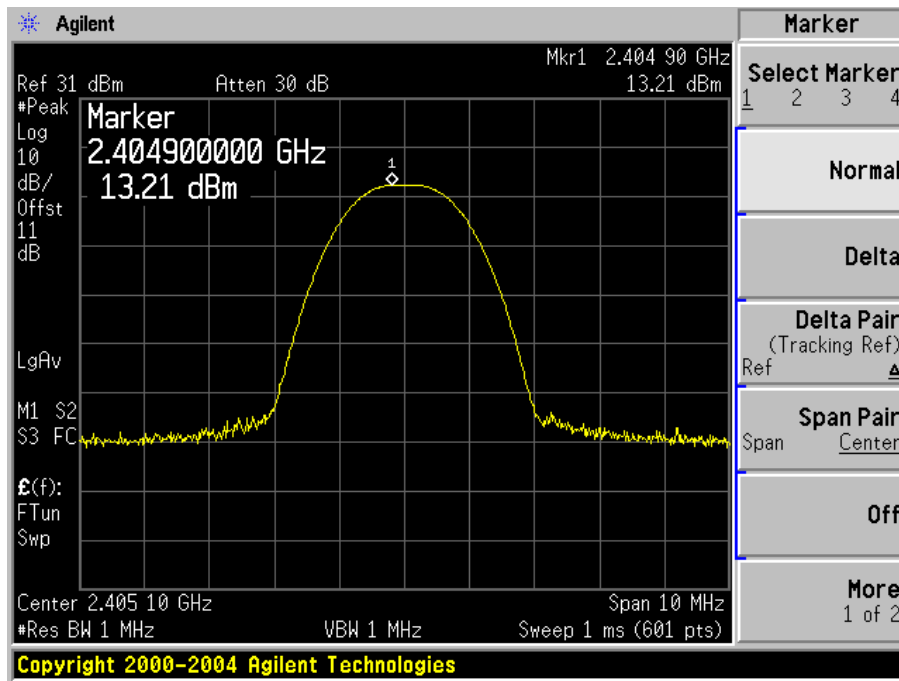
Low Channel



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

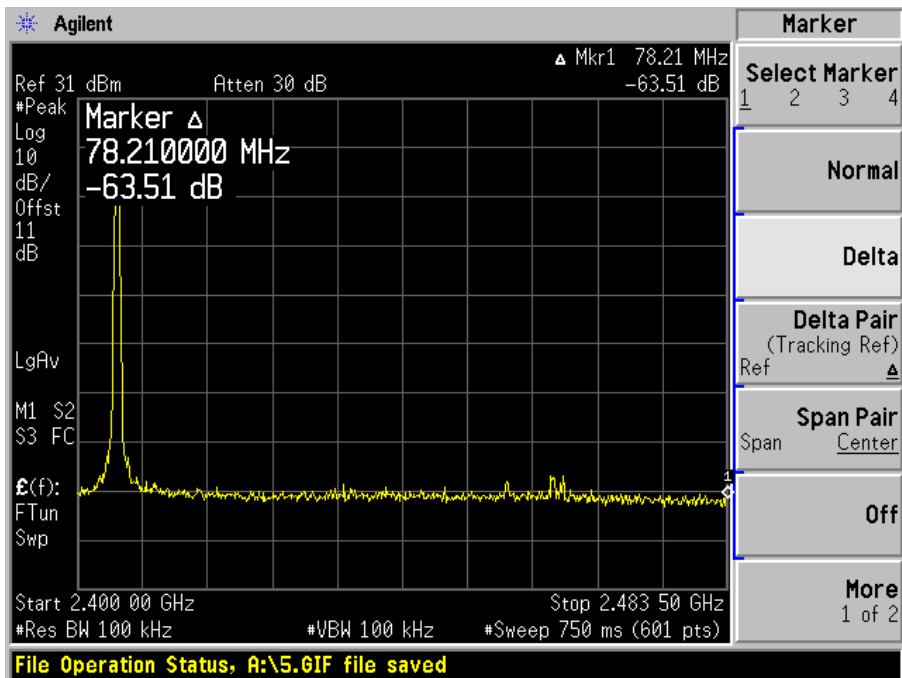
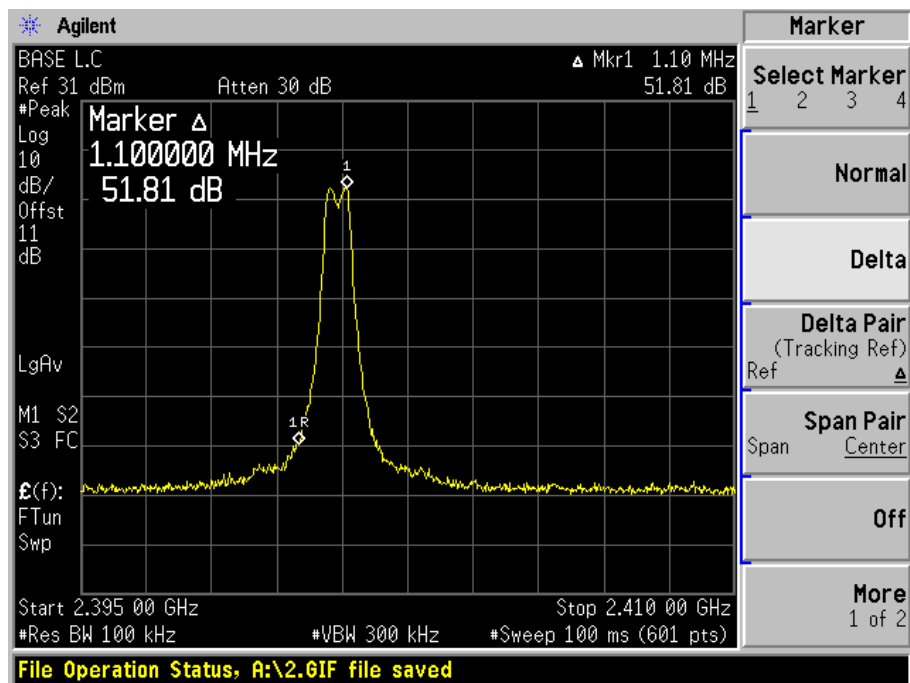
Environmental Conditions

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

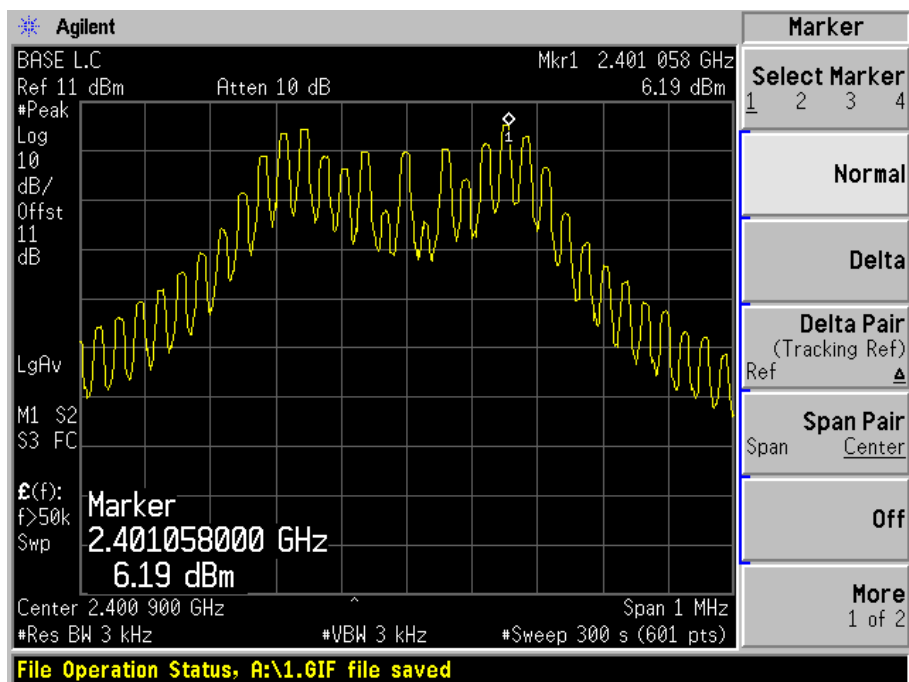
The testing was performed by Daniel Deng on 2005-11-18.

Test Result

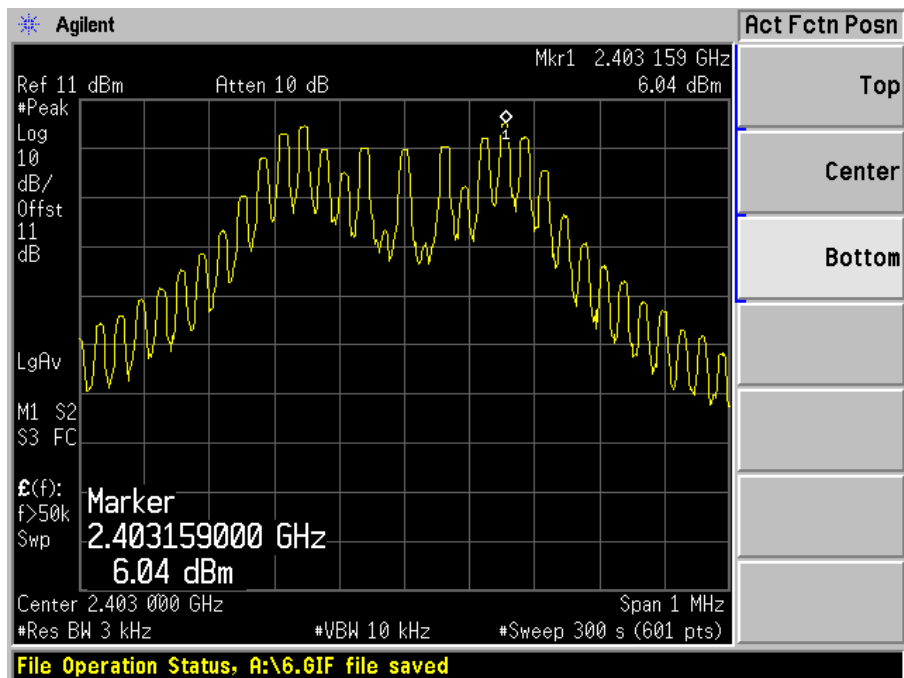
Model: E2116/E2126

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

