



# FCC PART 25 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

## DACOM Corporation

DACOM B/D, 65-228, Hangangro-3ga, Yongsan-gu, Seoul, Korea, 140-716

**FCC ID: TVYGIR2005NDU**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> 1.6/2.4 GHz SIGNAL BOOSTER (Indoor unit)
<b>Test Engineer:</b> Snell Leong 	
<b>Report No.:</b> R0511224	
<b>Report Date:</b> 2005-12-21	
<b>Reviewed By:</b> Richard Lee 	
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## GENERAL INFORMATION

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

The *DACOM Corporation* product, FCC ID: *TVYGIR2005NDU*, model number: GIR 2005 or the “EUT” as referred to in this report is a 1.6/2.4 GHz SIGNAL BOOSTER (Indoor unit). The EUT operates at 2485.5– 2498.5 MHz with maximum output power 9.28 dBm (EIRP).

*\* The test data gathered are from production sample, serial number: 008, provided by the manufacturer.*

### Objective

This type approval report is prepared on behalf of *DACOM* in accordance with Part 2, Subpart J, and Part 25, Subparts C of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for Radiated Emission, Frequency Tolerance, Emission Limitation (out of band), Power Density, Emission Limitation (in band), and Power Limit.

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

No Related Submittals.

### Test Methodology

All measurements contained in this report were conducted with TIA 603-C.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp.

### 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 with registration number: 90464.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC), Industry Canada (IC), 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, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2, IC registration number: 3062A, and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC, IC, 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 TIA 603-C.

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

### EUT Exercise Software

A Typical IS95 test signal is feeding into unit with sufficient level to saturate the output so maximum output power is obtained.

### Special Accessories

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

### Schematics / Block Diagram

Please refer to Appendix A.

### Equipment Modifications

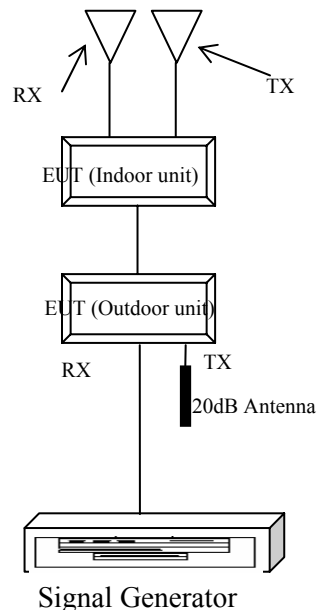
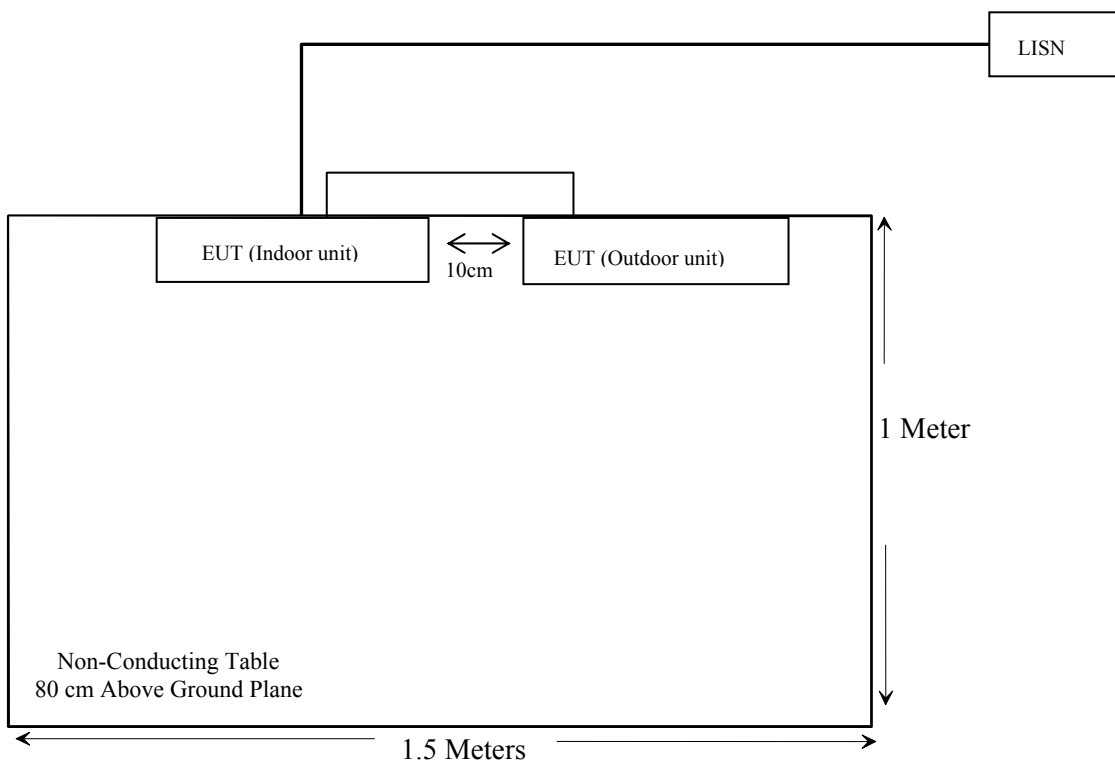
No modifications were made to the EUT.

### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
R&S	Signal generator	SMIO03	849192/0085	DoC

### External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Sma cable	2	Signal generator	EUT

**Configuration of Test System****Test Setup Block Diagram**

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## SUMMARY OF TEST RESULTS

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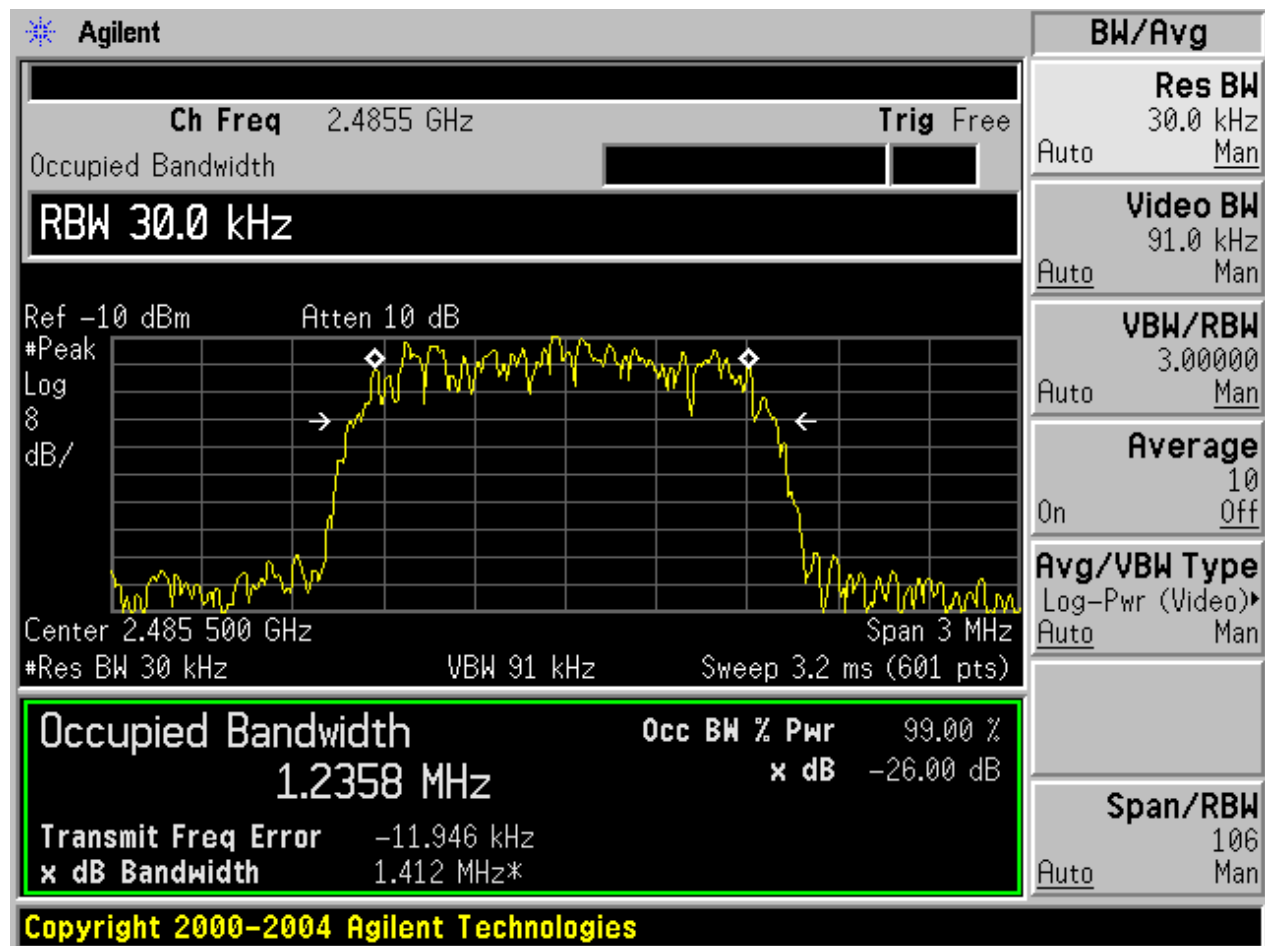
Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§1.1307(b)(1) & §2.1091	RF Exposure	Compliant
§2.1047	Modulation Characteristic	Compliant
§2.1051	Spurious Emission at Antenna Terminals	Compliant
§15.107	AC Line Conducted Emission	Compliant
§2.1055 & §25.202(d)	Frequency Stability	Compliant
§2.1053 & §25.202(f)	Field Strength of Spurious Radiation	Compliant
§25.202	Emission Mask	Compliant
§25.254(4)	Emission from Mobile Earth Station for Protection of Aeronautical Radionavigation- Satellite Service	Compliant
§2.1046 & §25.254(1)	Power Output	Compliant
25.254(2)	Band edge	Compliant



## §2.1047 – MODULATION CHARACTERISTICS

The EUT uses digital modulation techniques which were employed during the tests for occupied bandwidth. Per 2.1047(d) & part 25, there is no modulation requirement, therefore modulation characteristic is not presented. Please see below for occupied bandwidth shown.



## §2.1051 – SPURIOUS EMISSIONS AT ANTENNA TERMINALS

### Standard Applicable

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment by more than 250% of the authorized bandwidth (1.23MHz), at least

$43 + 10 \log (P_{\text{watts}})$  attenuation below the mean power of the transmitter.

### Measurement Procedure

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable and 20dB attenuator to the antenna output terminals of EUT.

### Equipment Lists

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

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

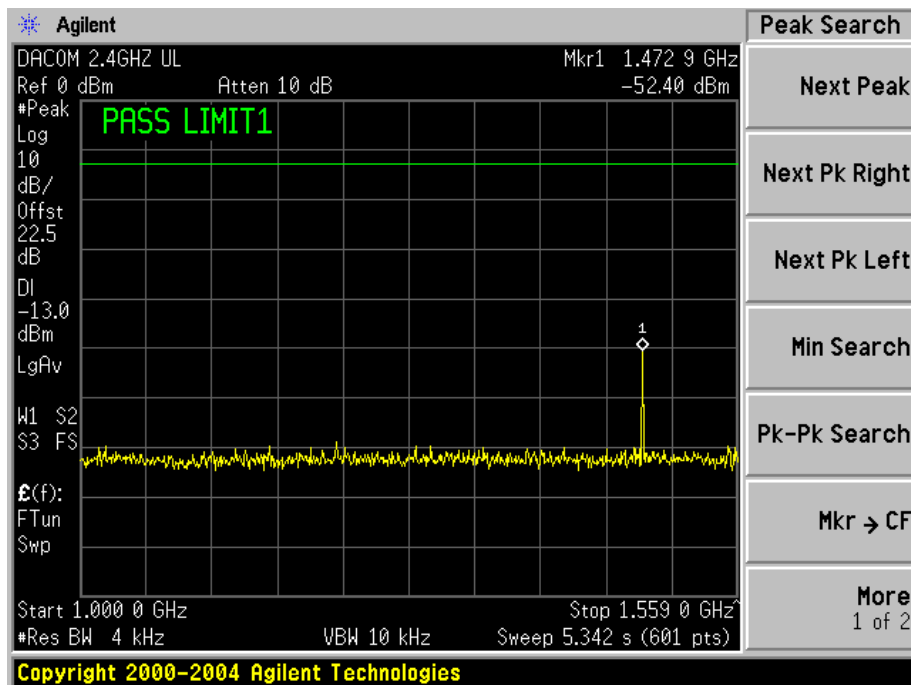
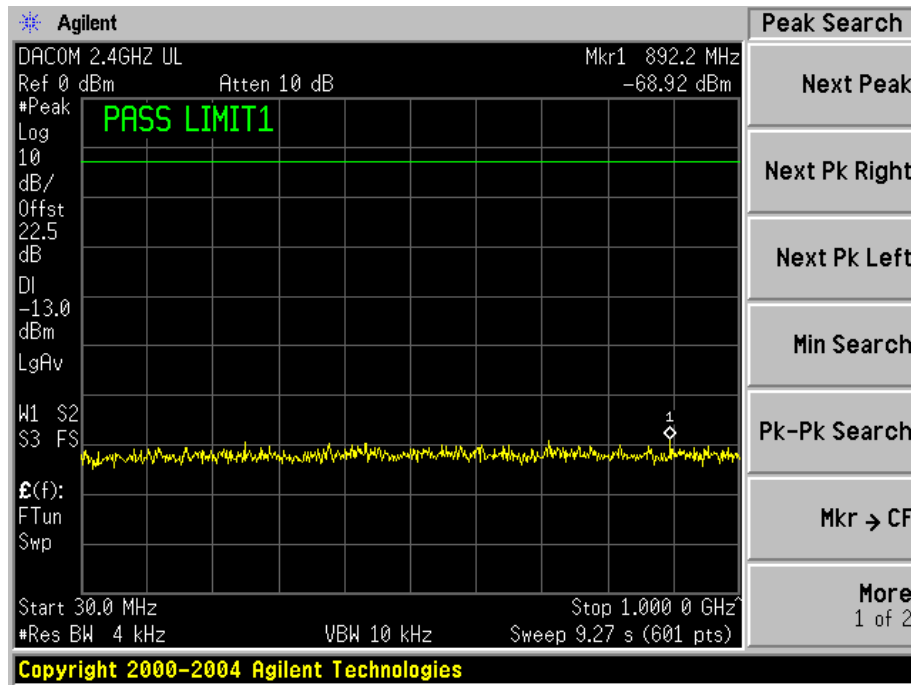
### Measurement Result

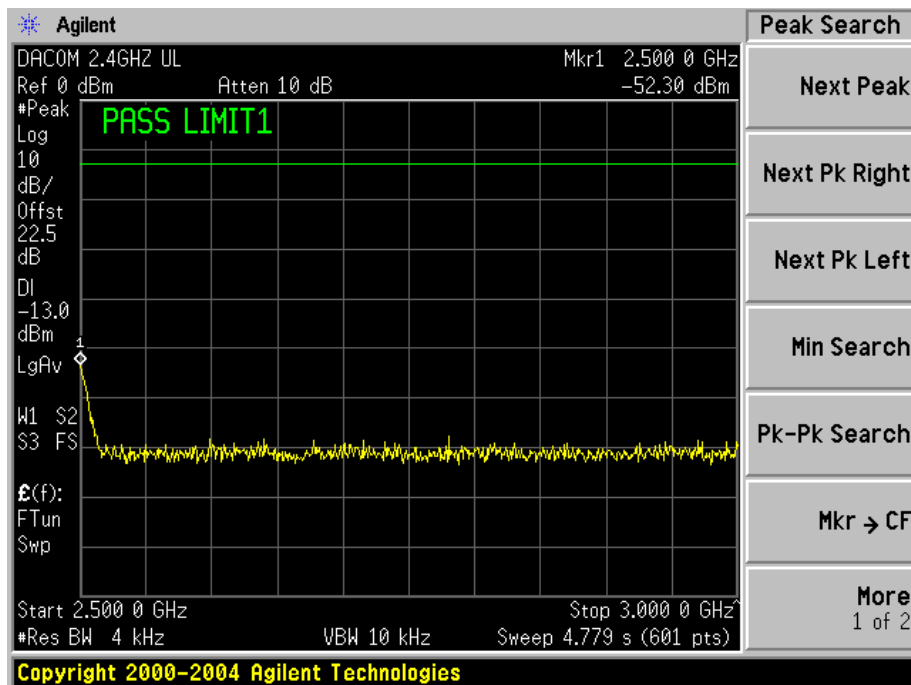
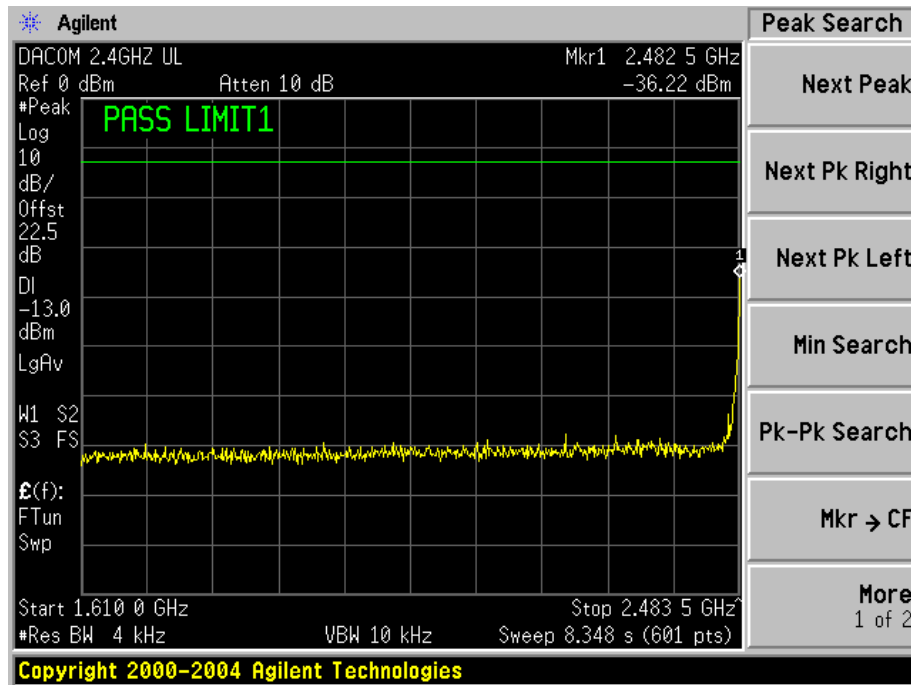
#### Environmental Conditions

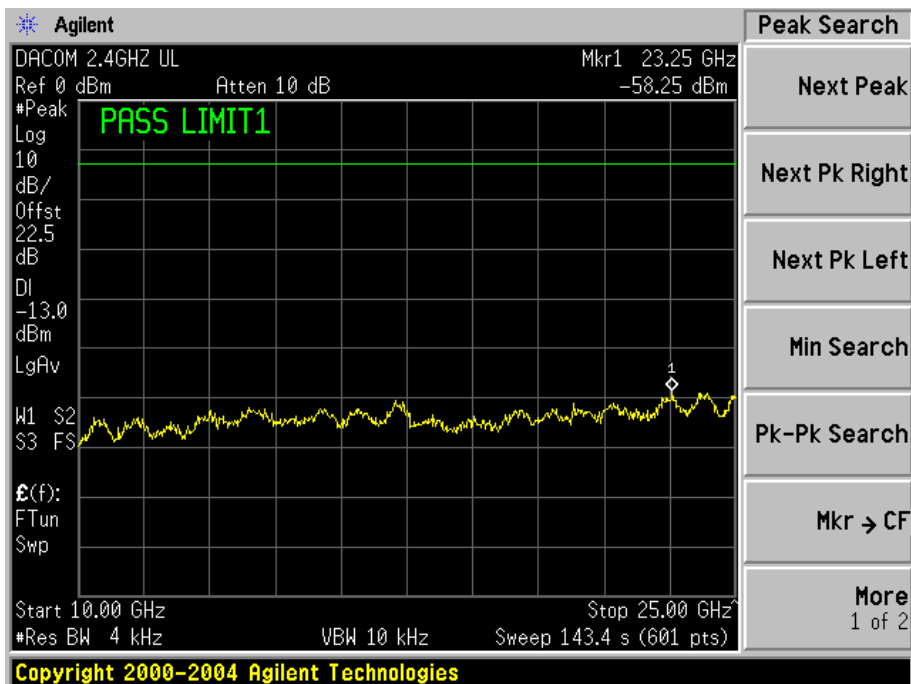
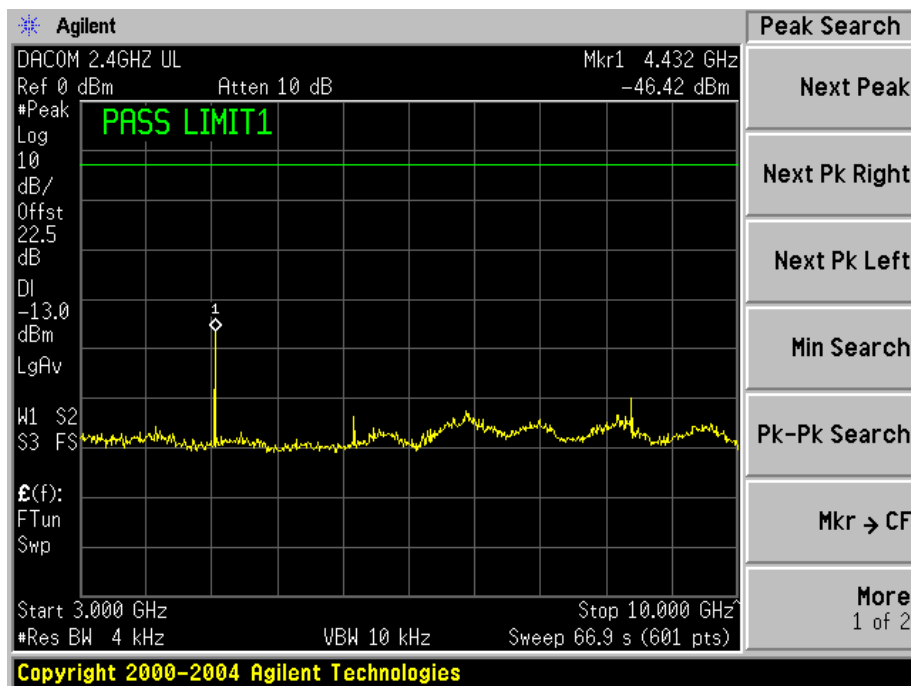
Temperature:	15° C
Relative Humidity:	82%
ATM Pressure:	1025mbar

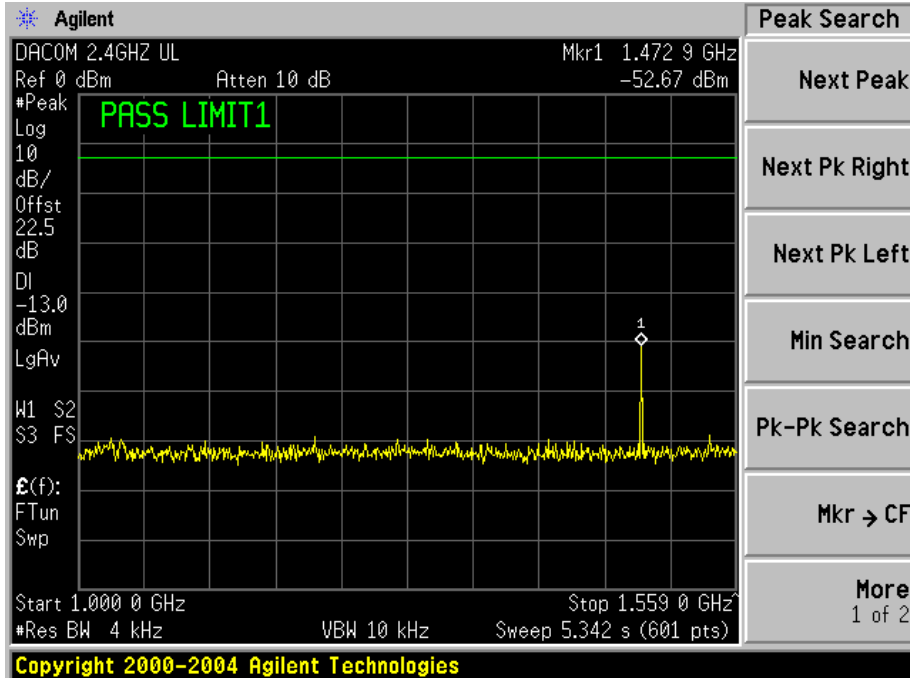
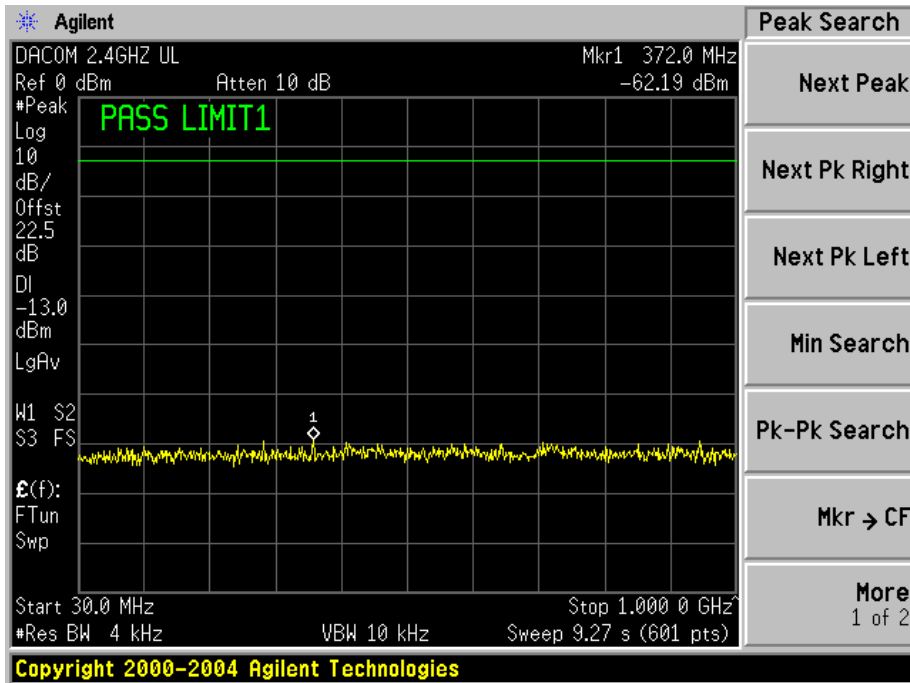
*The testing was performed by Snell Leong on 2005-12-17.*

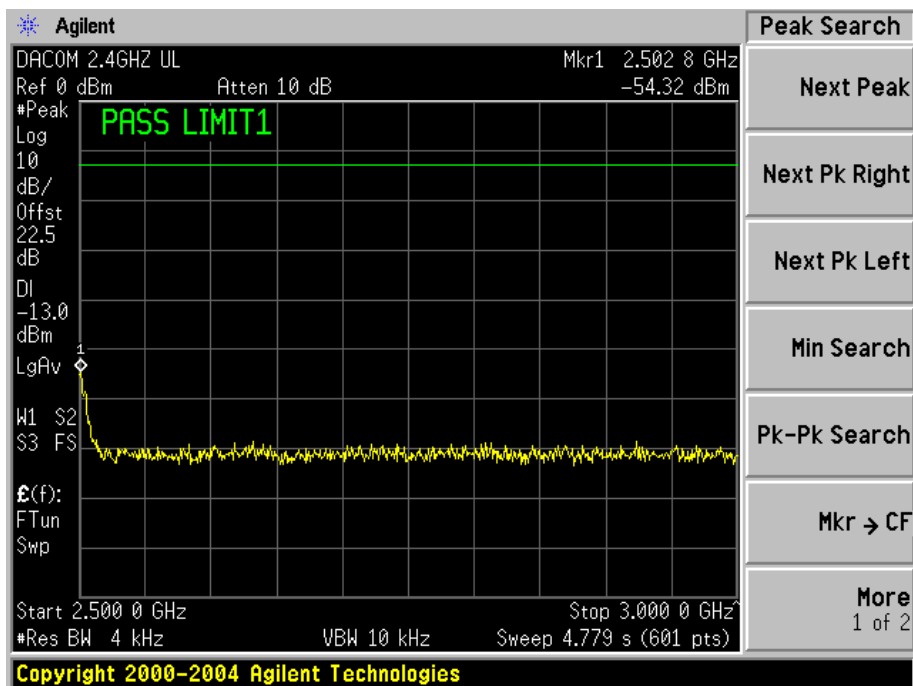
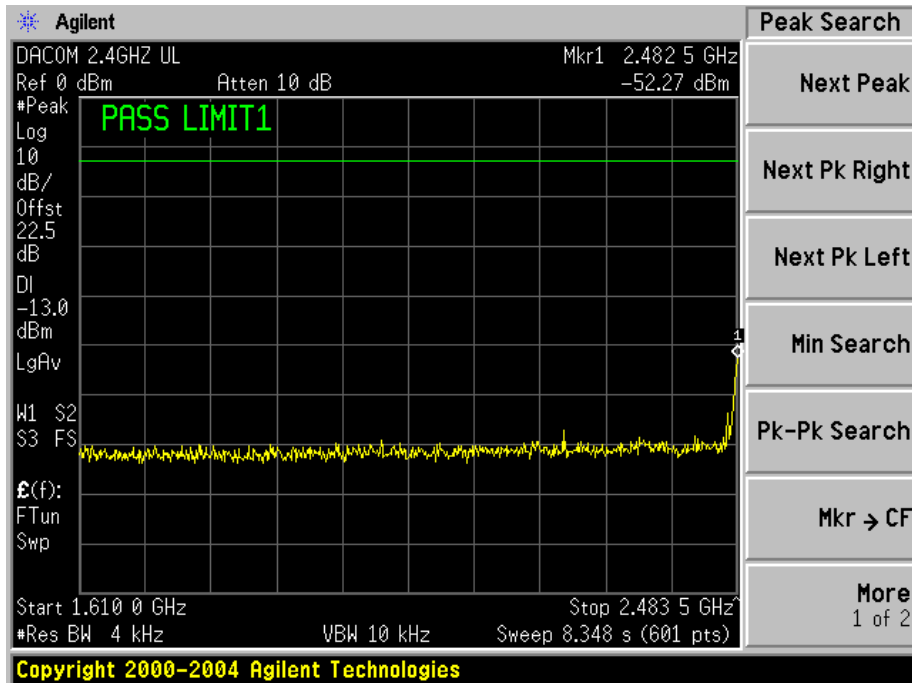
The following plots show that all emissions are fall below limit line -13 dBm.

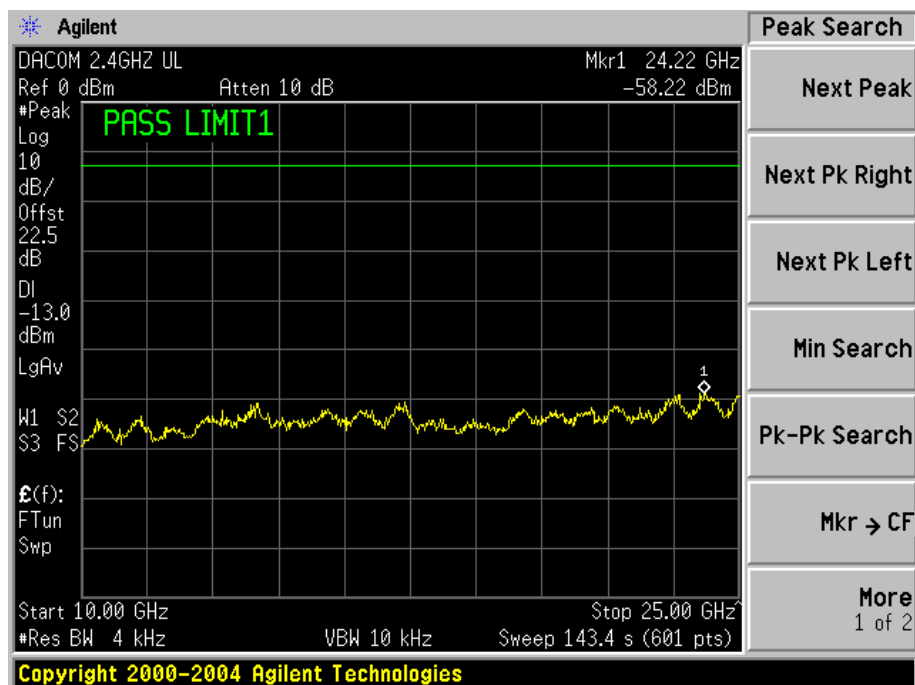
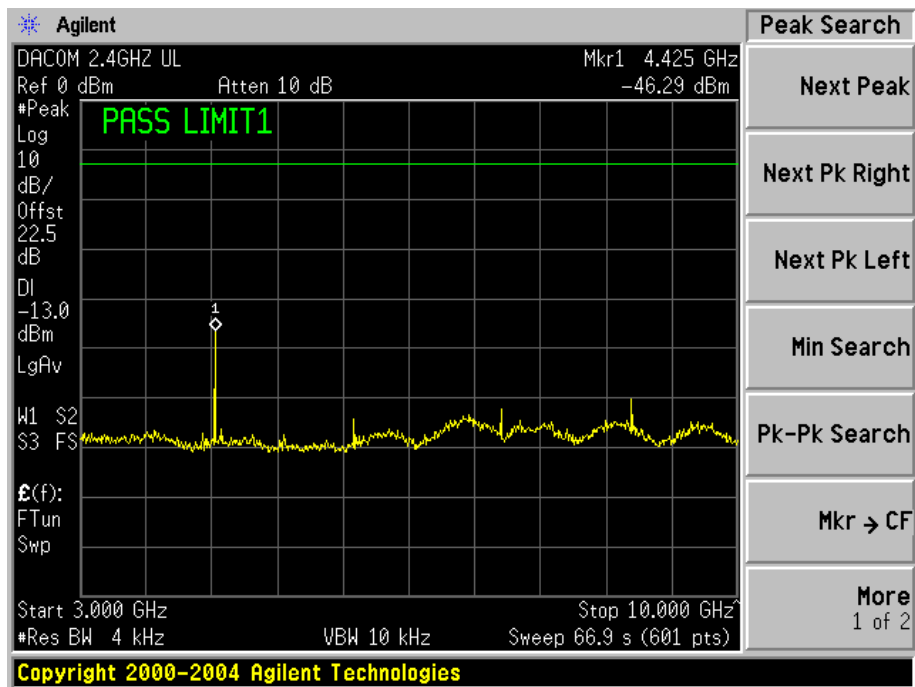
*Low Channel (Single Tone input)*





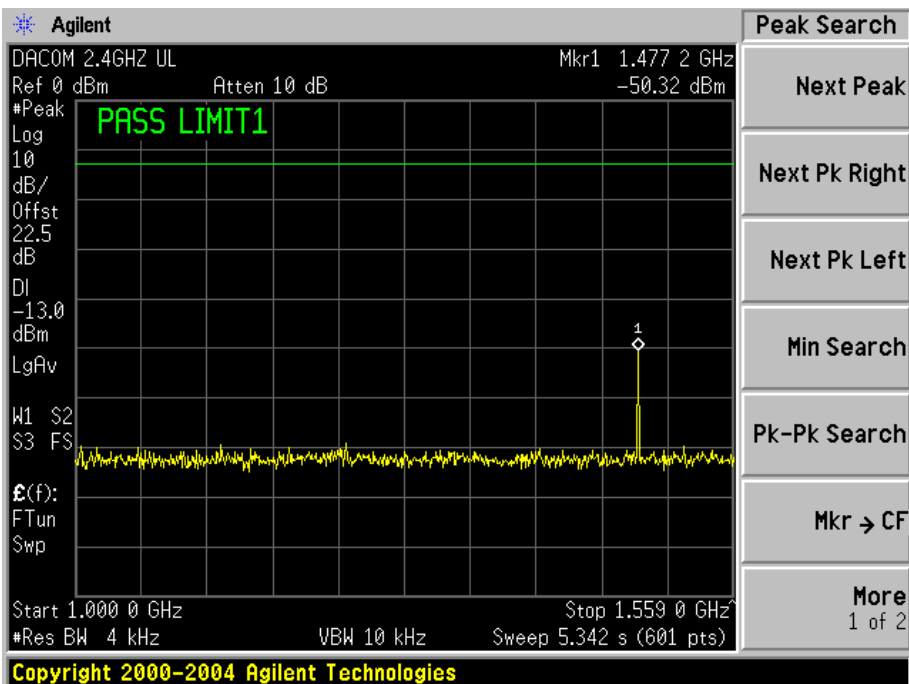
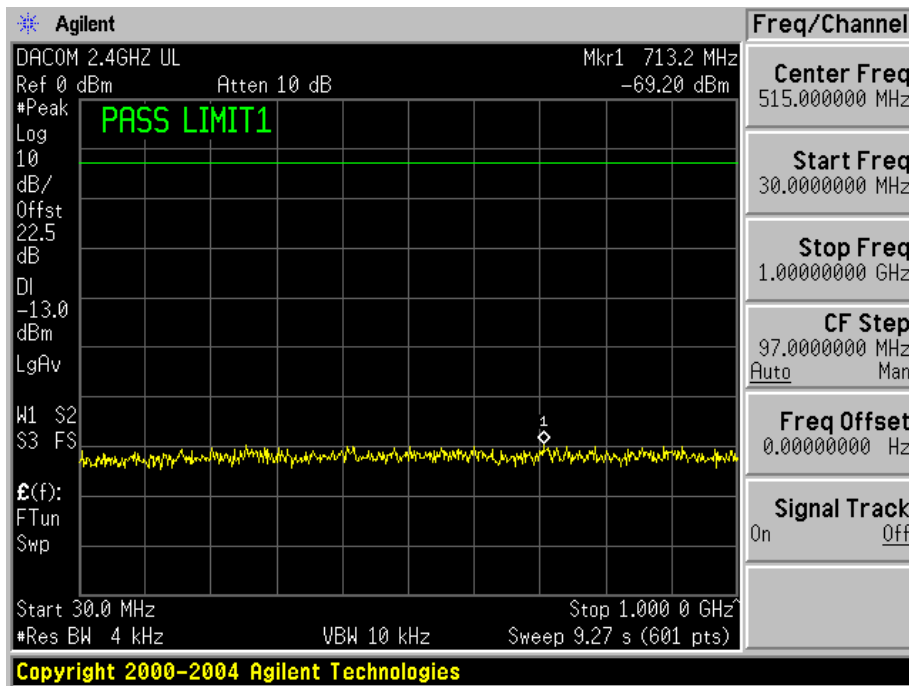
*Middle Channel(Single Tone input)*

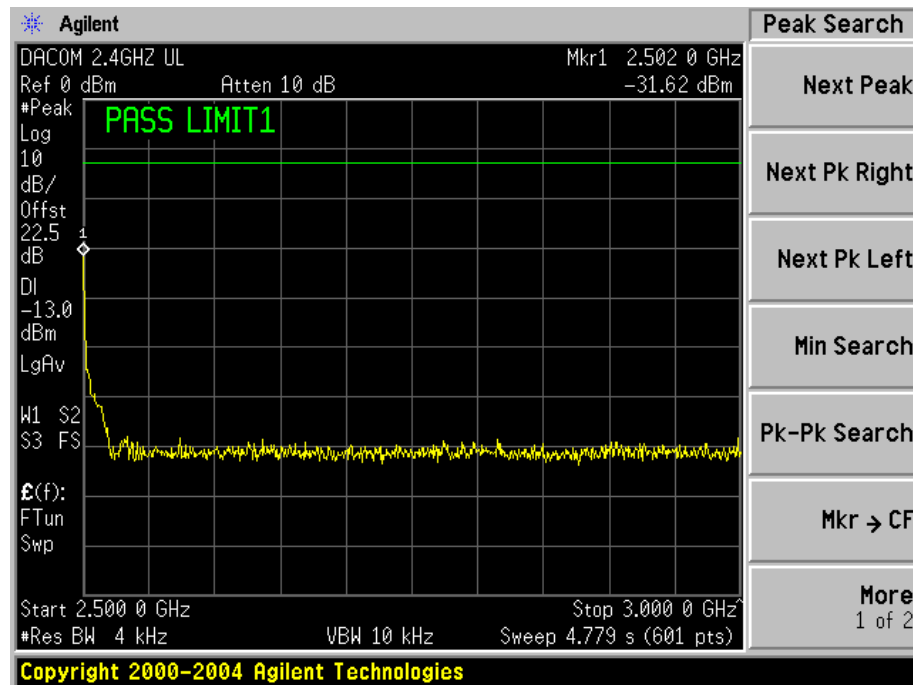
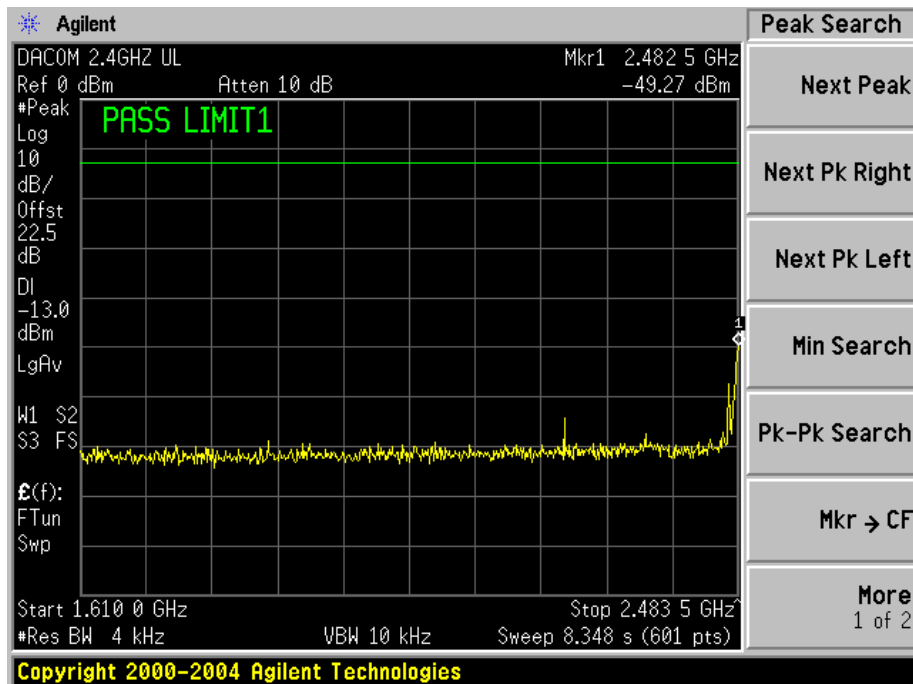


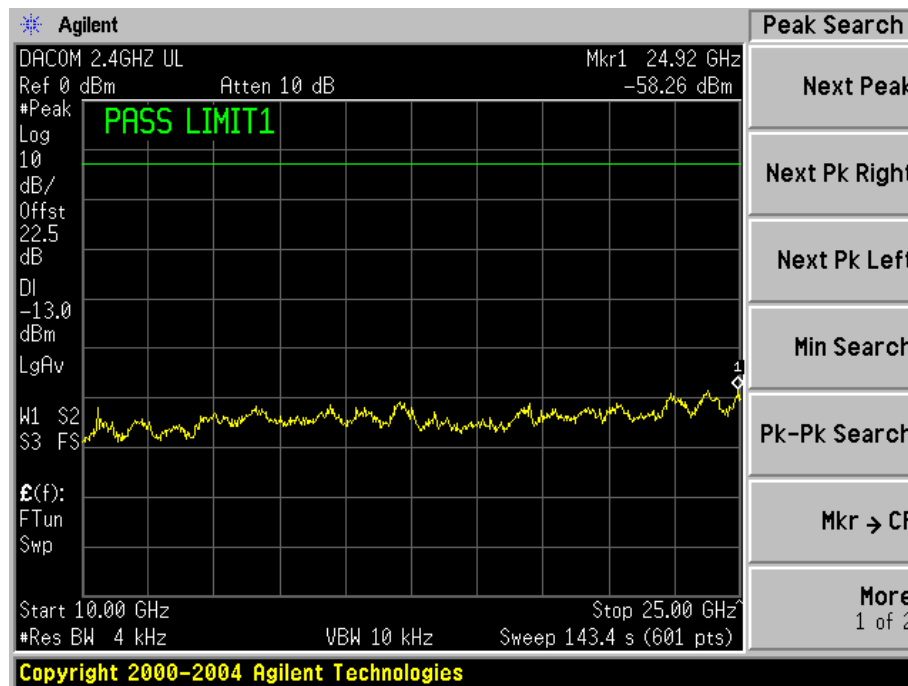
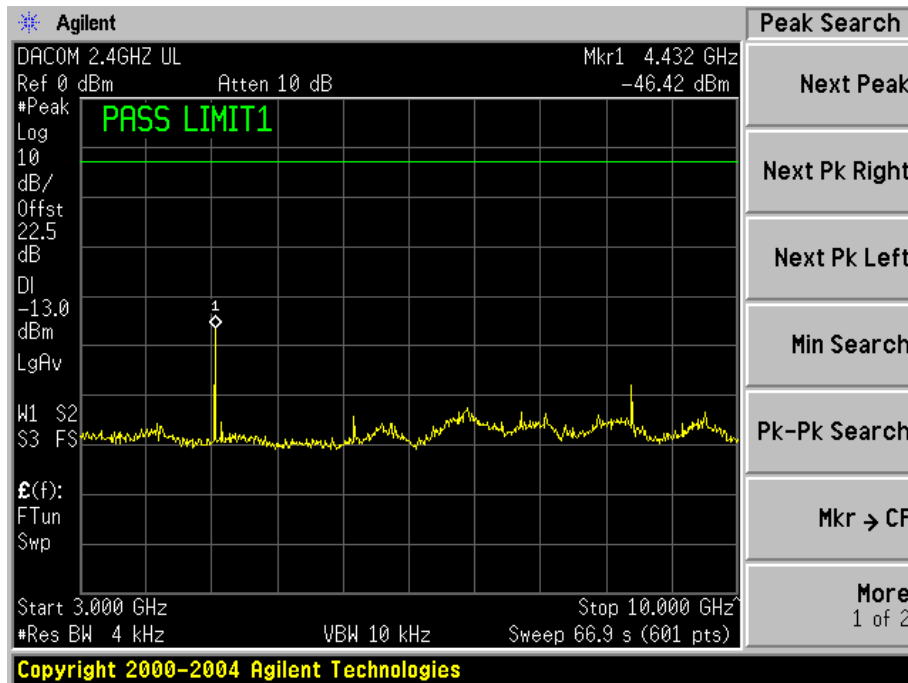




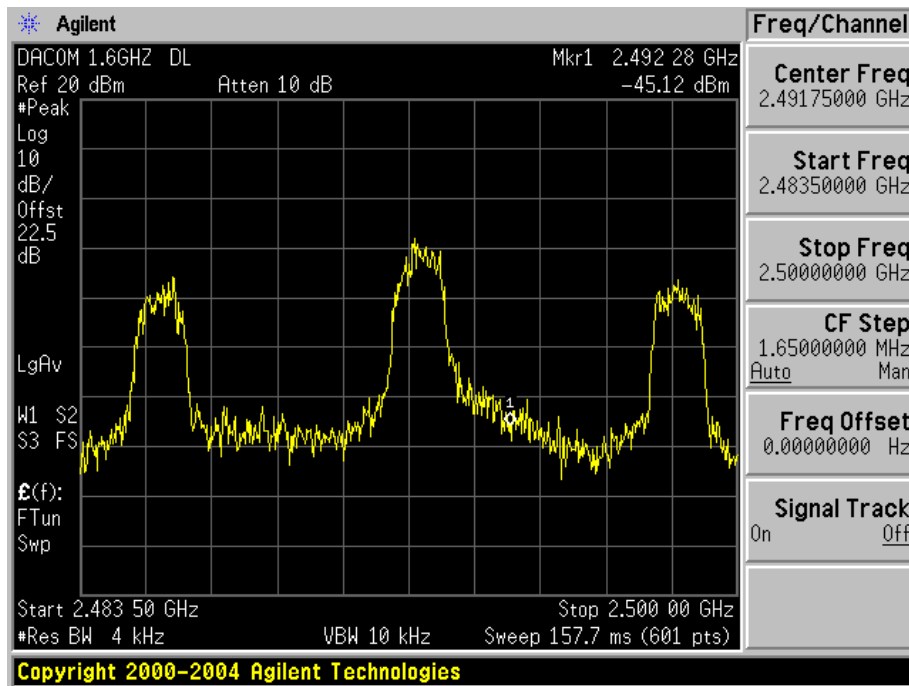
## High Channel(Single Tone input)



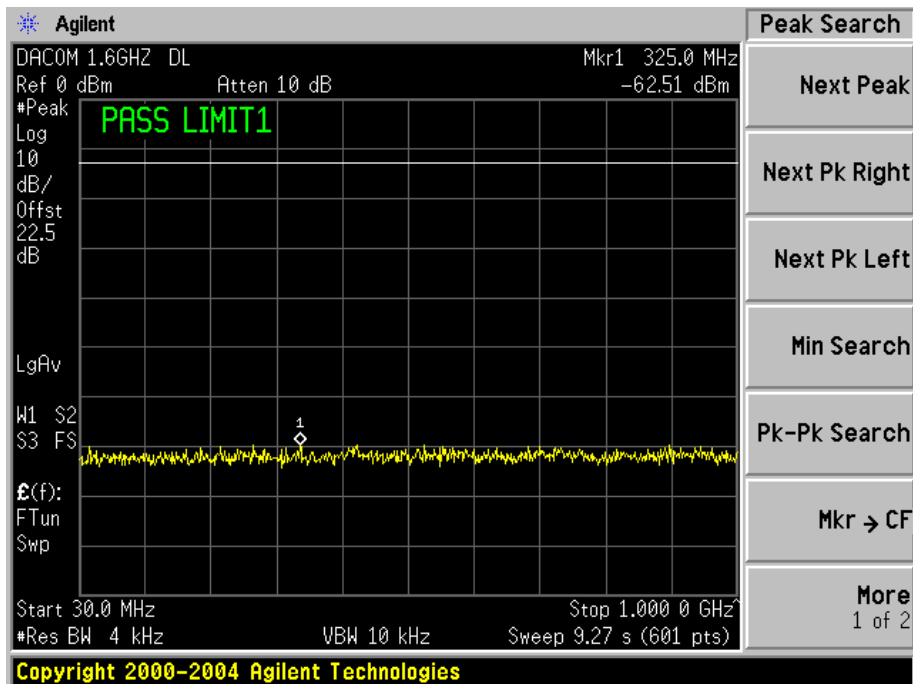


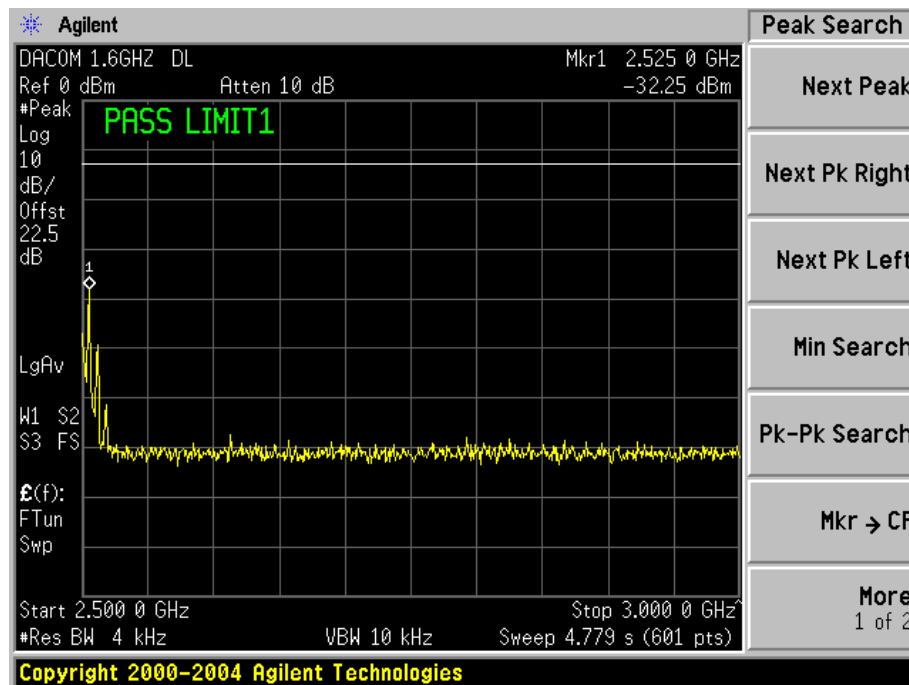
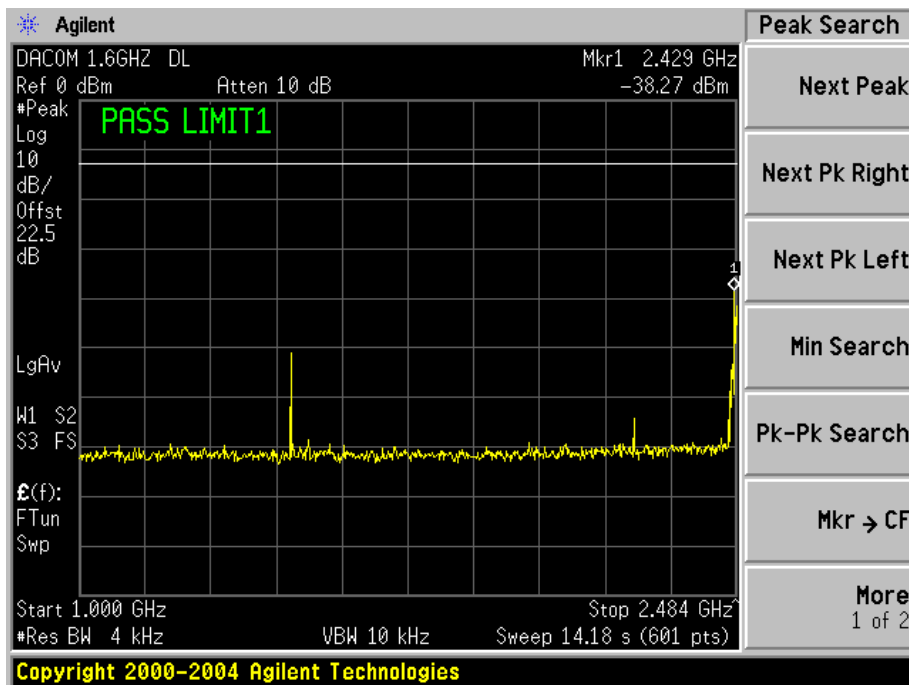


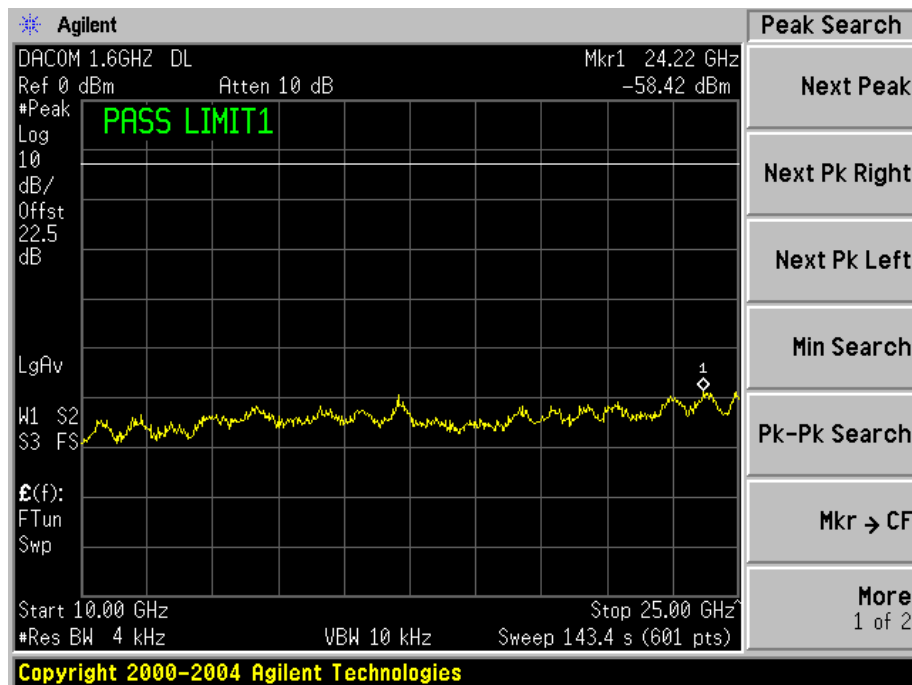
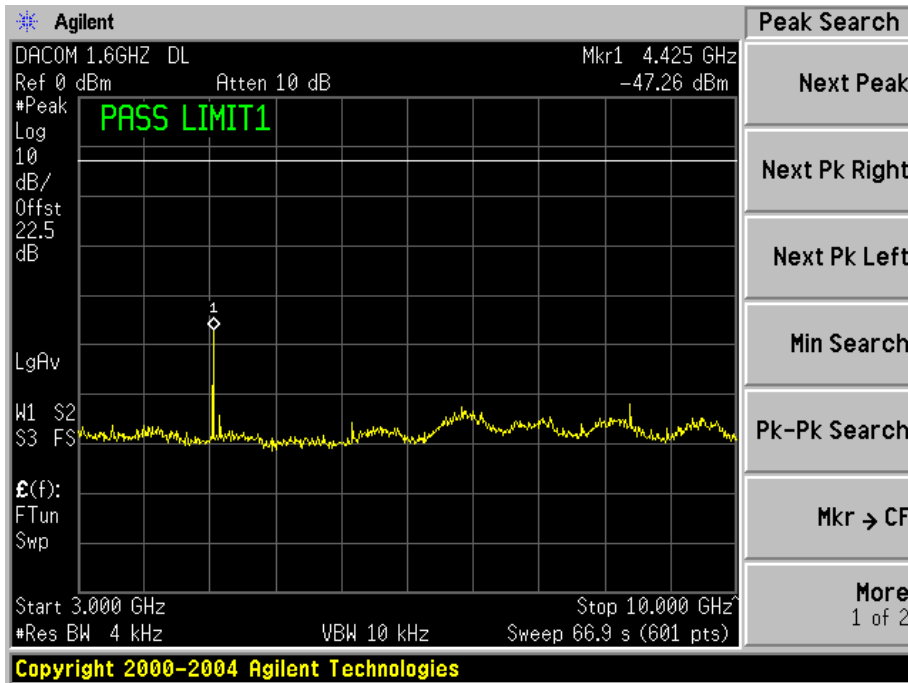
## 3 Tones input Plot For inter modulation emission



## 3 Tones Inter modulations Port Emission







## §15.107 - CONDUCTED EMISSIONS

### 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.

### EUT Setup

The measurement was performed in the shielded room, using the same setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC 15 Class B limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to 120VAC/60Hz power source.

### Receiver Setup

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

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-08-16
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2005-09-15
Fluke	Calibrated Voltmeter	189	18485-38	2005-09-15

\* **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, the power cord of the monitor and modem were connected to the LISN-2.

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

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

## Test Results Summary

According to the recorded data, the EUT complies with the FCC Conducted limits for a Class B device, with the worst margin reading of:

**-12.4 dB at 0.150 MHz at Line mode at 150 kHz to 30 MHz**

## Conducted Emissions Test Data

### Environmental Conditions

Temperature:	15 °C
Relative Humidity:	82%
ATM Pressure:	1025mbar

*\*Testing was performed by Snell Leong on 2005-12-18.*

Frequency MHz	LINE CONDUCTED EMISSIONS			FCC15 CLASS B	
	Amplitude dBμV	Detector Qp/Ave/Peak	Mode Line/Neutral	Limit dBμV	Margin dB
0.150	53.6	QP	Line	66.00	-12.4
0.150	52.3	QP	Neutral	66.00	-13.7
0.240	36.2	Ave	Line	52.10	-15.9
0.240	45.8	QP	Line	62.10	-16.3
0.240	35.5	Ave	Neutral	52.10	-16.6
0.325	31.6	Ave	Line	49.58	-18.0
0.325	31.4	Ave	Neutral	49.58	-18.2
0.240	43.5	QP	Neutral	62.10	-18.6
0.325	33.4	QP	Line	59.58	-26.2
0.325	32.9	QP	Neutral	59.58	-26.7
0.150	24.7	Ave	Line	56.00	-31.3
0.150	24.4	Ave	Neutral	56.00	-31.6

## Plots of Conducted Emission

The plots of conducted emission are presented hereinafter as reference.



**Bay Area Compliance Laboratory Corp**  
**Class B**

18. Dec 05 21:04

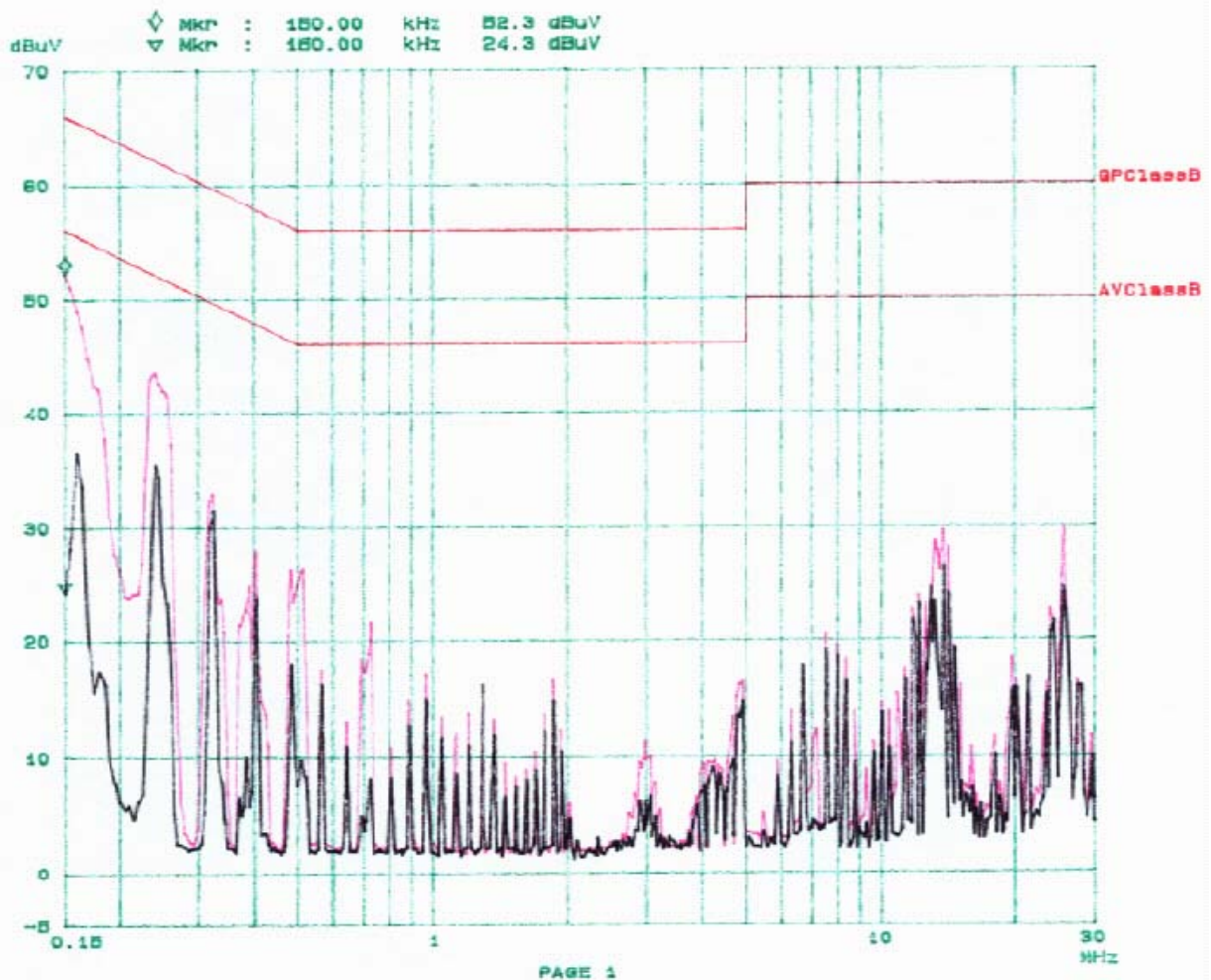
18 / Dec / 2005

Shen

EUT: 1.6/2.4 GHz satellite mobile unit  
Manuf: GIRA2005  
Op Cond: Normal  
Operator: SNELL  
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	18dB LN	OFF	
1M	5M	10k	9k	QP+AV	1ms	18dB LN	OFF	
5M	30M	100k	9k	QP+AV	1ms	18dB LN	OFF	



Bay Area Compliance Laboratory Corp  
Class B

18. Dec 05 20:32

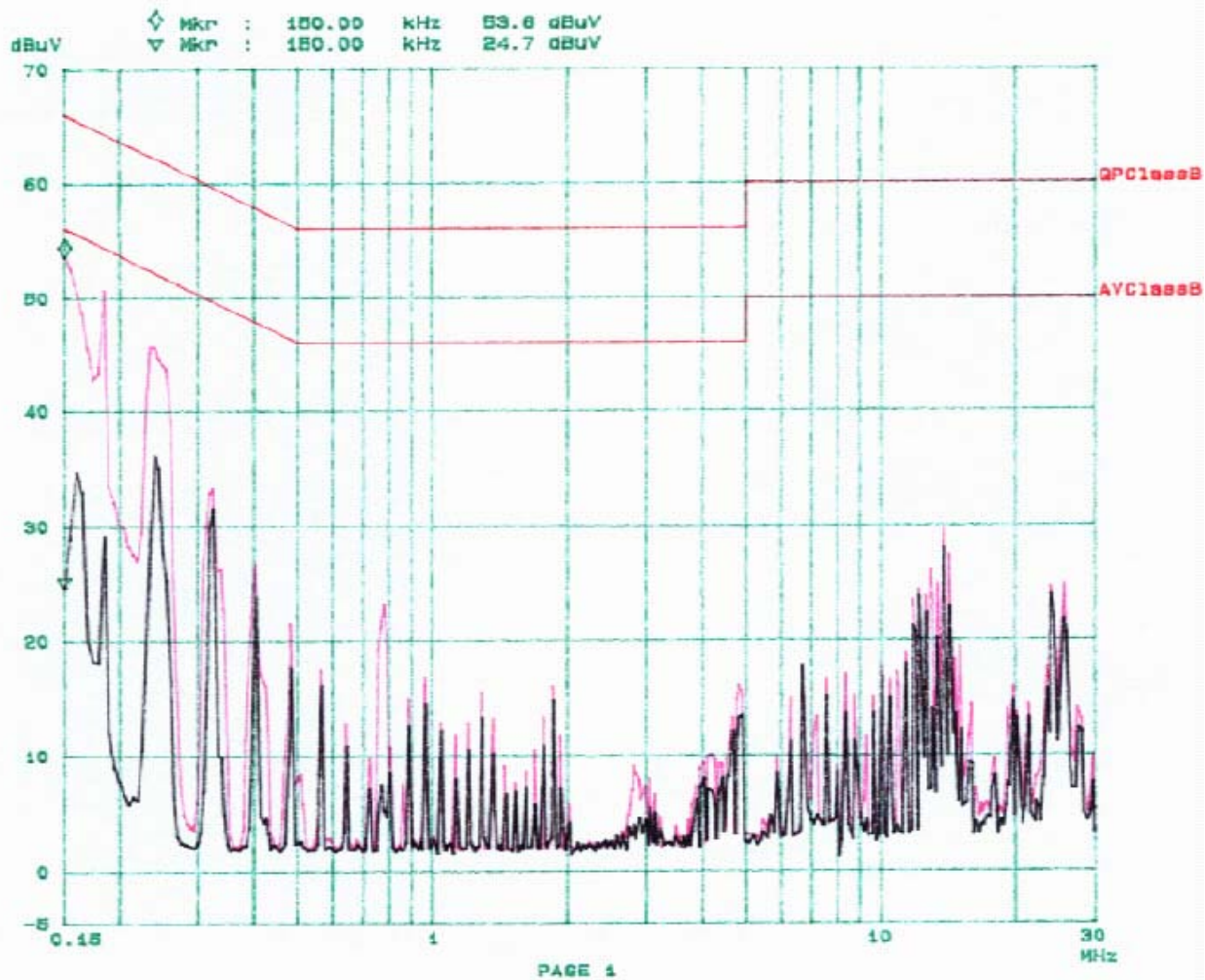
18/Dec/2005

Shel

EUT: 1.6/2.4 Ghz satellite mobile unit  
Manuf: SIR2005  
Op Cond: Normal  
Operator: SNELL  
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



**§ 2.1053 & §25.202 (f) – FIELD STRENGTH OF SPURIOUS RADIATION****Standard Applicable**

Requirements: CFR 47, § 25.202(f). The mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;

In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

**Measurement Procedure**

The testing procedure was set according to TIA 603-C.

**Equipment Lists**

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

\* **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:	15° C
Relative Humidity:	82%
ATM Pressure:	1025 mbar

*The testing was performed by Snell Leong on 2005-12-17.*

**Out of Band (Carrier On)**

*Final Scan 30MHz – 25GHz (Lowest Channel: 2485.5 MHz), Antenna gain= 4 dB, Cable Loss=4.8dB*

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Gain	Loss	Level		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	Correction	dB	dBm	dBm	dB
9942.0	37.1	180	1.4	v	9942.0	-56.4	9.7	4.93	-51.6	-13	-38.6
9942.0	36.8	0	1.4	h	9942.0	-57.0	9.7	4.93	-52.2	-13	-39.2
7456.5	36.5	90	1.2	v	7456.5	-57.5	9.3	4.27	-52.5	-13	-39.5
7456.5	35.9	0	1.4	h	7456.5	-57.9	9.3	4.27	-52.9	-13	-39.9
4971.0	35.7	180	1.4	v	4971.0	-59.8	11.8	5.07	-53.1	-13	-40.1
4971.0	35.5	330	1.2	h	4971.0	-60.3	11.8	5.07	-53.6	-13	-40.6

*Final Scan 30MHz – 25GHz (Middle Channel: 2492 MHz), Antenna gain=4 dB, Cable Loss=4.8dB*

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Gain	Loss	Level		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	Correction	dB	dBm	dBm	dB
7476	37.7	90	1.2	v	7476	-56.3	9.3	4.27	-51.3	-13	-38.3
4984	36.8	180	1.4	v	4984	-58.1	11.8	5.07	-51.4	-13	-38.4
9968	37.2	180	1.4	v	9968	-56.2	9.7	4.93	-51.4	-13	-38.4
9968	36.8	0	1.4	h	9968	-56.8	9.7	4.93	-52.0	-13	-39.0
7476	37.2	0	1.4	h	7476	-57.1	9.3	4.27	-52.1	-13	-39.1
4984	36.4	330	1.2	h	4984	-59.3	11.8	5.07	-52.6	-13	-39.6

*Final Scan 30MHz – 25GHz (Highest Channel: 2498.5 MHz), Antenna gain= 4 dB, Cable Loss=4.8dB*

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute	Limit	Margin
Frequency	Ampl.	Angle	Height	Polar	Frequency	Level	Gain	Loss	Level		
MHz	dBuV/m	Degree	Meter	H/V	MHz	dBm	Correction	dB	dBm	dBm	dB
7495.5	38.0	90	1.2	v	7495.5	-55.9	9.3	4.27	-50.9	-13	-37.9
7495.5	37.6	0	1.4	h	7495.5	-56.2	9.3	4.27	-51.2	-13	-38.2
9994.0	37.4	180	1.4	v	9994.0	-56	9.7	4.93	-51.2	-13	-38.2
9994.0	37.1	0	1.4	h	9994.0	-56.5	9.7	4.93	-51.7	-13	-38.7
4997.0	35.6	180	1.4	v	4997.0	-60	11.8	5.07	-53.3	-13	-40.3
4997.0	35.1	330	1.2	h	4997.0	-60.5	11.8	5.07	-53.8	-13	-40.8

## §25.202 – EMISSION MASK

### Standard Applicable

According to CFR 47, § 25.202. The mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and include 250 percent of the authorized bandwidth: 35 dB;

### 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 4 kHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

### Equipment Lists

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

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

### Measurement Result

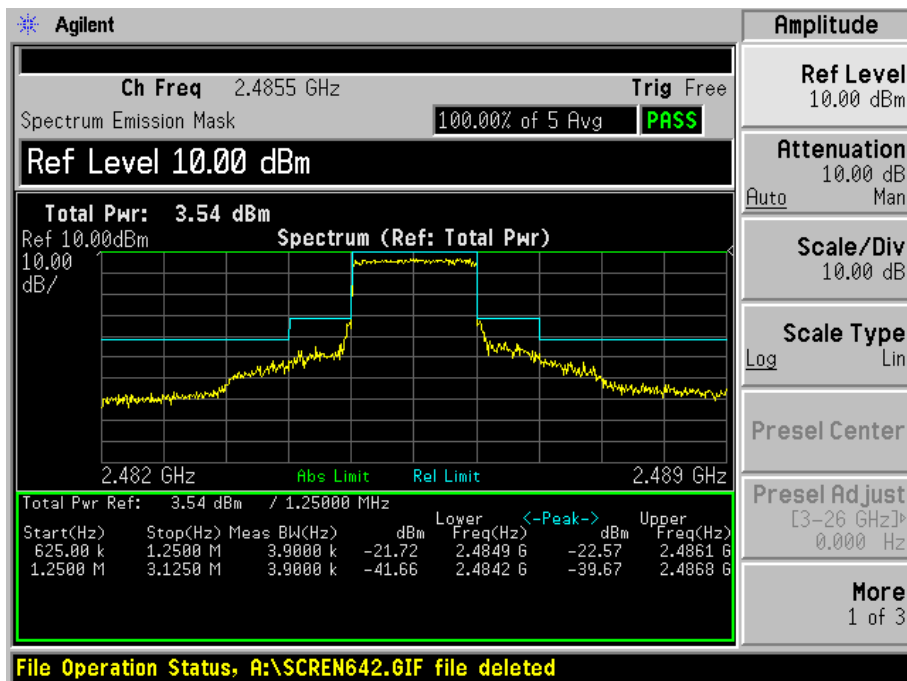
#### Environmental Conditions

Temperature:	15° C
Relative Humidity:	82%
ATM Pressure:	1025mbar

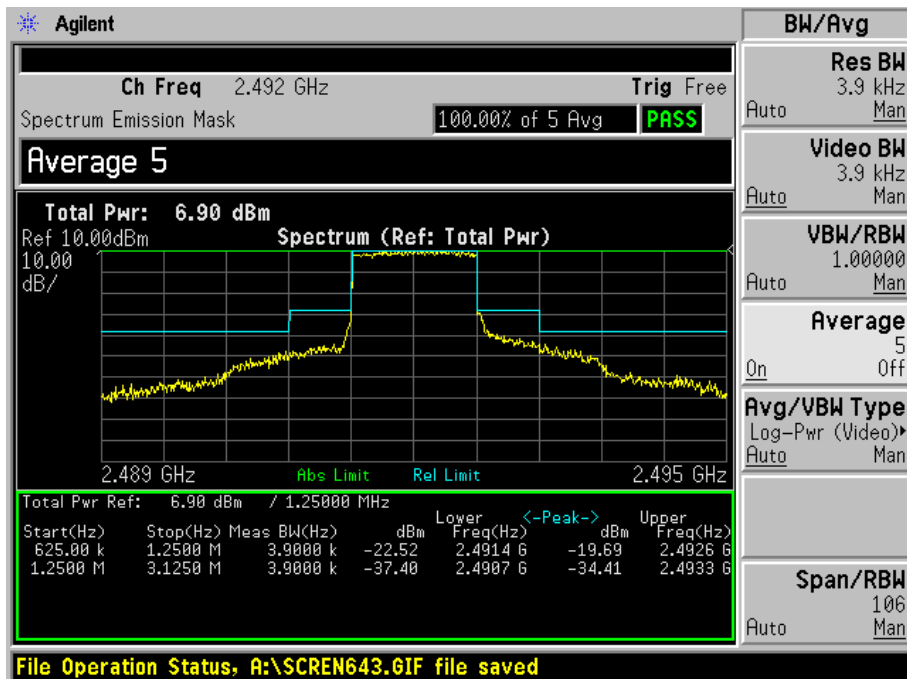
*The testing was performed by Snell Leong on 2005-12-17.*

Please note that Input Signal plots is included to show that spectral shape of the output look similar to input.

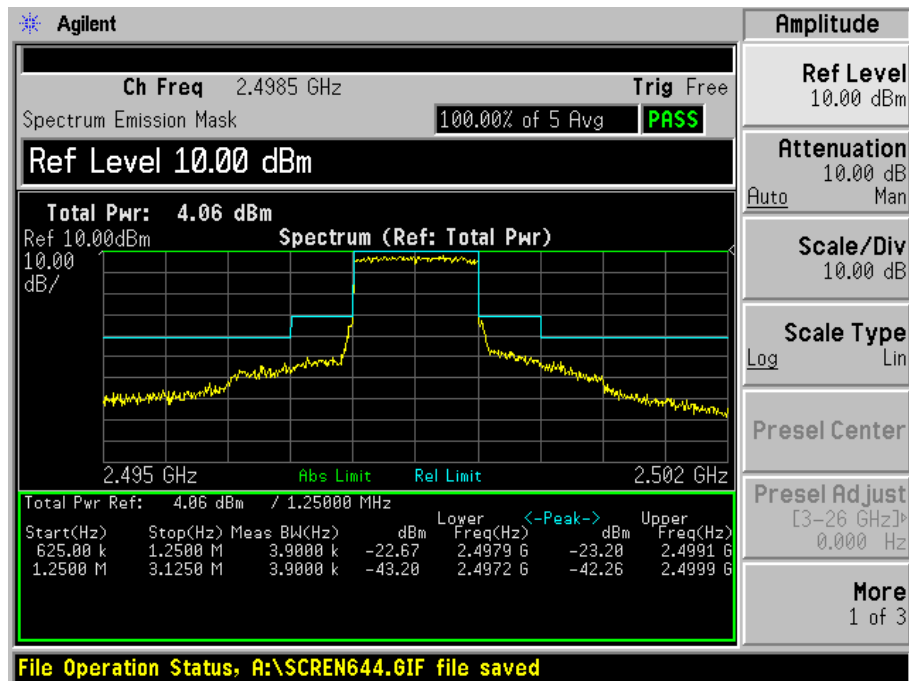
## Low Channel



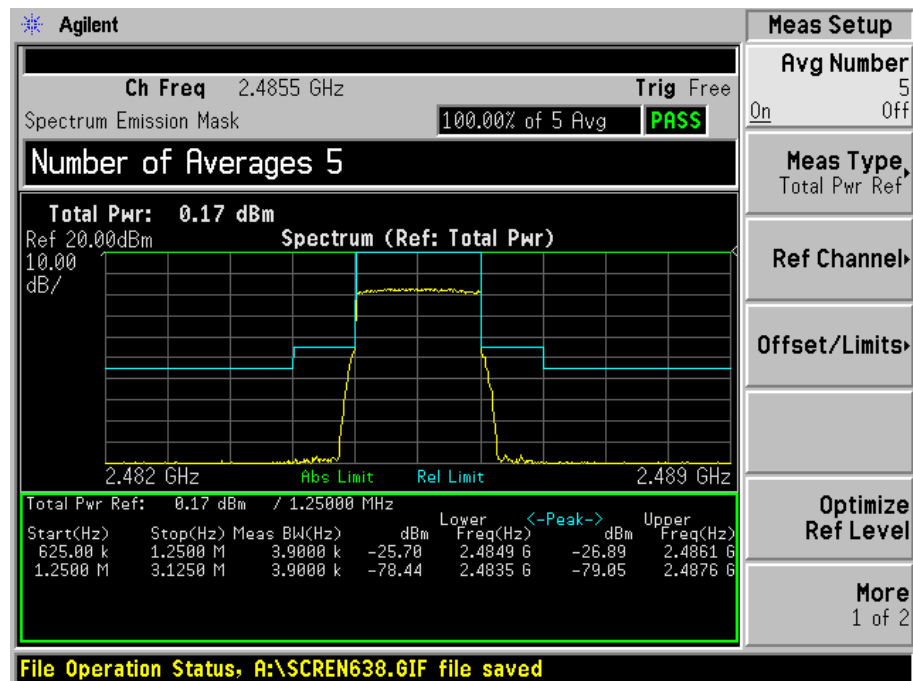
## Middle Channel



## High Channel

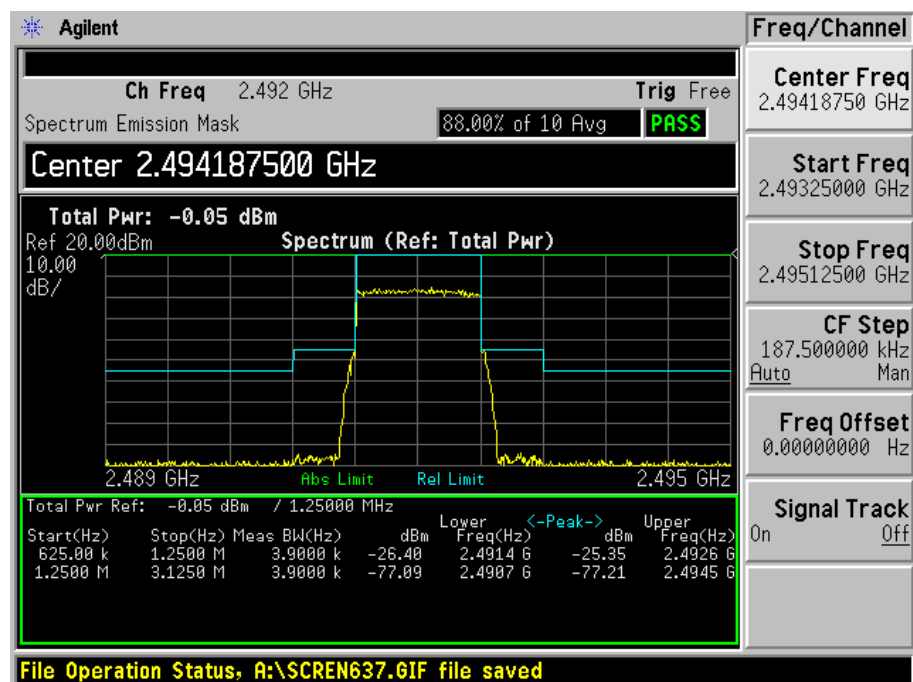


## Low Channel of Signal Input

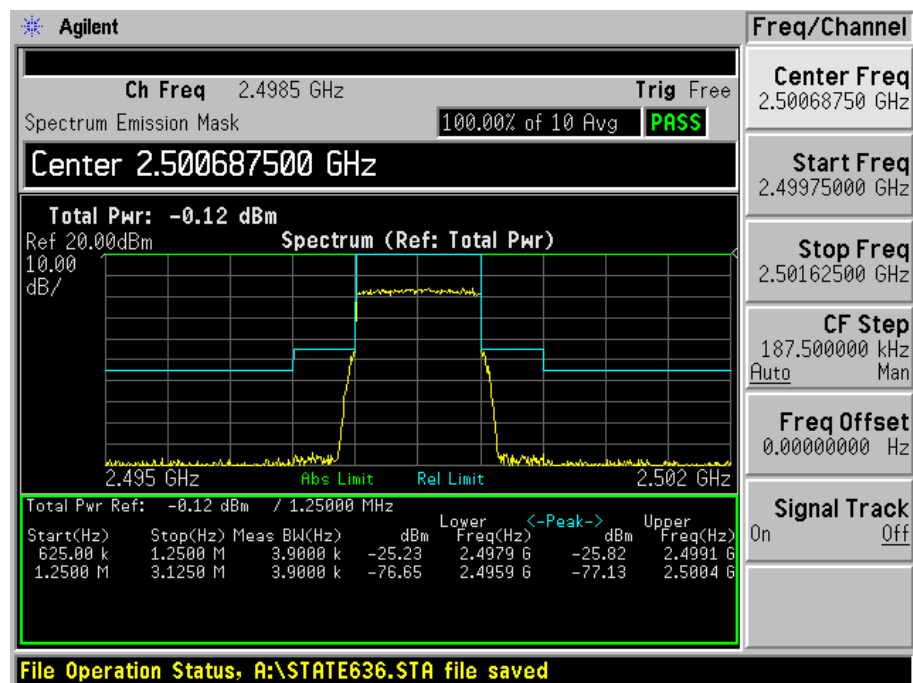




## Middle Channel of Signal Input



## High Channel of Signal Input





## §2.1046 & §25.254(a)(1) – POWER OUTPUT

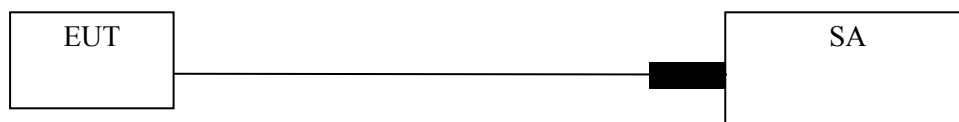
### Standard Applicable

a) An applicant for an ancillary terrestrial component in these bands must demonstrate that ATC base stations shall:

(1) Not exceed a peak EIRP of 32 dBW in 1.25 MHz;

### 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 & 20 dB attenuator from the antenna port to a Spectrum Analyzer.



### Equipment Lists

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

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

### Measurement Result

#### Environmental Conditions

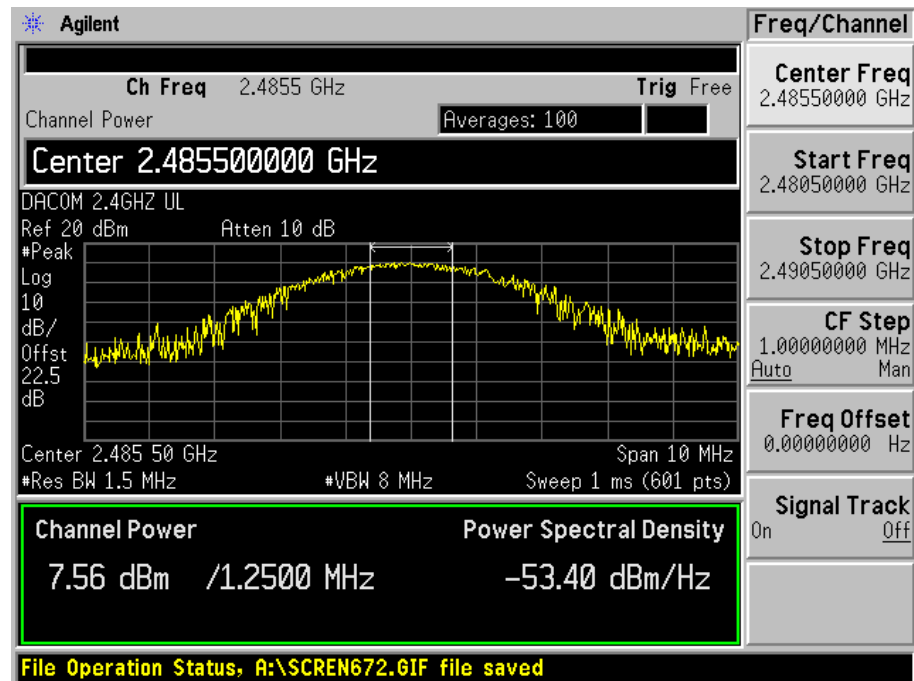
Temperature:	15° C
Relative Humidity:	82%
ATM Pressure:	1025 mbar

*The testing was performed by Snell Leong on 2005-12-17.*

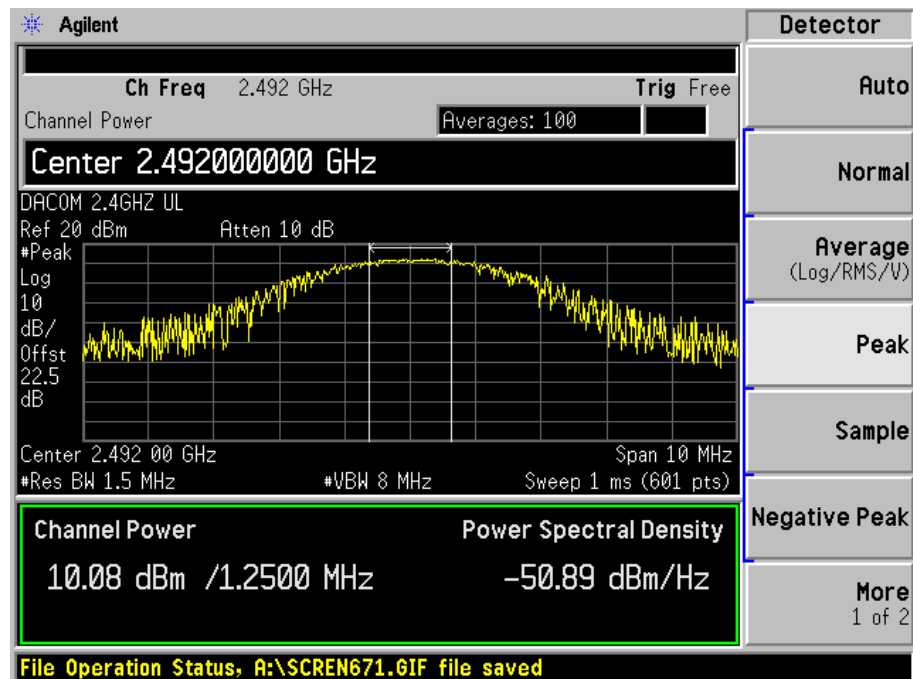
Antenna gain =4dB / Cable loss =4.8dB

Channel	Frequency MHz	Max conducted power (dBm)	Antenna gain & Cable loss	Corrected EIRP dBW	Limit (dBW)	Result
Low	2485.5	7.56	-0.80	-23.24	32	pass
Middle	2492.0	10.08	-0.80	-20.72	32	pass
High	2498.5	9.24	-0.80	-21.56	32	pass

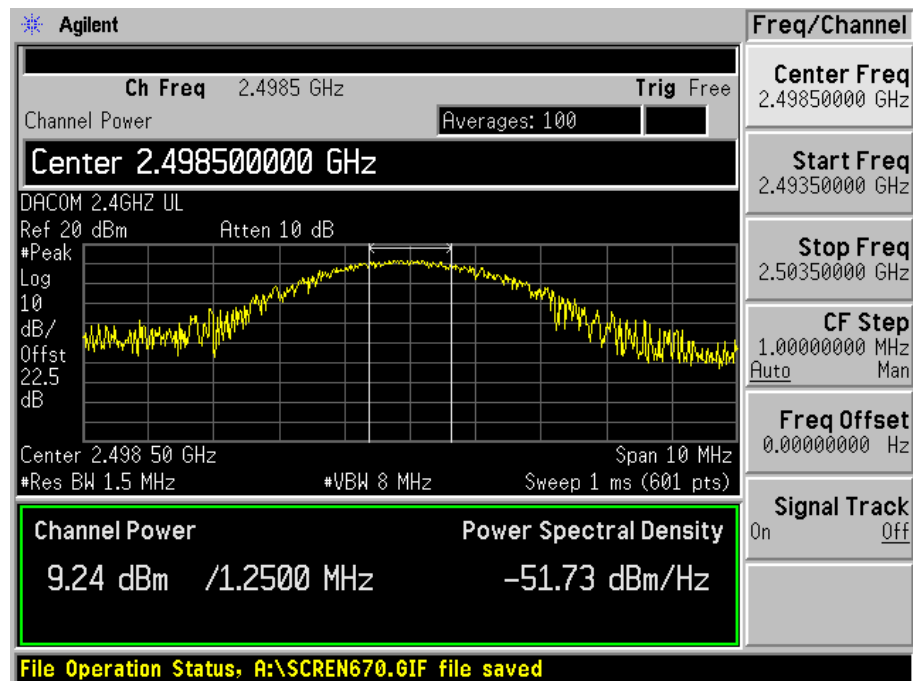
## Low Channel



## Middle Channel



## High Channel

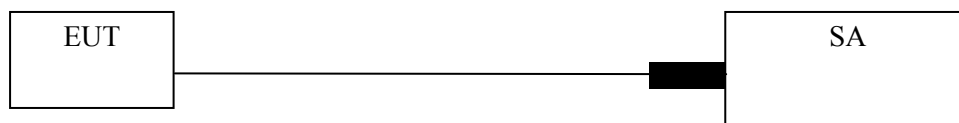


**§25.254(a)(2)–Band edge****Standard Applicable**

According to §25.254(a)(2): Not cause unacceptable interference to systems identified in paragraph (c) of this section and, in any case, shall not exceed out-of-channel emissions of  $-44.1$  dBW/30 kHz at the edge of the MSS licensee's authorized frequency assignment

**Test Procedure**

3. Place the EUT on a bench and set it in transmitting mode.
4. Remove the antenna from the EUT and then connect a low loss RF cable & 20 dB attenuator from the antenna port to a Spectrum Analyzer.

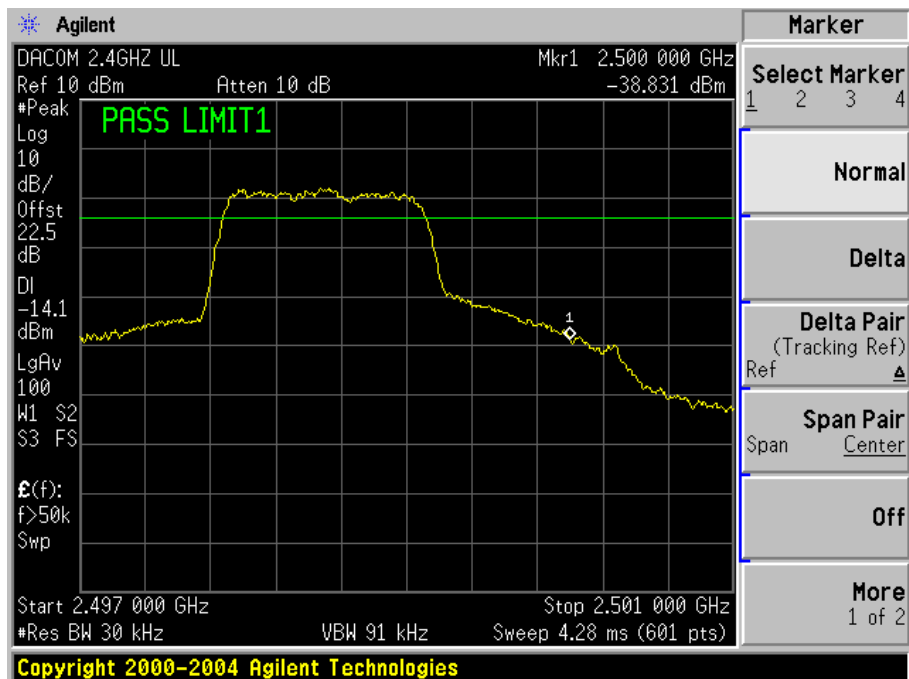
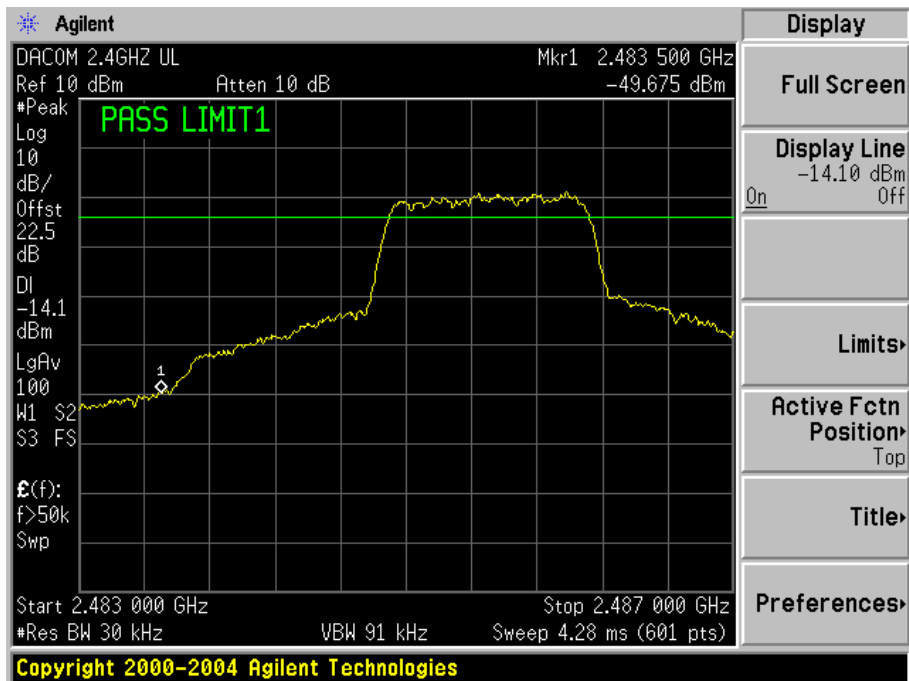
**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10	2006-11-10

**Measurement Result****Environmental Conditions**

Temperature:	15° C
Relative Humidity:	82%
ATM Pressure:	1025 mbar

*The testing was performed by Snell Leong on 2005-12-17.*



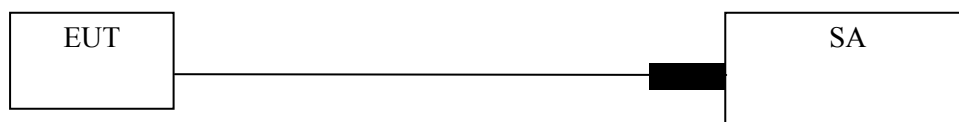
## §25.254(a)(4)– EMISSIONS FROM MOBILE EARTH STATIONS FOR PROTECTION OF AERONAUTICAL RADIONAVIGATION-SATELLITE SERVICE

### Standard Applicable

4) Base stations operating in frequencies above 2483.5 MHz shall not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than  $-70$  dBW/MHz in the 1559–1610 MHz band. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations shall not exceed  $-80$  dBW in the 1559–1610 MHz band. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

### Measurement Procedure

5. Place the EUT on a bench and set it in transmitting mode.
6. Remove the antenna from the EUT and then connect a low loss RF cable & 20 dB attenuator from the antenna port to a Spectrum Analyzer.



### Equipment Lists

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

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

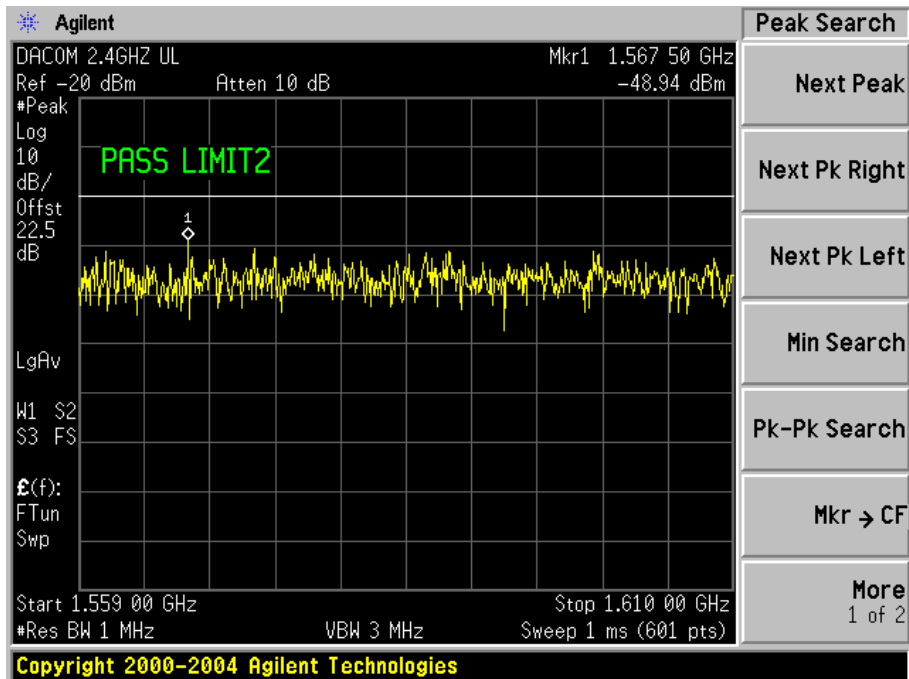
### Measurement Result

#### Environmental Conditions

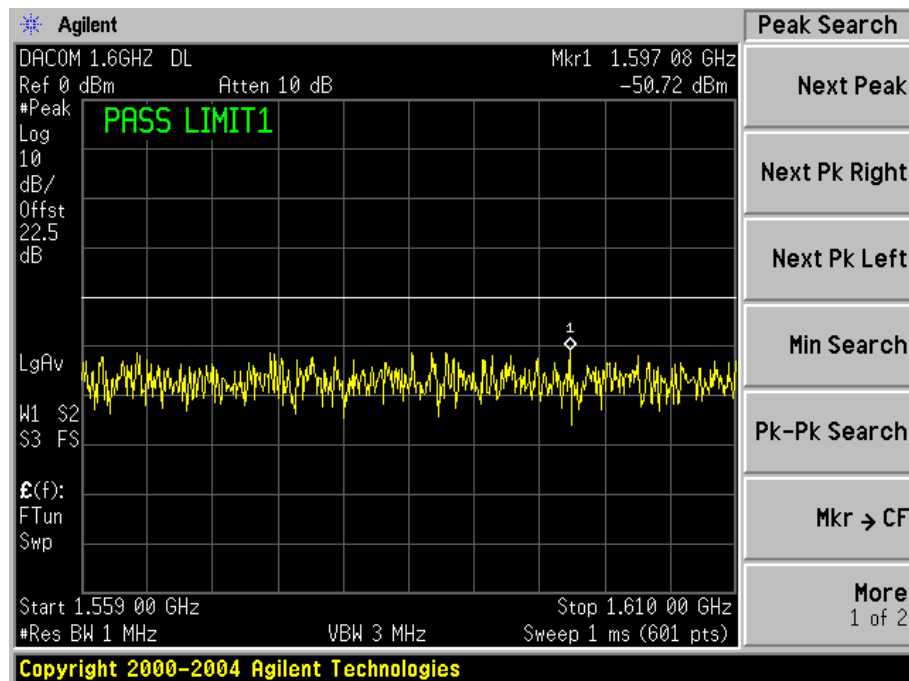
Temperature:	15° C
Relative Humidity:	82%
ATM Pressure:	1025 mbar

*The testing was performed by Snell Leong on 2005-12-17.*

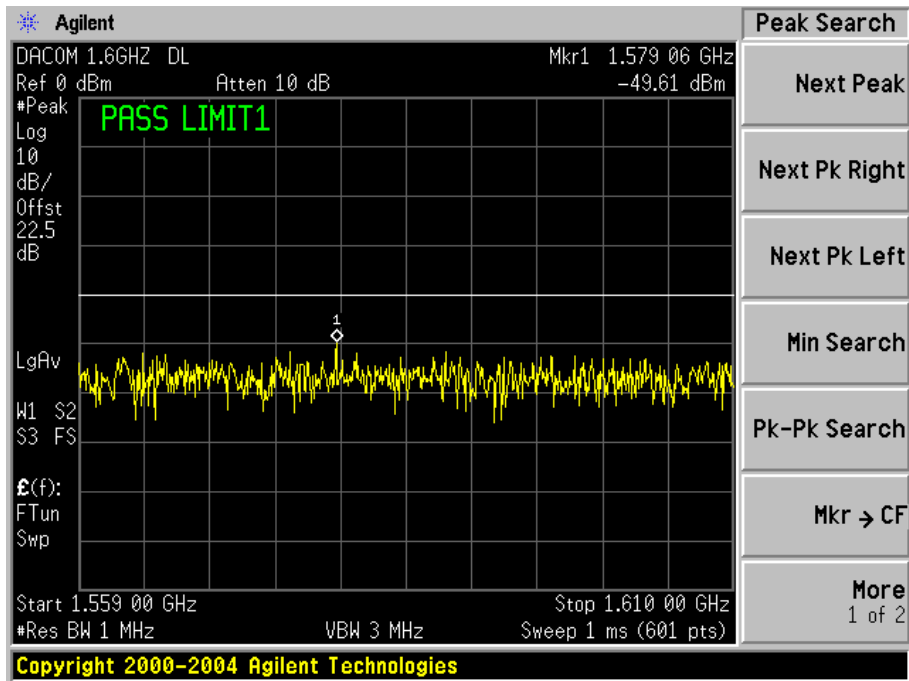
## Low Channel



## Middle Channel



## High Channel





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## **§2.1055 & §25.202(d) – FREQUENCY STABILITY**

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No Required for Signal Booster