Lab Code: 200167-0

FCC PART 25 TYPE APPROVAL

MEASUREMENT AND TEST REPORT

For

Globalstar USA, LLC

461 S. Milpitas Blvd.
Milpitas, CA 95035, U.S.A.

FCC ID: TSEMCM-4M

This Report Concerns:	Product name:
☒ Original Report (rev.1)	Modular Four-Channel Satellite Modem

Test Engineer:	James Ma
Report Number:	R0612141-25a
Report Date:	2007-02-07
Reviewed By:	Hans Mellberg, VP of Engineering
Prepared By (J8):	Bay Area Compliance Laboratories Corp. (BACL) 1274 Anvilwood Ave. Sunnyvale, CA 94089 Tel: (408) 732-9162 Fax: (408) 732 9164

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Globalstar USA, LLC's* product, *FCC ID: TSEMCM-4M*, model number: *MCM-4M* or the "EUT" as referred to in this report is a *Modular Four-Channel Satellite Modem* designed to operate at 1.6 GHz. The EUT is a full duplex data access device able to establish up to four concurrent satellite connections. There are two components that comprise the EUT : an Antenna (either 2.3 dBi or 4.5 dBi) and a Multi Channel Modem (*MCM-4M*). Designed either to connect to a public server site or to a private site such as a Virtual Private Network (VPN), the EUT features a single standard Ethernet connection and is powered by 12 VCD from an AC/DC adapter.

EUT Photo

Please see Exhibit C for additional EUT photos

Mechanical Description

The *Globalstar USA, LLC's* product, *FCC ID: TSEMCM-4M* or the "EUT" as referred to in this report is a *Single Antenna Multi Channel Modem*, which measures approximately *420mmL x 400mmW x 40mmH and weighs 4.99 kg*.

** The test data gathered are from production sample, serial number: 2907, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Globalstar USA, LLC* 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/EIA 603-C.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp.

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. 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 values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

Test Facility

The test site used by BACL Corp. to conduct and collect safety measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. 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 have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11, 1997 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the test methods and procedures set forth in ANSI C63.4-2003 & TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: R-2463 and C-2698. 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 Corp. 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/EIA 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

The EUT was operating in max power mode during radiated and conducted testing.

Special Accessories

NA

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
IBM	Laptop	560	78-HN065 97/04
Anritsu	Global Star User terminal tester	MT8803G	MB06886
Anritsu	Global Star User terminal tester	MT8803G	MB08587
Dell	Laptop	300M	NA

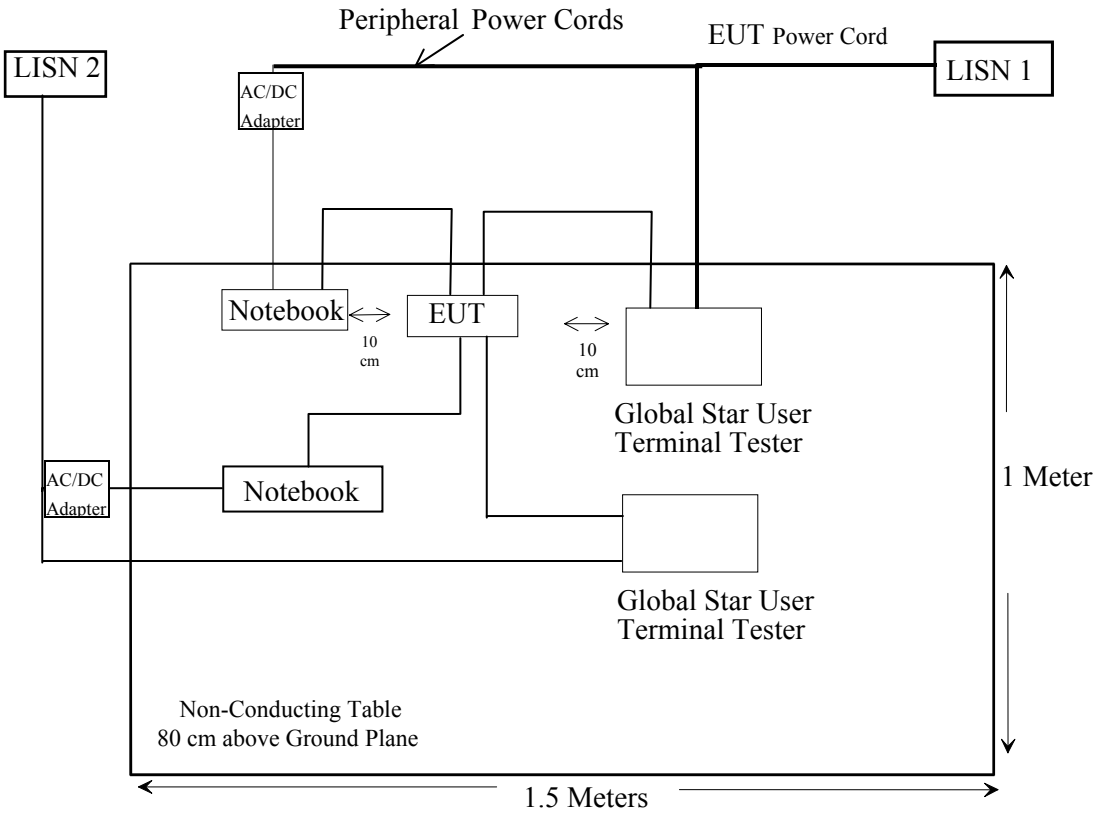
Power Supply Information

Manufacturer	Description	Model	Serial Number
GUI Inc	ADC power supply	EA1050A-120	DTS-120500UC-p-ET

External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Serial cable	1.5	Laptop (IBM)	EUT (SDM1)
Serial cable	1.5	Laptop (dell)	EUT (SDM2)

Test Setup Block Diagram



SUMMARY OF TEST RESULTS

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 (d)	Modulation Characteristics	NA
§2.1051	Spurious Emission at Antenna Terminals	Compliant
§15.107	AC Line Conducted Emission	Compliant
§2.1053 & §25.202(f)	Field Strength of Spurious Radiation	Compliant
§25.202(f)	Emission Limitations (Emission Mask)	Compliant
§2.1049	Occupied Bandwidth	Compliant
§25.204(a)	Power Limits	Compliant
§2.1046 & §25.204	Power Output	Compliant
§25.216 (b) &/or (g)	Emission from Mobile Earth Station for Protection of Aeronautical Radio navigation-Satellite Service (e.i.r.p. density)	Compliant
§2.1055 & §25.202(d)	Frequency Stability/ Tolerance	Compliant
§2.1057	Spectrum Investigated	Compliant
§25.202(a)(4)(i)	1610 – 1626.5 GHz Authorized Frequency	NA
§25.209	Antenna Performance	Compliant
§25.213	Protection of Radio astronomy	site dependent

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

According to §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

Prediction 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

2.3 dBi antenna

Maximum peak output power at antenna input terminal (dBm):	32.53(dBm)
Maximum peak output power at antenna input terminal (mW):	1790.61 (mW)
Predication distance (cm):	73.70 cm
Predication frequency (MHz):	1615.65 (MHz)
Maximum Antenna Gain, typical (dBi):	2.3 (dBi)
Maximum Antenna Gain (numeric):	1.698 (numeric)
Power density of predication frequency at 73.7 cm (mW/cm^2):	0.045 (mW/cm^2)
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	1.00 (mW/cm^2)

4.5 dBi antenna

Maximum peak output power at antenna input terminal (dBm):	32.53(dBm)
Maximum peak output power at antenna input terminal (mW):	1790.61 (mW)
Predication distance (cm):	73.70 cm
Predication frequency (MHz):	1615.65 (MHz)
Maximum Antenna Gain, typical (dBi):	4.5 (dBi)
Maximum Antenna Gain (numeric):	2.818 (numeric)
Power density of predication frequency at 73.7 cm (mW/cm^2):	0.072 (mW/cm^2)
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	1.00 (mW/cm^2)

Test Result

The power density of predication frequency at 73.7 cm is 0.072 mW/cm^2 for the 4.5 dBi antenna and 0.045 mW/cm^2 for the 2.3 dBi antenna, both of which were according to calculation under the MPE limit for uncontrolled exposure of 1.00 mW/cm^2.

§2.1047 – MODULATION CHARACTERISTICS

The EUT uses digital modulation techniques only which were employed during the tests for occupied bandwidth. Part 25 does not have a modulation characteristics requirement for digital modulation thus this section is not applicable.

§2.1051 & §25 – SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Standard Applicable

§2.1051: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§25: Protection of the radio-navigation-satellite service: Mobile earth stations operating in the 1610-1626.5 MHz band shall limit out-of-band emissions in the 1574.397-1576.443 MHz band so as not to exceed an e.i.r.p. density level of –70 dB (W/MHz) averaged over any 20 ms period. The e.i.r.p. of any discrete spurious emission (i.e., bandwidth less than 600 Hz) in the 1574.397-1576.443 MHz band shall not exceed -80 dBW.

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_{watts}) attenuation below the mean power of the transmitter.

For Middle Channel = 43 + 10 log (1.79 W) = 45.53 dBc

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 to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

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

Measurement Result

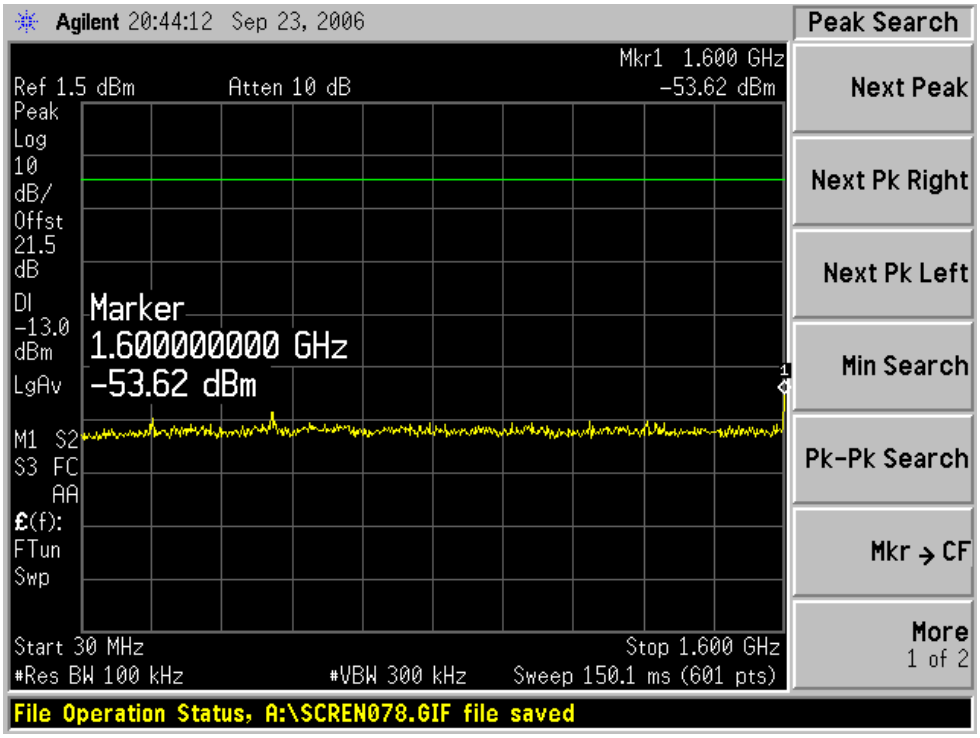
Environmental Conditions

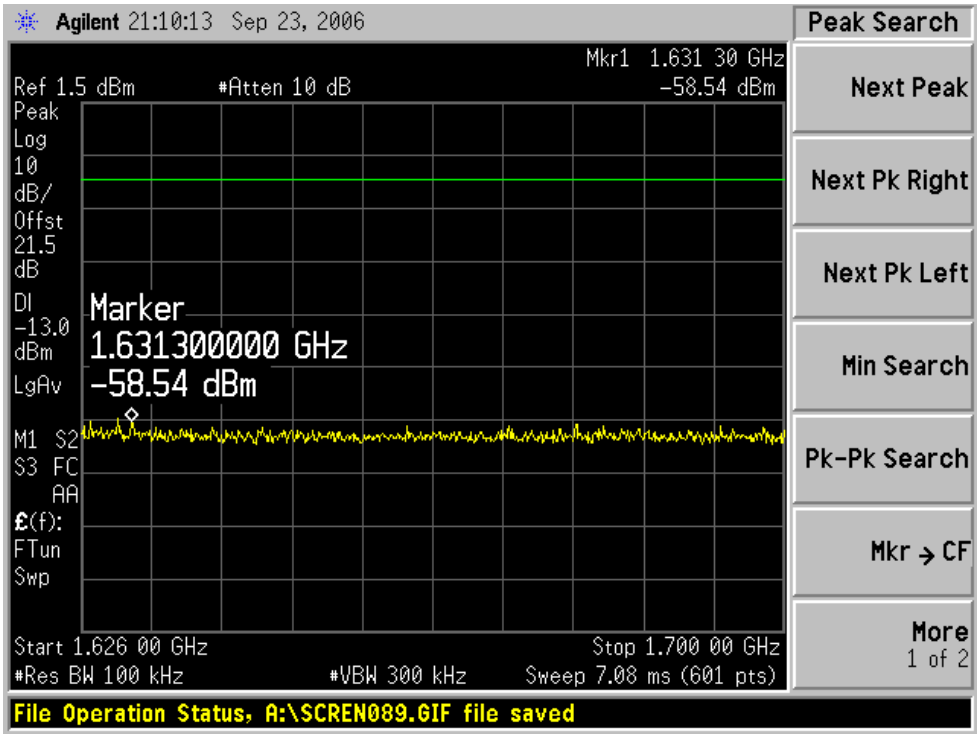
Temperature:	23° C
Relative Humidity:	65%
ATM Pressure:	1025 mbar

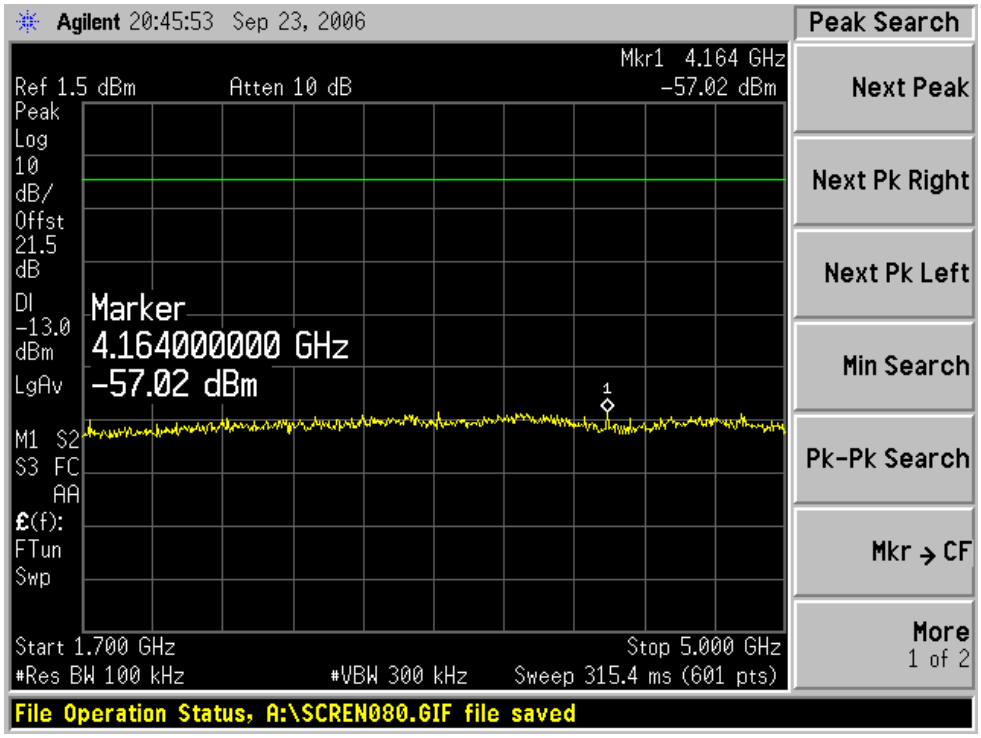
** The testing was performed by James Ma on 2007-01-03.*

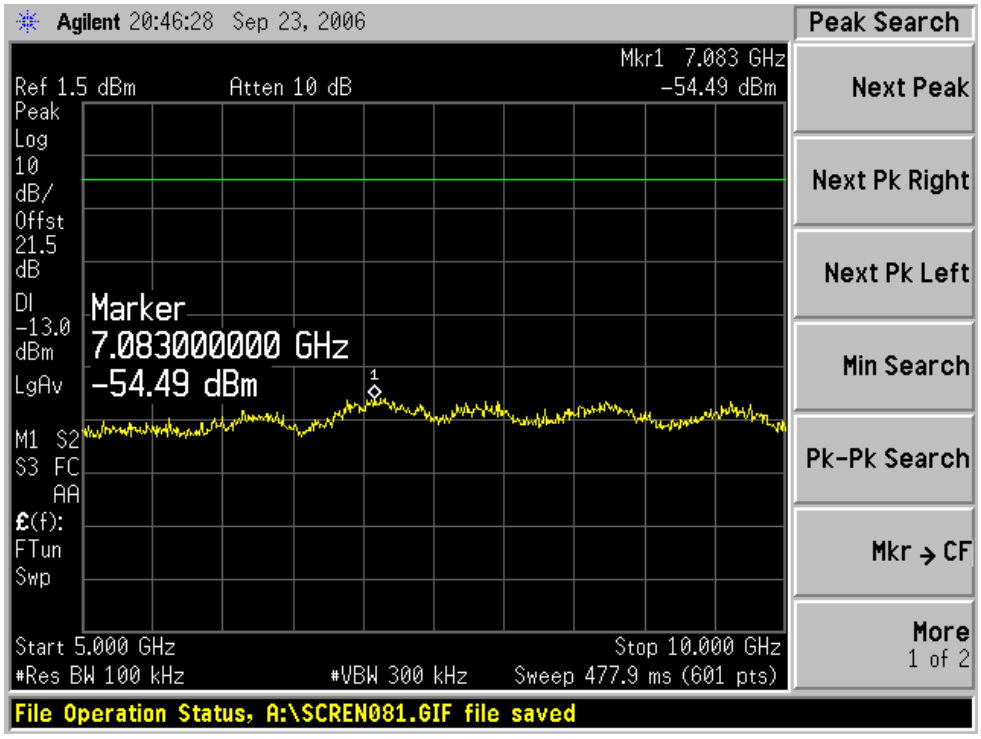
The following plots show that all emissions are at least 45.53 dB below the fundamental.

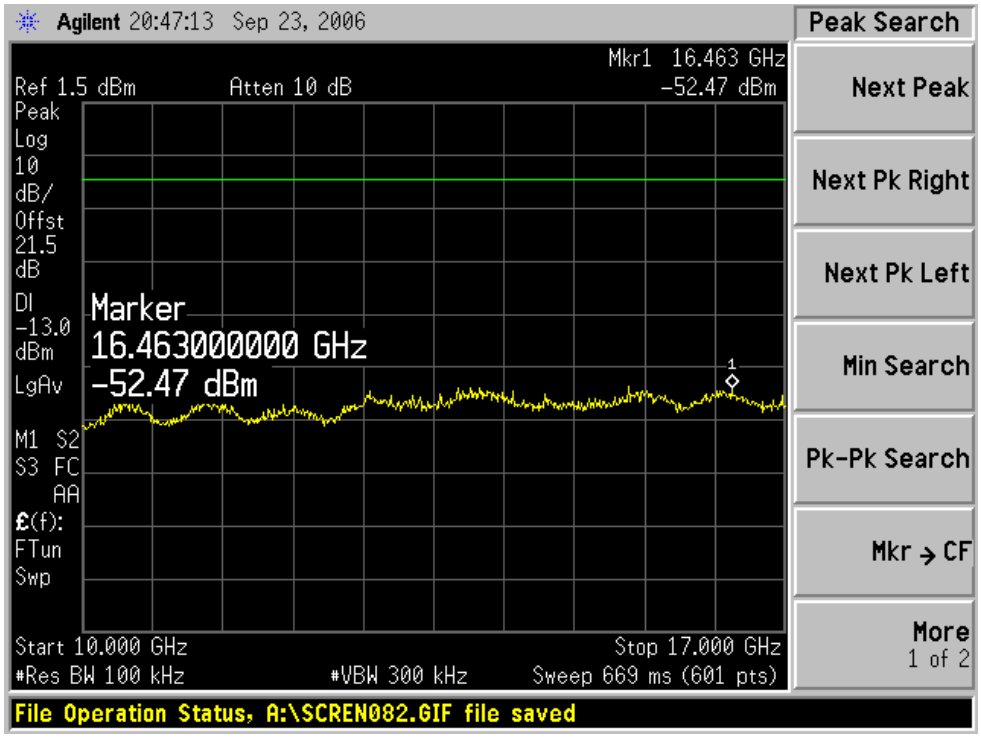
Low Channel


Agilent 20:44:12 Sep 23, 2006
Peak Search
Mkr1 1.600 GHz
Ref 1.5 dBm
Atten 10 dB
-53.62 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
1.600000000 GHz
-53.62 dBm
Start 30 MHz
Stop 1.600 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 150.1 ms (601 pts)
File Operation Status, A:\SCREN078.GIF file saved

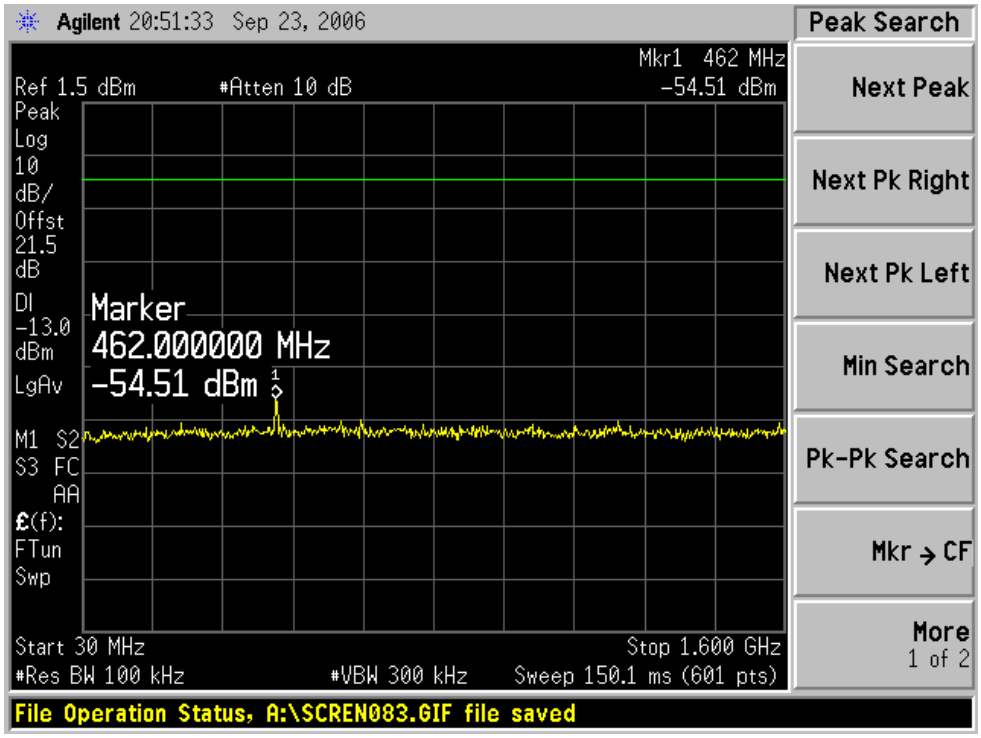

Agilent 21:10:13 Sep 23, 2006
Peak Search
Mkr1 1.631 30 GHz
Ref 1.5 dBm
#Atten 10 dB
-58.54 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
1.631300000 GHz
-58.54 dBm
Start 1.626 00 GHz
Stop 1.700 00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 7.08 ms (601 pts)
File Operation Status, A:\SCREN089.GIF file saved

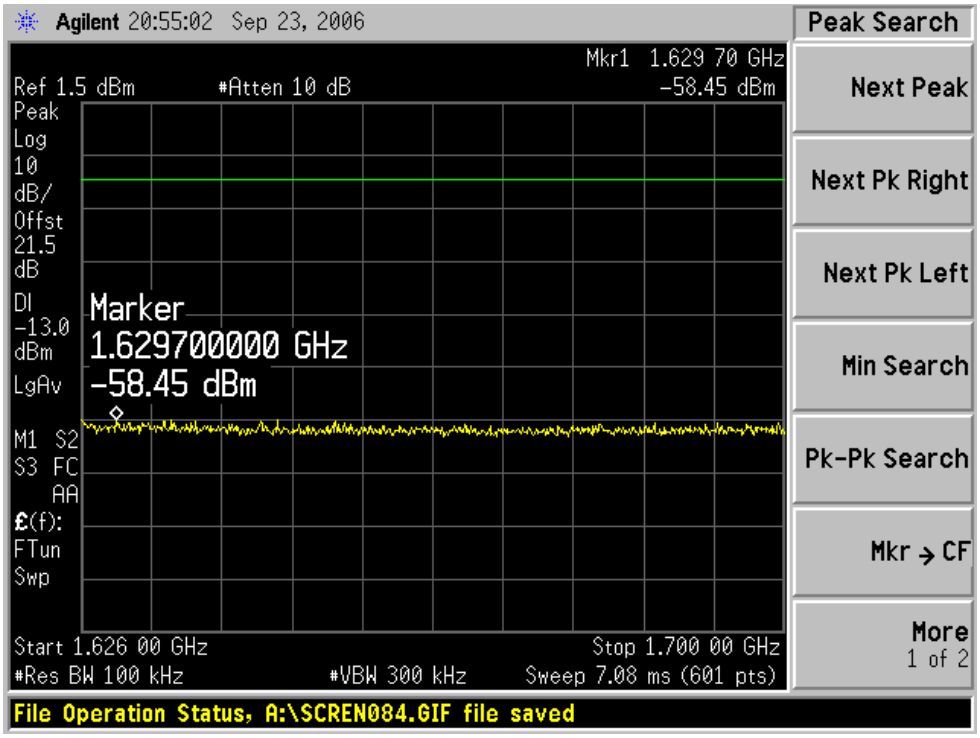

Agilent 20:45:53 Sep 23, 2006
Peak Search
Mkr1 4.164 GHz
Ref 1.5 dBm
Atten 10 dB
-57.02 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
4.164000000 GHz
-57.02 dBm
Start 1.700 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5.000 GHz
Sweep 315.4 ms (601 pts)
File Operation Status, A:\SCREN080.GIF file saved

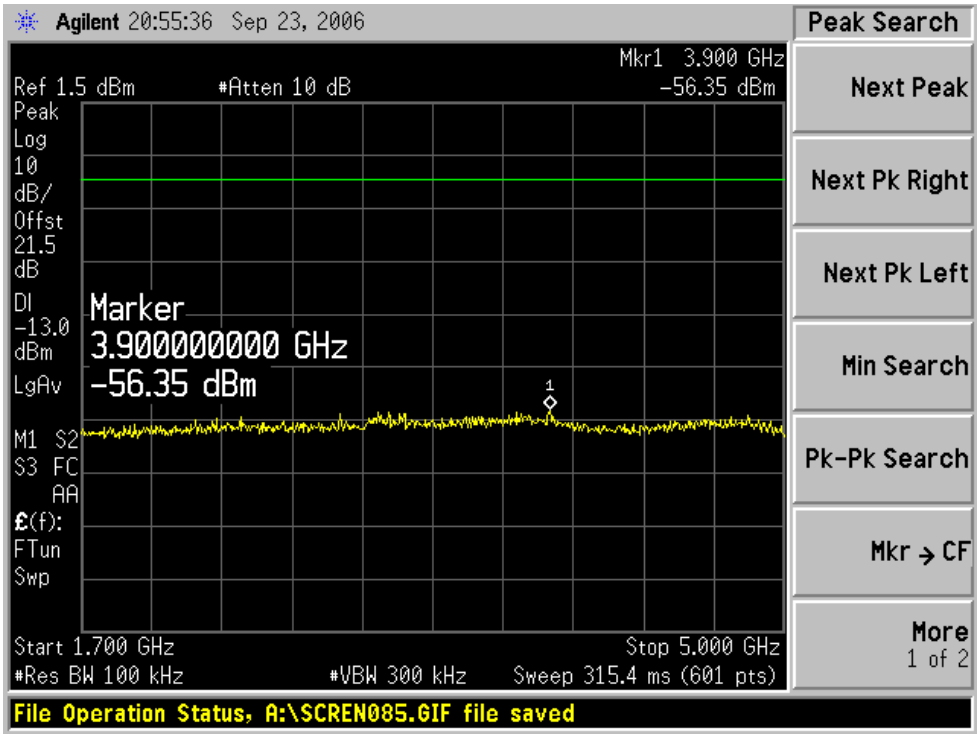

Agilent 20:46:28 Sep 23, 2006
Peak Search
Mkr1 7.083 GHz
Ref 1.5 dBm
Atten 10 dB
-54.49 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
7.083000000 GHz
-54.49 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (601 pts)
File Operation Status, A:\SCREN081.GIF file saved

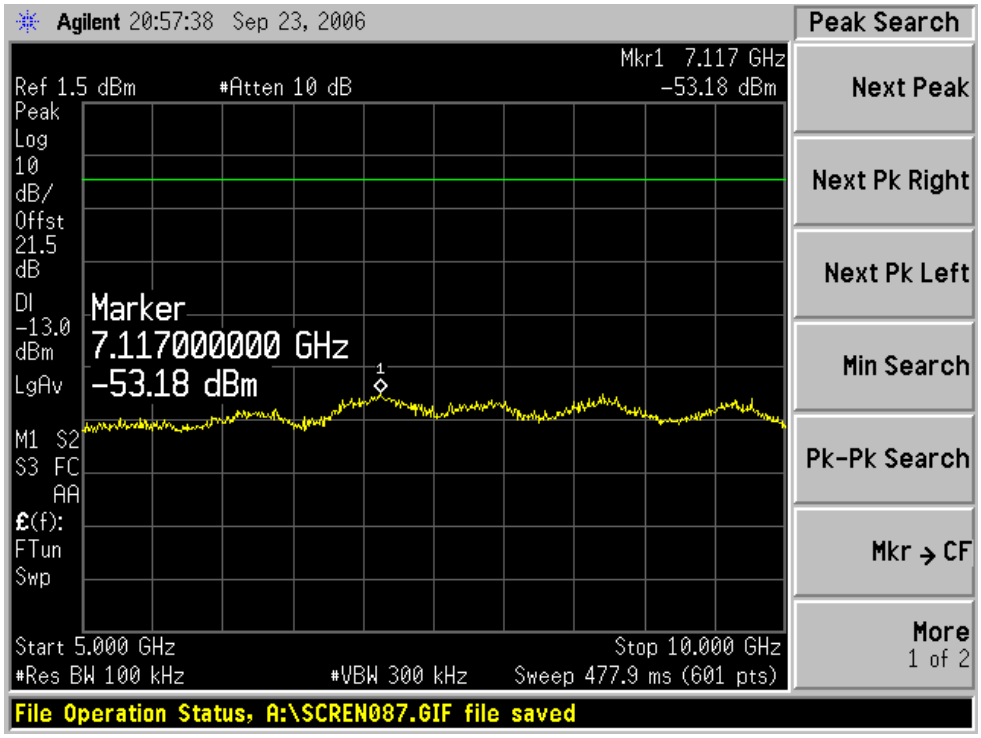


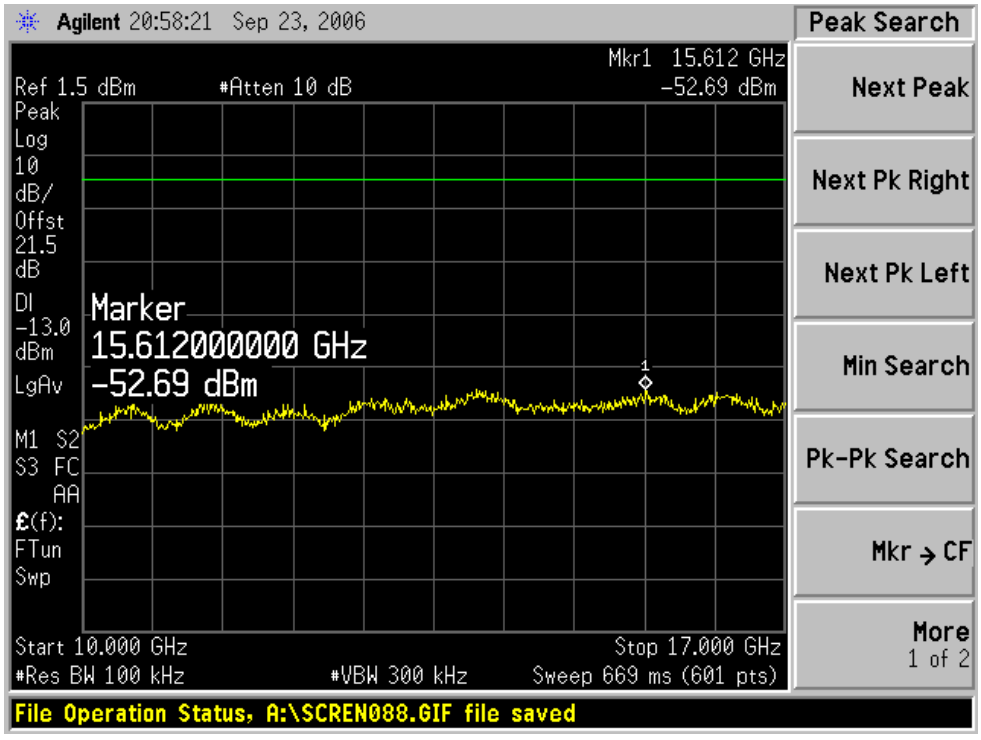
Middle Channel:



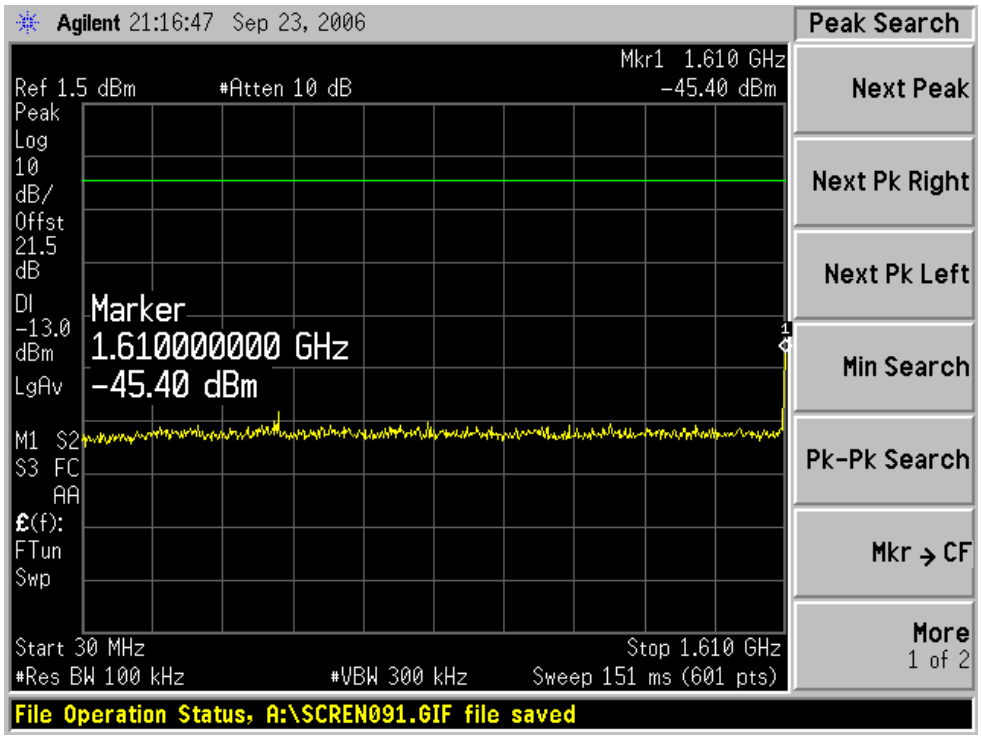

Agilent 20:55:02 Sep 23, 2006
Peak Search
Mkr1 1.629 70 GHz
Ref 1.5 dBm
#Atten 10 dB
-58.45 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
Marker
1.629700000 GHz
-58.45 dBm
DI
-13.0
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 1.626 00 GHz
Stop 1.700 00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 7.08 ms (601 pts)
More
1 of 2
File Operation Status, A:\SCREN084.GIF file saved

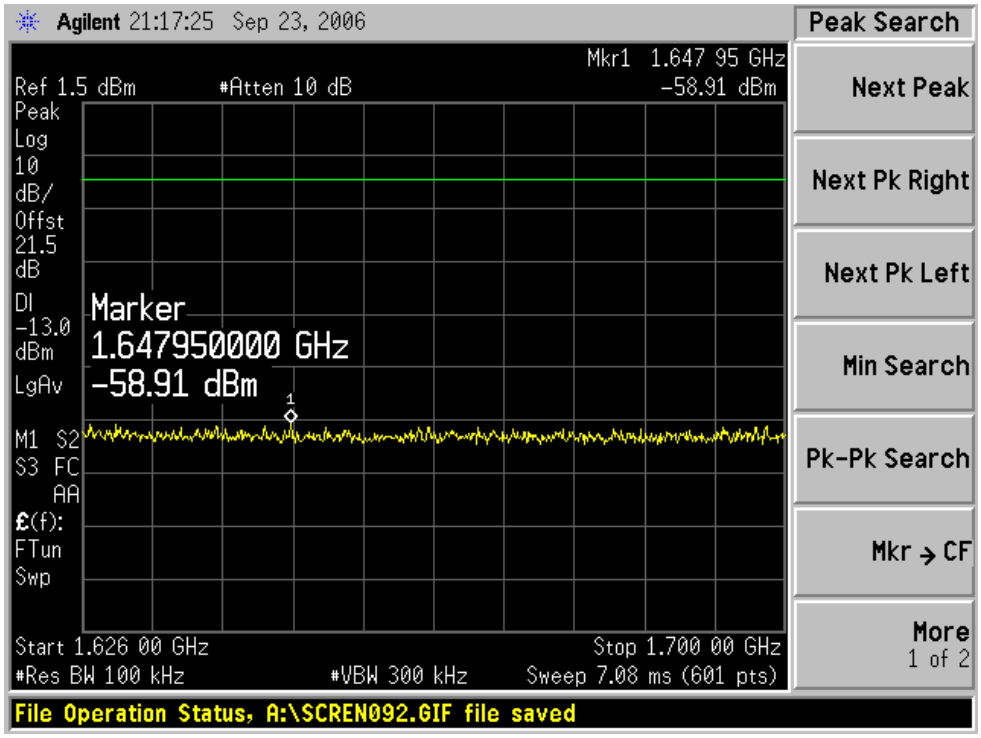

Agilent 20:55:36 Sep 23, 2006
Peak Search
Mkr1 3.900 GHz
Ref 1.5 dBm
#Atten 10 dB
-56.35 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
Marker
3.900000000 GHz
-56.35 dBm
DI
-13.0
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 1.700 GHz
Stop 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 315.4 ms (601 pts)
More
1 of 2
File Operation Status, A:\SCREN085.GIF file saved

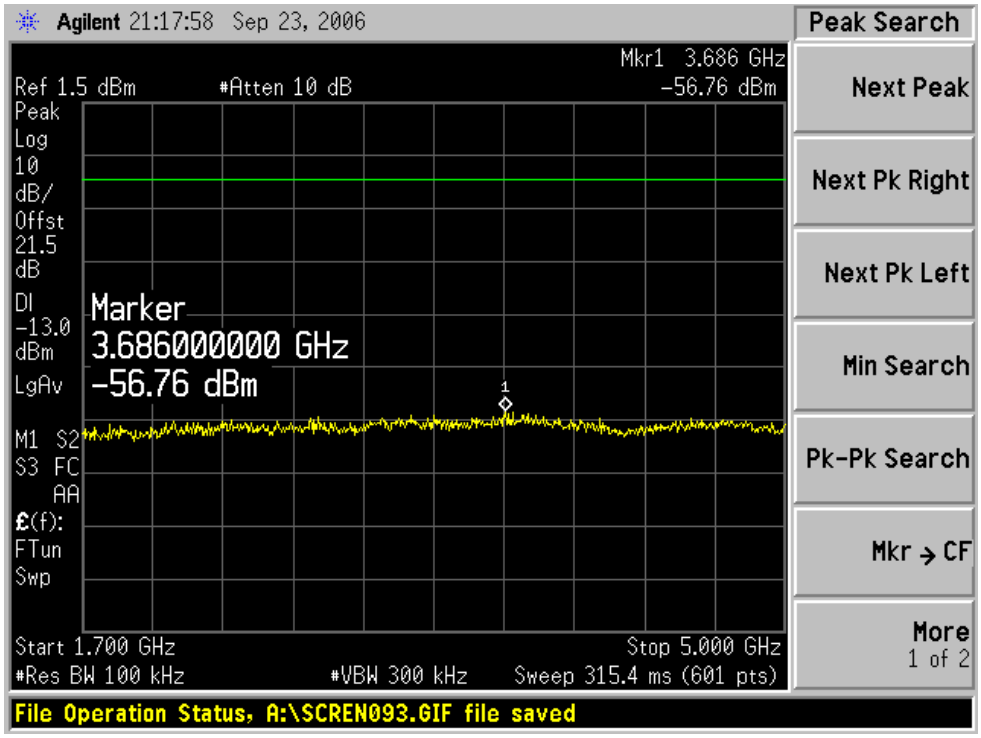

Agilent 20:57:38 Sep 23, 2006
Peak Search
Mkr1 7.117 GHz
Ref 1.5 dBm
#Atten 10 dB
-53.18 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
7.117000000 GHz
-53.18 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (601 pts)
File Operation Status, A:\SCREN087.GIF file saved

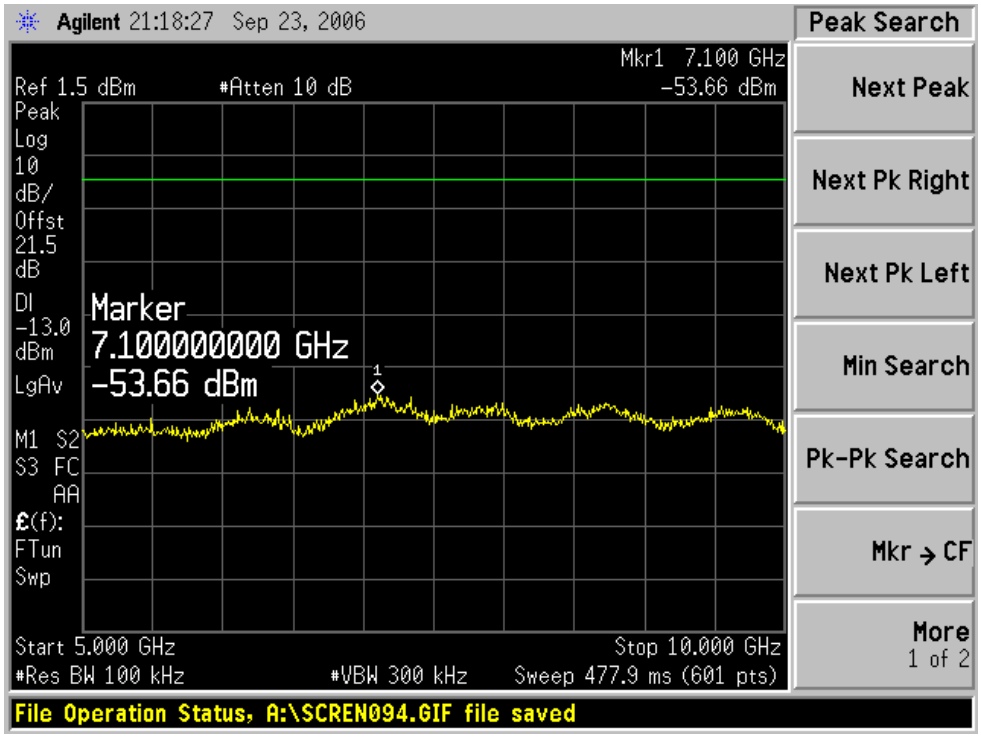

Agilent 20:58:21 Sep 23, 2006
Peak Search
Mkr1 15.612 GHz
Ref 1.5 dBm
#Atten 10 dB
-52.69 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
15.612000000 GHz
-52.69 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 17.000 GHz
Sweep 669 ms (601 pts)
File Operation Status, A:\SCREN088.GIF file saved

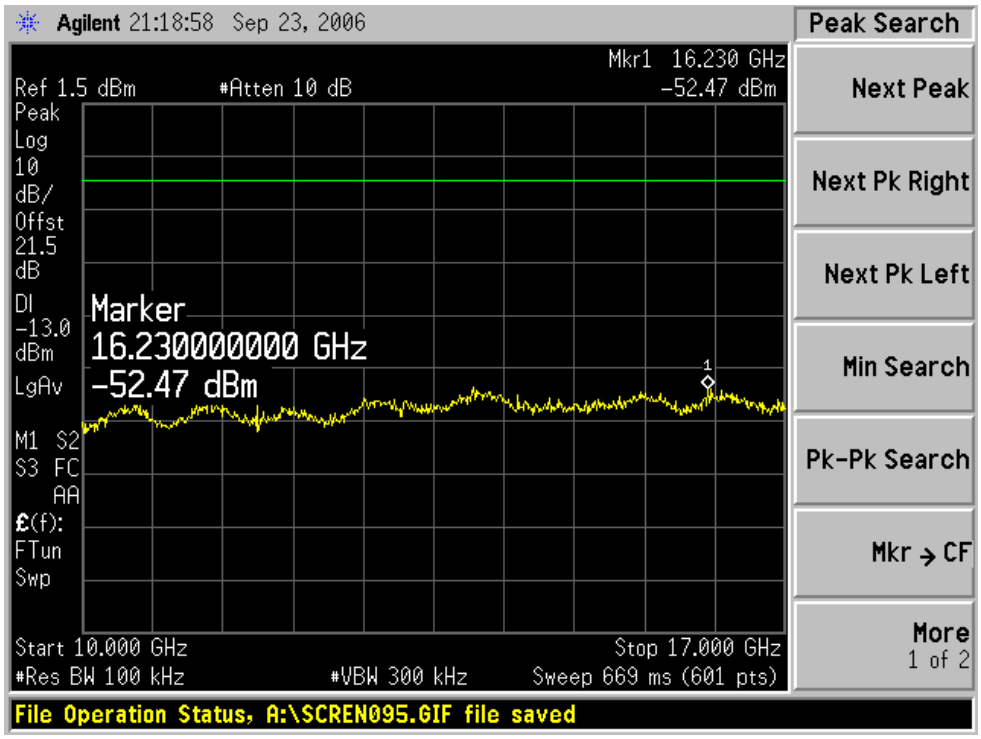
High Channel



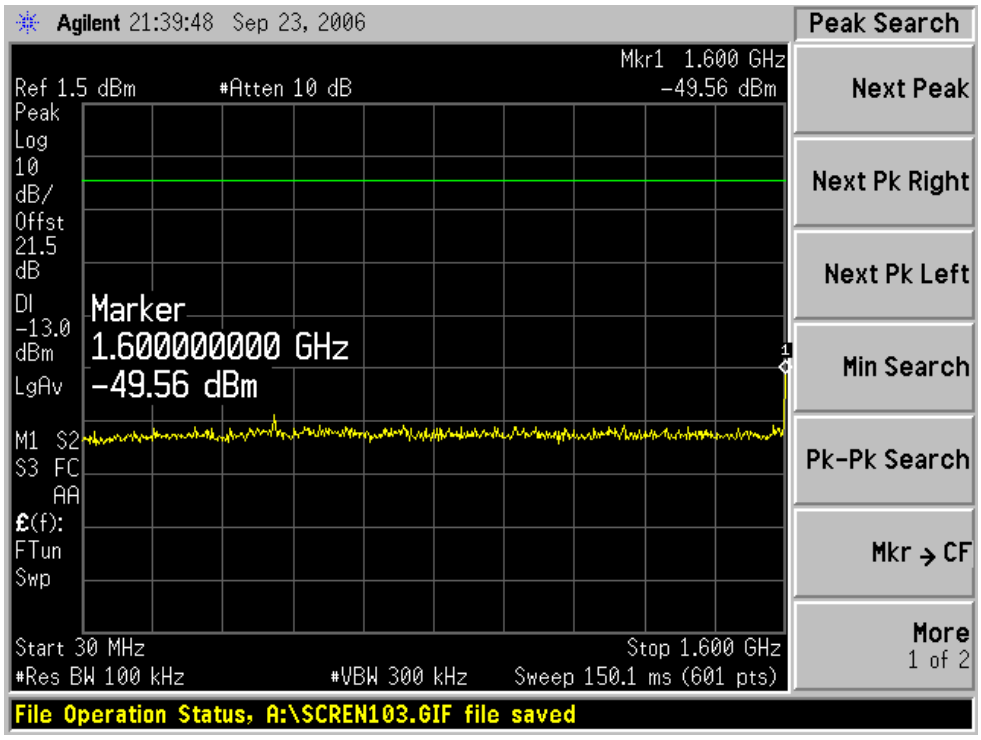


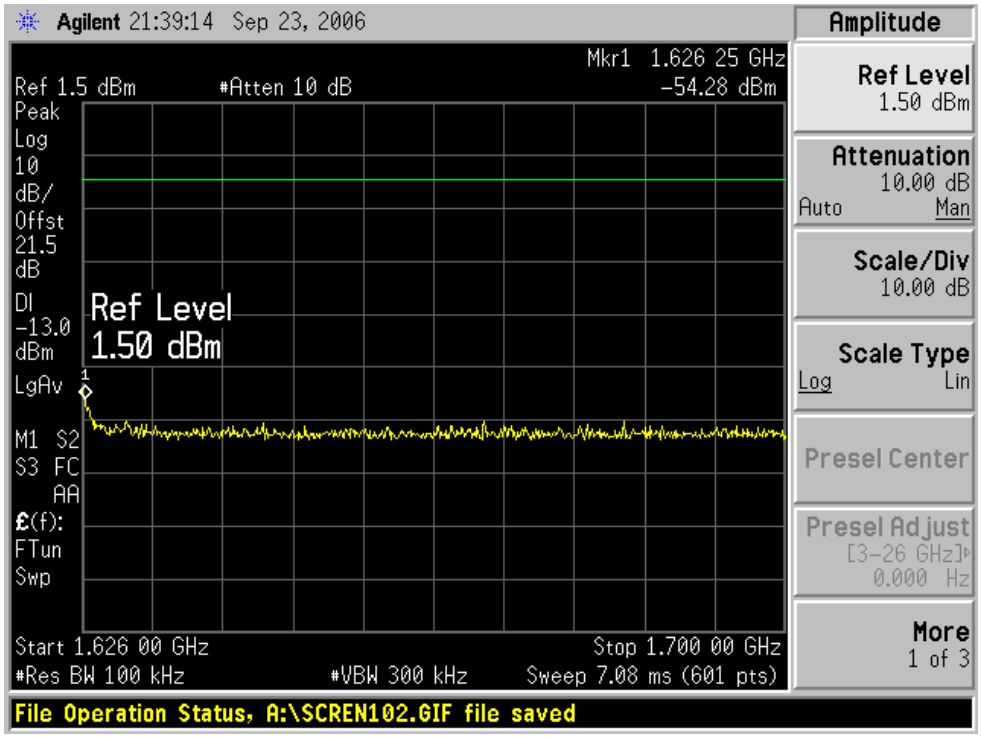

Agilent 21:17:58 Sep 23, 2006
Peak Search
Mkr1 3.686 GHz
Ref 1.5 dBm
#Atten 10 dB
-56.76 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
Marker
3.686000000 GHz
-56.76 dBm
Start 1.700 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5.000 GHz
Sweep 315.4 ms (601 pts)
More
1 of 2
File Operation Status, A:\SCREN093.GIF file saved

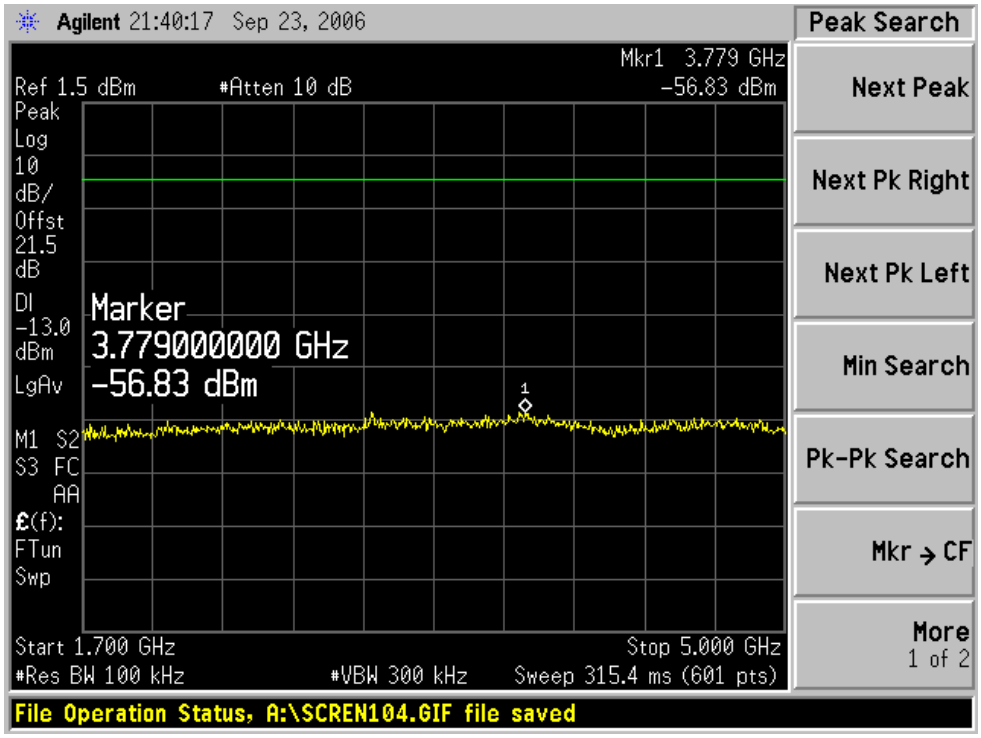

Agilent 21:18:27 Sep 23, 2006
Peak Search
Mkr1 7.100 GHz
Ref 1.5 dBm
#Atten 10 dB
-53.66 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
Marker
7.100000000 GHz
-53.66 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (601 pts)
More
1 of 2
File Operation Status, A:\SCREN094.GIF file saved

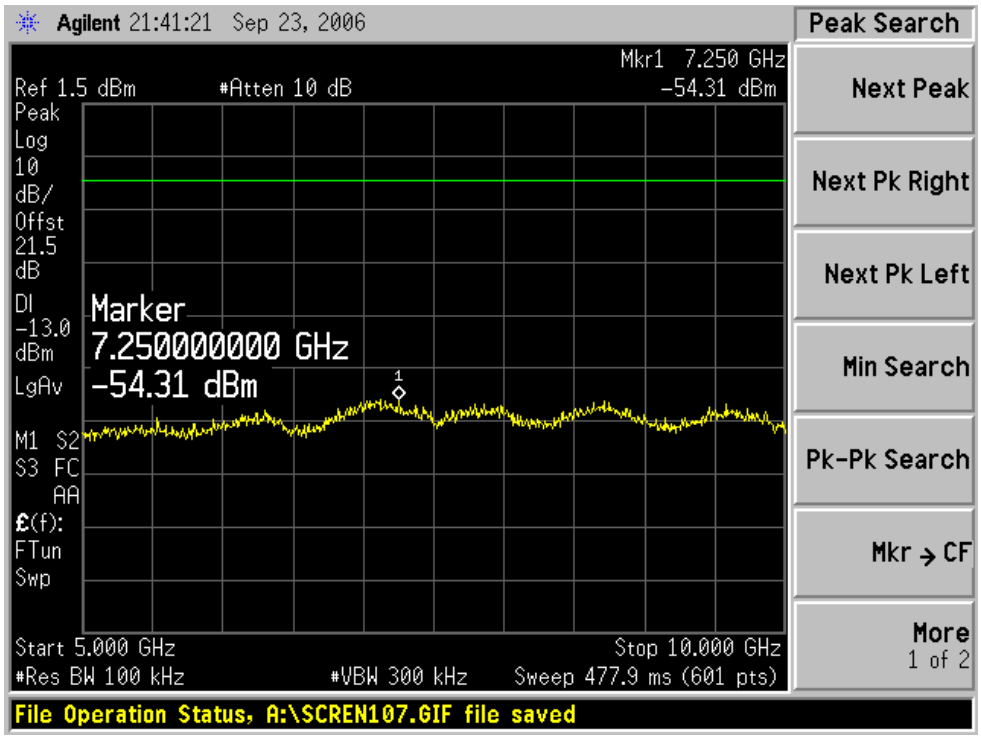

Agilent 21:18:58 Sep 23, 2006
Peak Search
Mkr1 16.230 GHz
Ref 1.5 dBm
#Atten 10 dB
-52.47 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
16.230000000 GHz
-52.47 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 17.000 GHz
Sweep 669 ms (601 pts)
File Operation Status, A:\SCREN095.GIF file saved

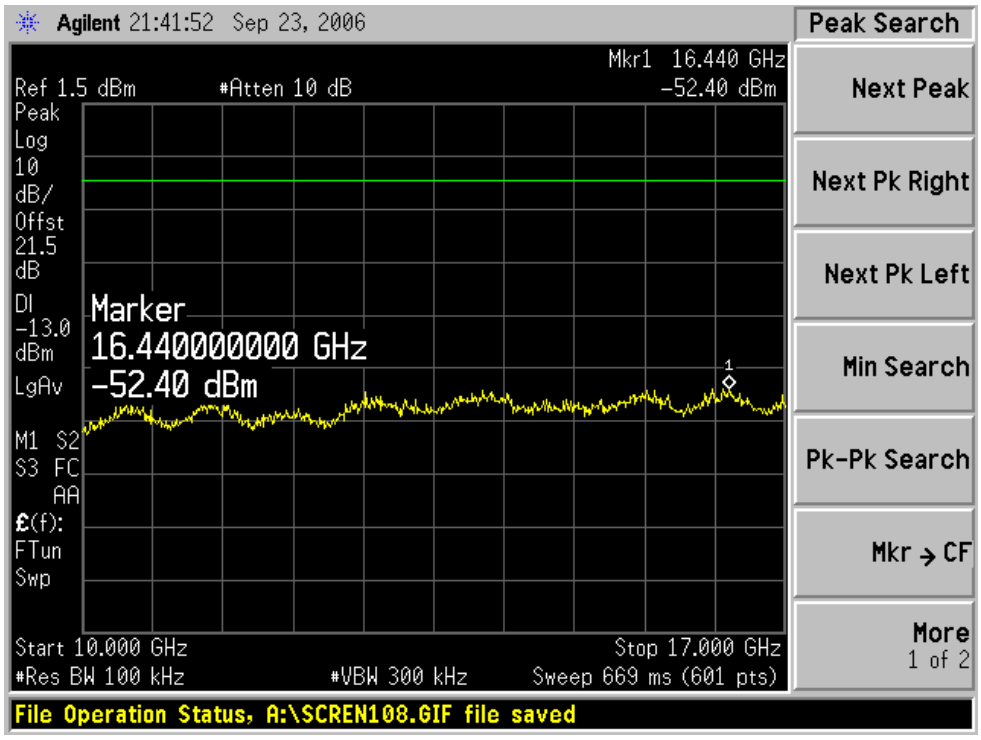
Intermodulation Port Emission Channel 1-5



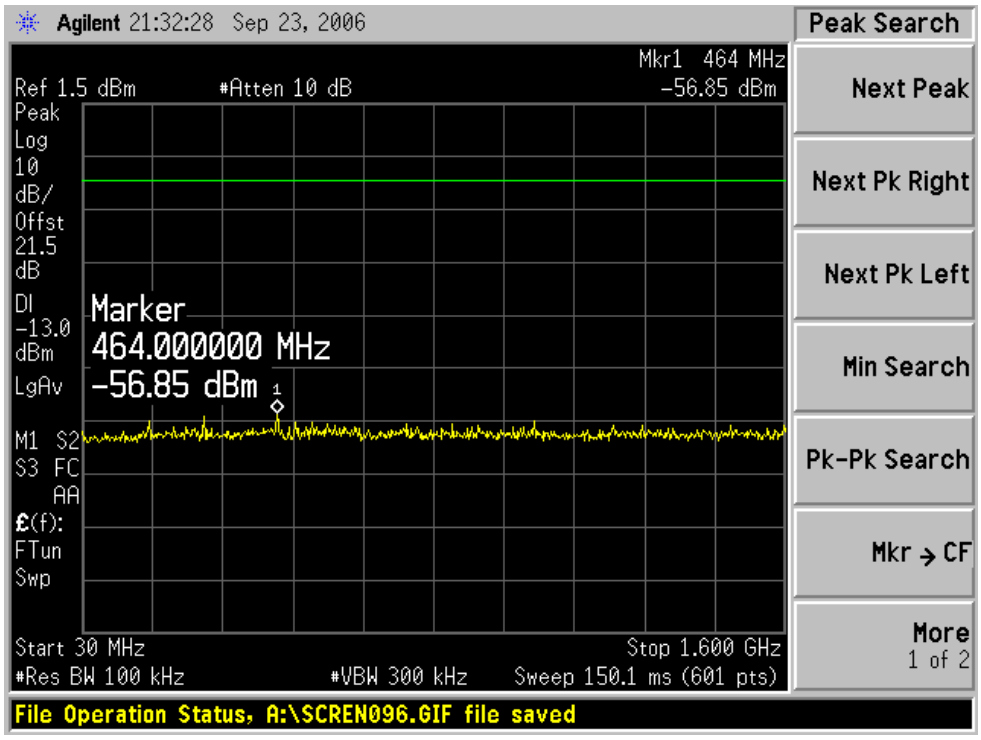


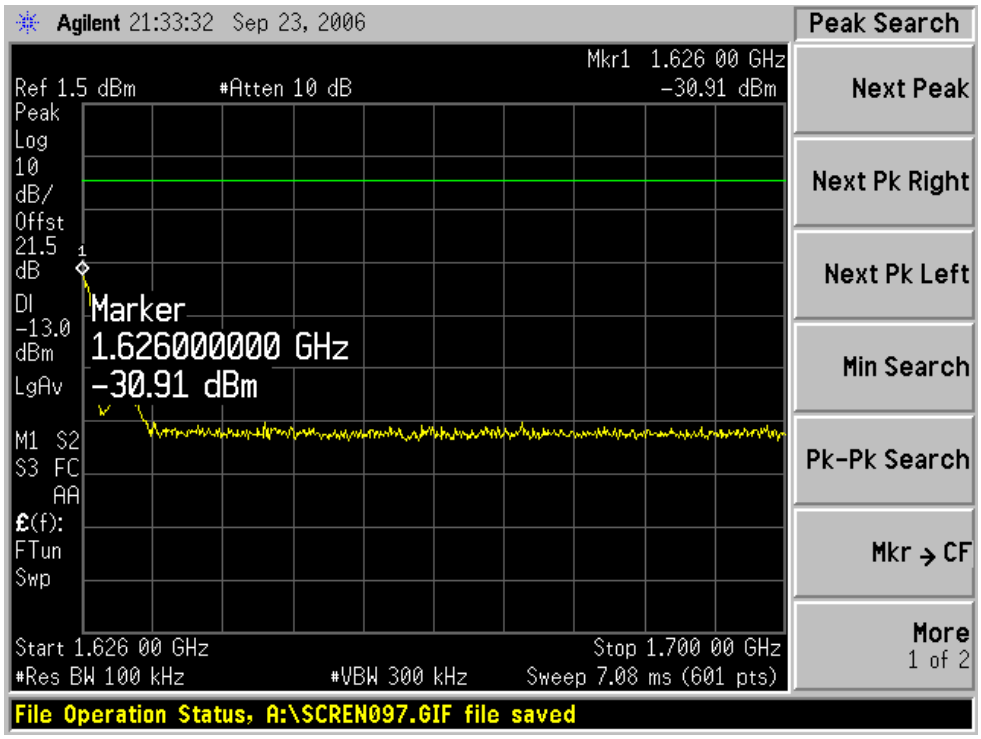

Agilent 21:40:17 Sep 23, 2006
Peak Search
Mkr1 3.779 GHz
Ref 1.5 dBm
#Atten 10 dB
-56.83 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
3.779000000 GHz
-56.83 dBm
Start 1.700 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 5.000 GHz
Sweep 315.4 ms (601 pts)
File Operation Status, A:\SCREN104.GIF file saved

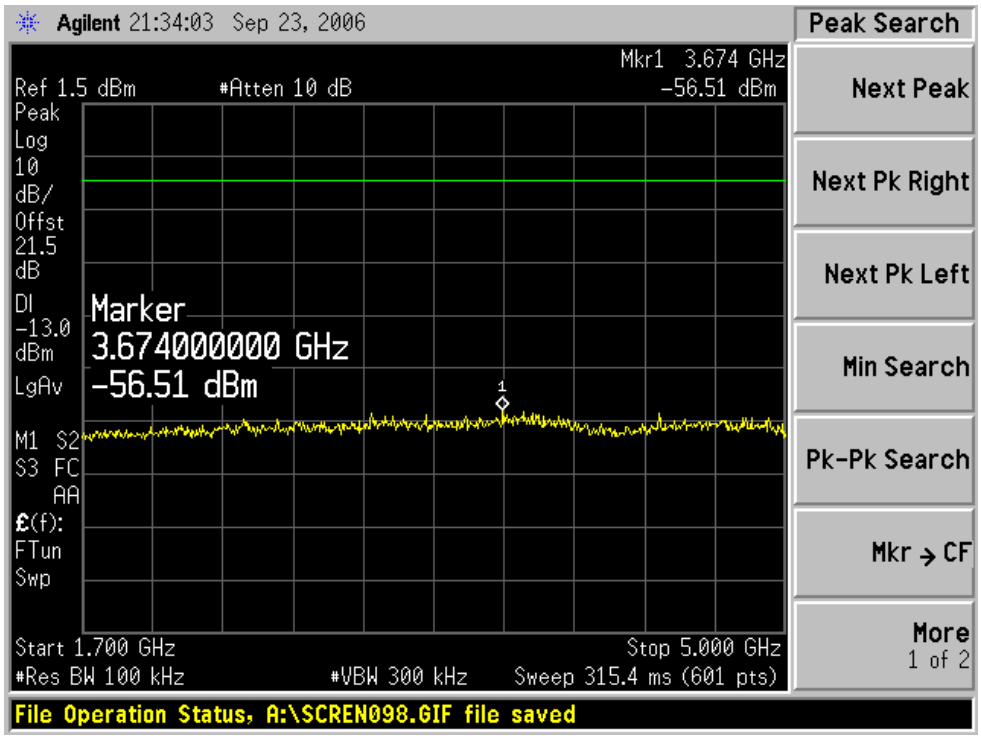

Agilent 21:41:21 Sep 23, 2006
Peak Search
Mkr1 7.250 GHz
Ref 1.5 dBm
#Atten 10 dB
-54.31 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
7.250000000 GHz
-54.31 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (601 pts)
File Operation Status, A:\SCREN107.GIF file saved

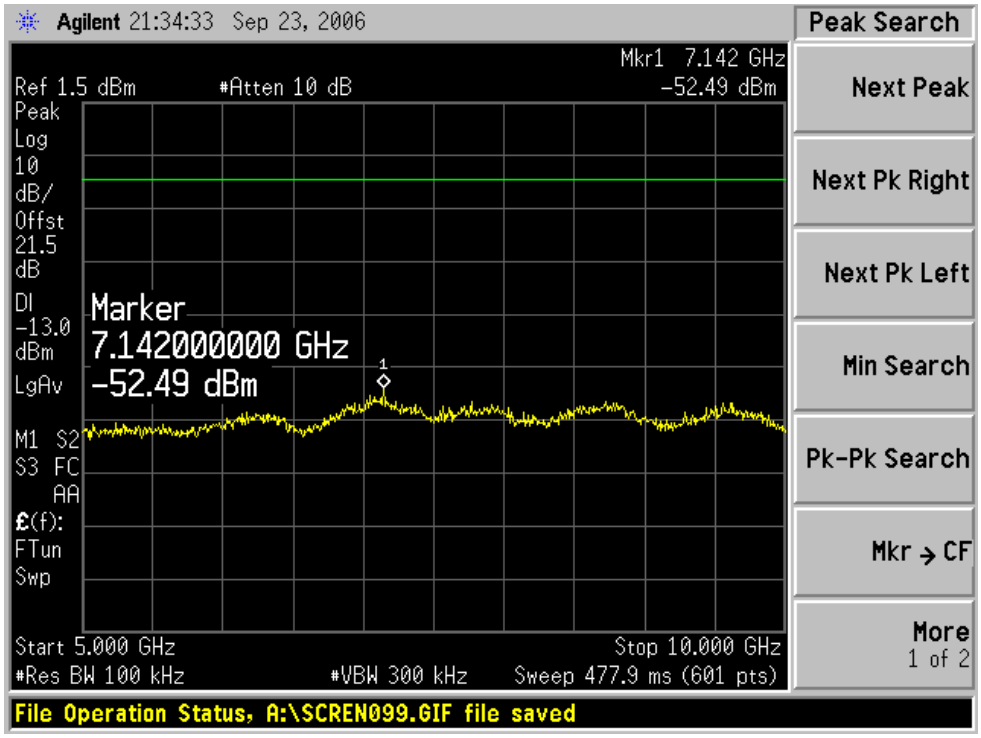


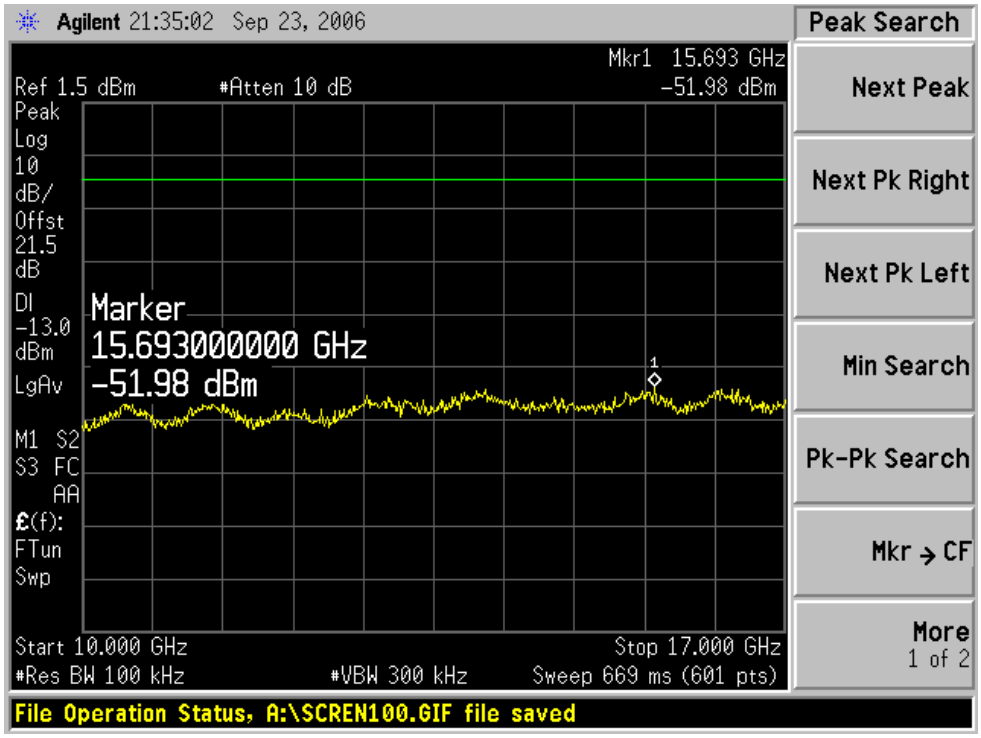
Intermodulation Port Emission Channel 5-9




Agilent 21:33:32 Sep 23, 2006
Peak Search
Mkr1 1.626 00 GHz
Ref 1.5 dBm
#Atten 10 dB
-30.91 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Dl
-13.0
dBm
LgAv
Marker
1.626000000 GHz
-30.91 dBm
Min Search
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Start 1.626 00 GHz
Stop 1.700 00 GHz
More
1 of 2
#Res BW 100 kHz
#VBW 300 kHz
Sweep 7.08 ms (601 pts)
File Operation Status, A:\SCREN097.GIF file saved


Agilent 21:34:03 Sep 23, 2006
Peak Search
Mkr1 3.674 GHz
Ref 1.5 dBm
#Atten 10 dB
-56.51 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Dl
-13.0
dBm
LgAv
Marker
3.674000000 GHz
-56.51 dBm
Min Search
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
Start 1.700 GHz
Stop 5.000 GHz
More
1 of 2
#Res BW 100 kHz
#VBW 300 kHz
Sweep 315.4 ms (601 pts)
File Operation Status, A:\SCREN098.GIF file saved


Agilent 21:34:33 Sep 23, 2006
Peak Search
Mkr1 7.142 GHz
Ref 1.5 dBm
#Atten 10 dB
-52.49 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
7.142000000 GHz
-52.49 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 477.9 ms (601 pts)
File Operation Status, A:\SCREN099.GIF file saved


Agilent 21:35:02 Sep 23, 2006
Peak Search
Mkr1 15.693 GHz
Ref 1.5 dBm
#Atten 10 dB
-51.98 dBm
Next Peak
Peak
Log
10
dB/
Offst
21.5
dB
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker
15.693000000 GHz
-51.98 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 17.000 GHz
Sweep 669 ms (601 pts)
File Operation Status, A:\SCREN100.GIF file saved

§15.107 - CONDUCTED EMISSIONS

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 12 VDC via AC/DC adapter connected to 120VAC/60Hz power source.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
R&S	Receiver, EMI Test	ESCS30	100176	2006-03-16
R&S	LISN, Artificial Mains	ESH2-Z5	871884/039	2006-11-12

*** 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 provided emissions of the EUT.

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

Conducted Emissions Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	65%
ATM Pressure:	1025mbar

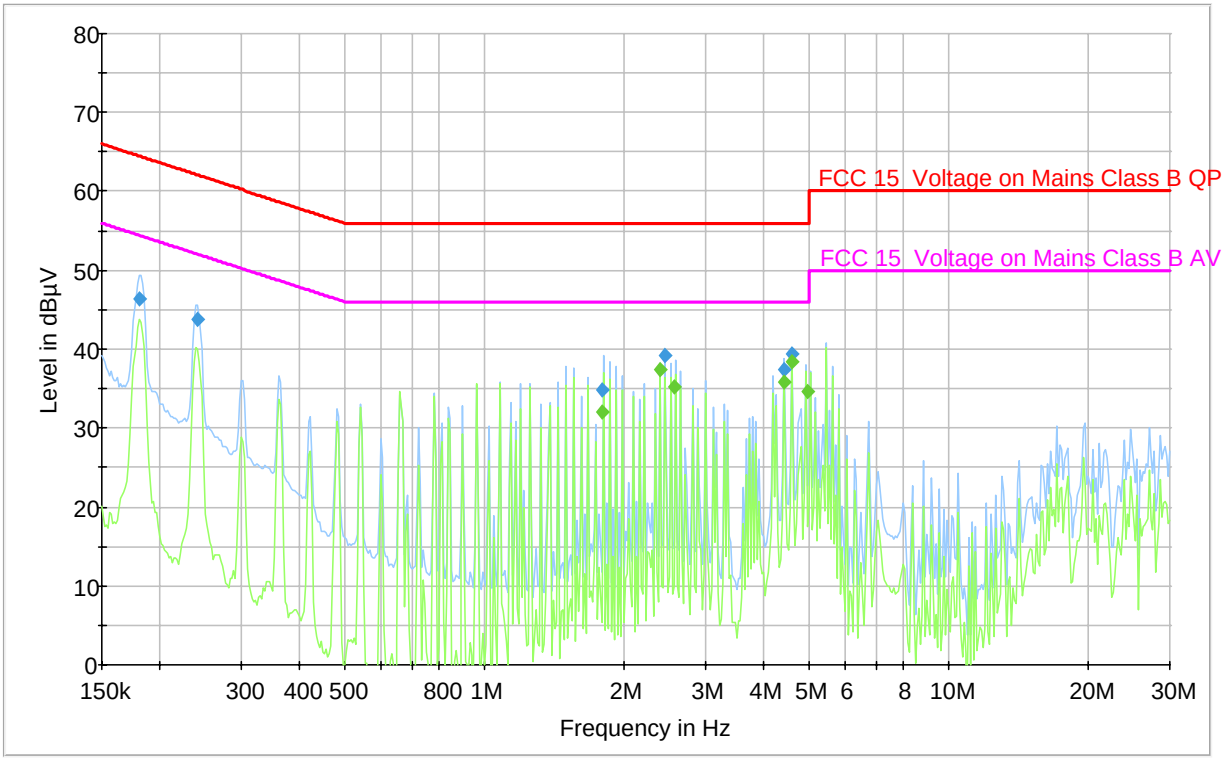
**The testing was performed by James Ma on 2007-01-03.*

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:

-7.6 dB at **4.606010 MHz** at **Line** mode at 150 kHz to 30 MHz

FCC CLASS B - Line



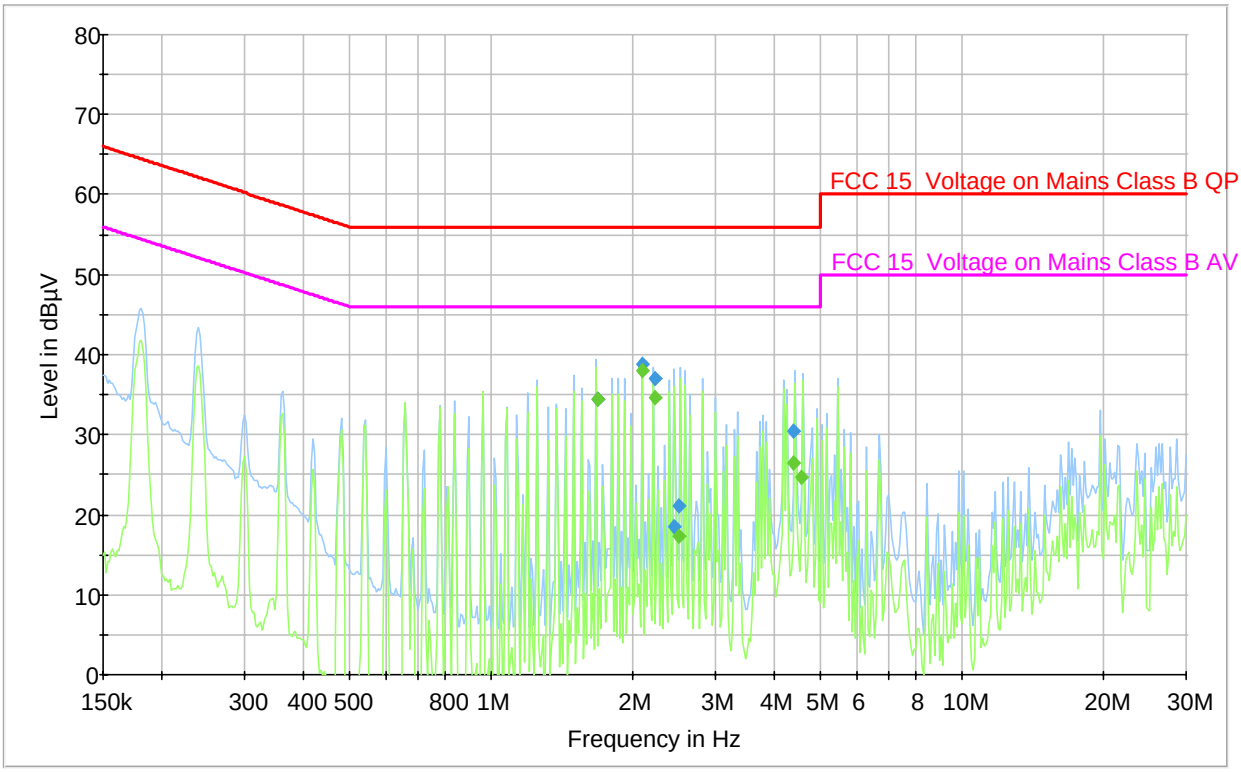
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Correction Value (dB)	Limit (dBµV)	Margin (dB)
4.606010	39.4	L1	0.3	56.0	-16.6
2.452660	39.2	L1	0.3	56.0	-16.8
0.180170	46.4	L1	0.2	64.5	-18.1
0.240360	43.8	L1	0.2	62.1	-18.3
4.424330	37.4	L1	0.3	56.0	-18.6
1.799600	34.9	L1	0.3	56.0	-21.1

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Correction Value (dB)	Limit (dBµV)	Margin (dB)
4.606010	38.4	L1	0.3	46.0	-7.6
2.393640	37.5	L1	0.3	46.0	-8.5
4.424330	35.8	L1	0.3	46.0	-10.2
2.575010	35.3	L1	0.2	46.0	-10.7
4.963180	34.5	L1	0.3	46.0	-11.5
1.799600	32.1	L1	0.3	46.0	-14.0

FCC CLASS B - Neutral



QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Correction Value (dB)	Limit (dBµV)	Margin (dB)
2.101290	38.7	N	0.2	56.0	-17.3
2.224470	37.1	N	0.3	56.0	-18.9
1.685250	34.4	N	0.3	56.0	-21.6
4.389220	30.5	N	0.3	56.0	-25.5
2.513100	21.1	N	0.3	56.0	-34.9
2.452660	18.6	N	0.3	56.0	-37.4

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Correction Value (dB)	Limit (dBµV)	Margin (dB)
2.101290	37.9	N	0.2	46.0	-8.1
2.224470	34.7	N	0.3	46.0	-11.3
1.685250	34.3	N	0.3	46.0	-11.7
4.389220	26.4	N	0.3	46.0	-19.6
4.569450	24.7	N	0.3	46.0	-21.4
2.513100	17.4	N	0.3	46.0	-28.6

§ 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/EIA 603-C.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06
HP	Pre, Amplifier (1 ~ 26.5 GHz)	8449B	3147A00400	2006-08-21
Sonoma Instrument	Amplifier Broadband (10 KHz - 2500 MHz)	317	260407	2006-03-20
Sunol Science	30Mhz ~ 3 GHz Antenna	JB3	A020106-3/S006628	2006-02-14
HP	Generator, Signal	83650B	3614A00276	2006-05-10
A.R.A	Antenna, Horn, DRG	DRG-118/A	1132	2005-08-17*

**Two year calibration cycle*

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:	23° C
Relative Humidity:	65%
ATM Pressure:	1025 mbar

** The testing was performed by James Ma on 2007-01-03.*

Test Results Summary

According to the data in the following table, the EUT was found compliant with the Class B limits of FCC Standard §25.202 and §15.209, and had the worst margin reading(s) of:

- **2.3 dBi Antenna**
    - **-25.2 dB at 3221.46 MHz** at the Low Channel setting in the **Horizontal** polarization
    - **-27.1 dB at 3231.30 MHz** at the Middle Channel setting in the **Horizontal** polarization
    - **-42.0 dB at 3241.14 MHz** at the High Channel setting in the **Vertical** polarization
- **4.5 dBi Antenna**
    - **-24.2 dB at 3221.46 MHz** at the Low Channel setting in the **Vertical** polarization
    - **-32.7 dB at 3231.30 MHz** at the Middle Channel setting in the **Vertical** polarization
    - **-41.9 dB at 3241.14 MHz** at the High Channel setting in the **Horizontal** polarization
- **Unintentional Radiated Emissions**
    - **-3.1 dB at 38.201250 MHz** in the **Horizontal** polarization from 30 – 1000 MHz

Out of Band (Carrier On)

Antenna Gain = 2.3 dBi

Final Scan 1GHz – 16.5GHz (Lowest Channel: 1610.73 MHz)

Indicated Freq. (MHz)	Amplitude (dBuV)	Table Angle Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Freq. (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
3221.46	60.3	330	1.2	H	3221.46	-45.4	9.6	2.40	-38.2	-13	-25.2
4832.19	55.1	90	1.2	V	4832.19	-46.7	11.8	5.07	-40.0	-13	-27.0
4832.19	53.6	45	1.4	H	4832.19	-48.8	11.8	5.07	-42.1	-13	-29.1
3221.46	57.3	180	1.4	V	3221.46	-49.4	9.6	2.40	-42.2	-13	-29.2

Final Scan 1GHz – 16.5GHz (Middle Channel: 1615.65 MHz)

Indicated Freq. (MHz)	Amplitude (dBuV)	Table Angle Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Freq. (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
3231.30	58.4	330	3.1	H	3231.30	-47.3	9.6	2.40	-40.1	-13	-27.1
3231.30	50.4	180	3.1	V	3231.30	-56.2	9.6	2.40	-49.0	-13	-36.0
4846.95	42.3	90	1.2	V	4846.95	-59.5	11.8	5.07	-52.8	-13	-39.8
4846.95	42.1	90	1.4	H	4846.95	-60.3	11.8	5.07	-53.6	-13	-40.6

Final Scan 1GHz – 16.5GHz (Highest Channel: 1620.57 MHz)

Indicated Freq. (MHz)	Amplitude (dBuV)	Table Angle Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Freq. (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
3241.14	43.5	180	1.4	V	3241.14	-63.1	9.6	2.40	-55.9	-13	-42.9
3241.14	42.0	330	1.2	H	3241.14	-63.7	9.6	2.40	-56.5	-13	-43.5
4861.71	36.6	90	1.2	V	4861.71	-65.2	11.8	5.07	-58.5	-13	-45.5
4861.71	35.8	0	1.4	H	4861.71	-66.6	11.8	5.07	-59.9	-13	-46.9

Antenna Gain = 4.5 dBi

Final Scan 1GHz – 16.5GHz (Lowest Channel: 1610.73 MHz)

Indicated Freq. (MHz)	Amplitude (dBuV)	Table Angle Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Freq. (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
3221.46	62.2	180	2.6	V	3221.46	-44.4	9.6	2.40	-37.2	-13	-24.2
4832.19	57.3	90	2.5	V	4832.19	-44.5	11.8	5.07	-37.8	-13	-24.8
3221.46	58.5	330	2.7	H	3221.46	-47.2	9.6	2.40	-40.0	-13	-27.0
4832.19	52.4	230	2.5	H	4832.19	-50.0	11.8	5.07	-43.3	-13	-30.3

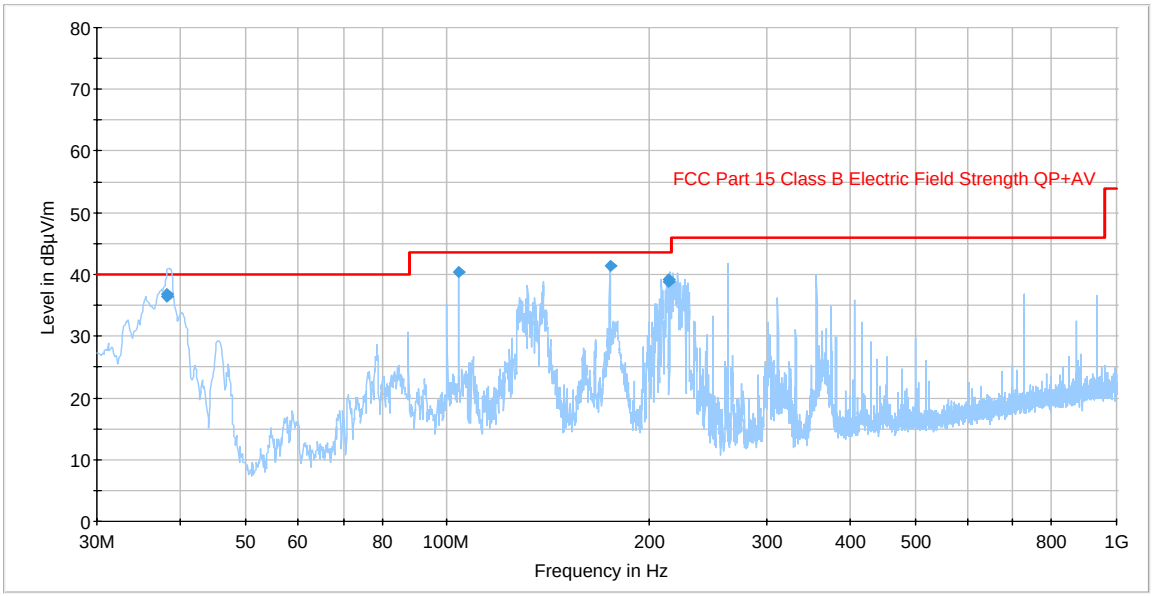
Final Scan 1GHz – 16.5GHz (Middle Channel: 1615.65 MHz)

Indicated Freq. (MHz)	Amplitude (dBuV)	Table Angle Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Freq. (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
3231.30	53.7	180	1.4	V	3231.30	-52.9	9.6	2.40	-45.7	-13	-32.7
3231.30	50.7	330	1.2	H	3231.30	-55.0	9.6	2.40	-47.8	-13	-34.8
4846.95	41.2	180	1.2	V	4846.95	-60.6	11.8	5.07	-53.9	-13	-40.9
4846.95	36.4	180	1.4	H	4846.95	-66.0	11.8	5.07	-59.3	-13	-46.3

Final Scan 1GHz – 16.5GHz (Highest Channel: 1620.57 MHz)

Indicated Freq. (MHz)	Amplitude (dBuV)	Table Angle Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Freq. (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
3241.14	44.5	180	1.4	V	3241.14	-62.1	9.6	2.40	-54.9	-13	-41.9
3241.14	40.6	330	1.2	H	3241.14	-65.1	9.6	2.40	-57.9	-13	-44.9
4861.71	37.2	90	1.2	V	4861.71	-64.6	11.8	5.07	-57.9	-13	-44.9
4861.71	35.4	180	1.4	H	4861.71	-67.0	11.8	5.07	-60.3	-13	-47.3

Final Scan 30 MHz – 1000 MHz



Frequency (MHz)	Quasi Peak (dBµV)	Antenna height (cm)	Polarity	Turntable position (deg)	Limit (dBµV/m)	Margin (dB)
38.201250	36.9	99.0	V	-3.0	40.0	-3.1
38.246250	36.5	99.0	V	-2.0	40.0	-3.5
104.002500	40.3	99.0	V	164.0	43.5	-3.2
175.015000	41.5	99.0	V	0.0	43.5	-2.0
214.266250	39.3	153.0	H	321.0	43.5	-4.2
214.395000	38.8	188.0	H	346.0	43.5	-4.7

§25.202 (f) (1)..(3) – EMISSION LIMITATIONS

Standard Applicable

According to CFR 47, § 25.202 (f) (1) through (3), the mean power of emission shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(1) 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;

(2) 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;

(3) 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

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 10th harmonic.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

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

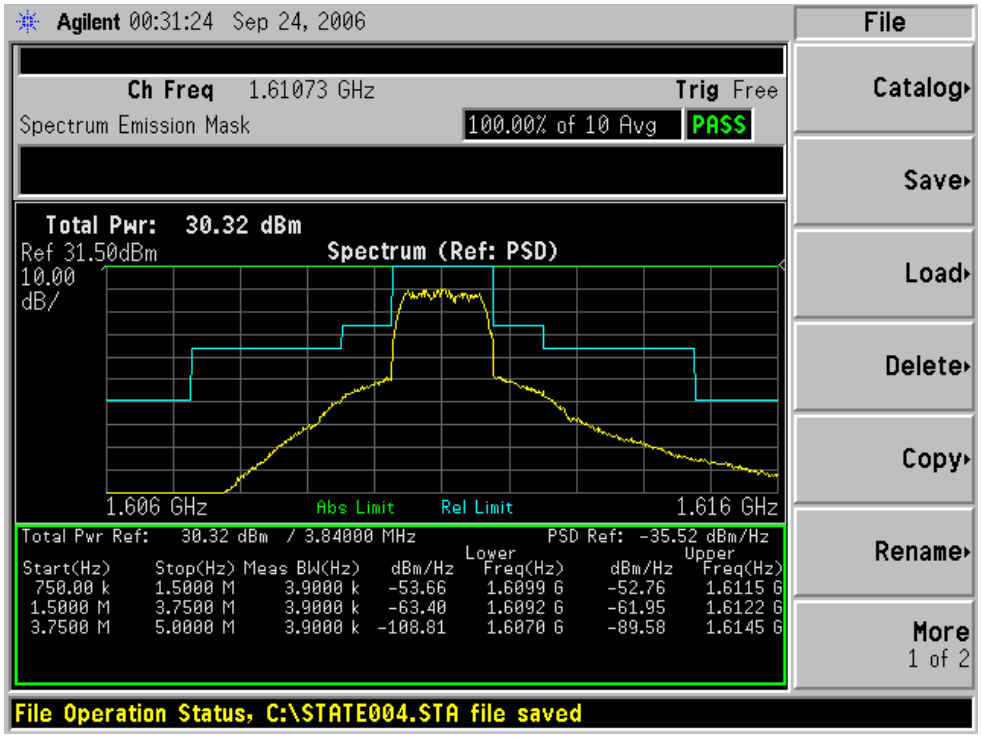
Measurement Result

Environmental Conditions

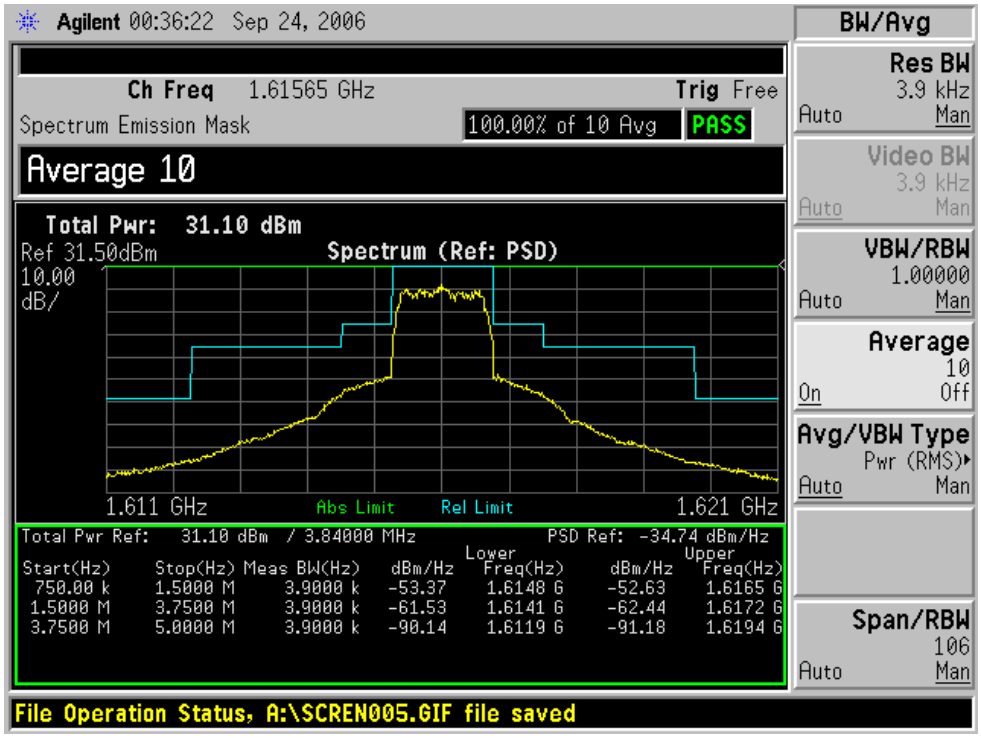
Temperature:	23° C
Relative Humidity:	65%
ATM Pressure:	1025 mbar

** The testing was performed by James Ma on 2007-01-04.*

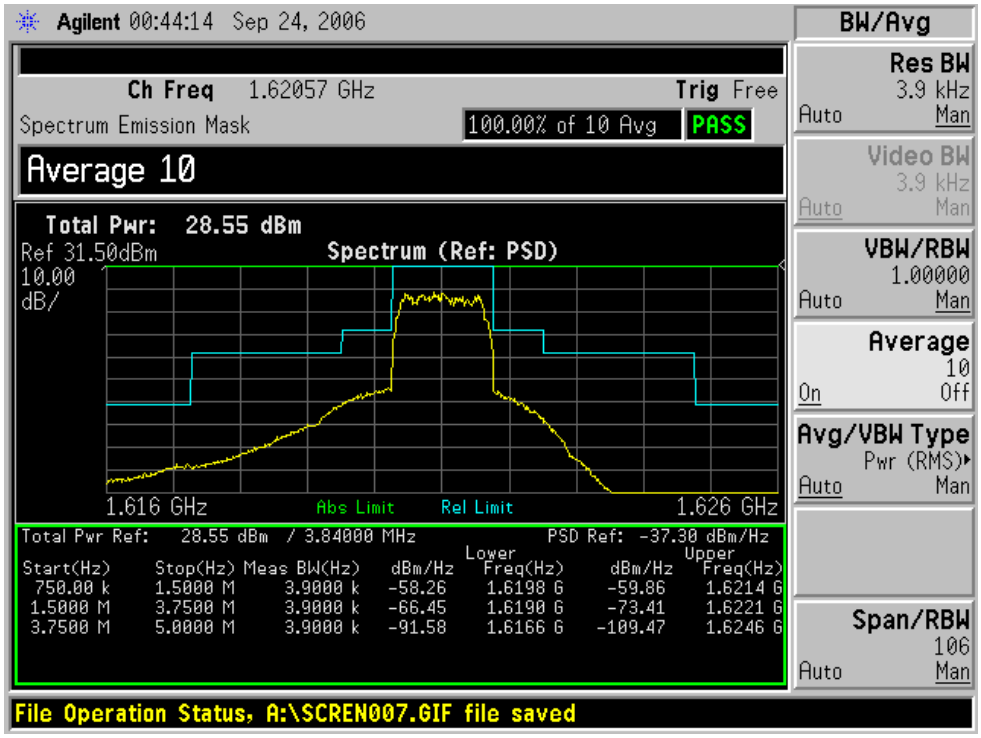
Low Channel



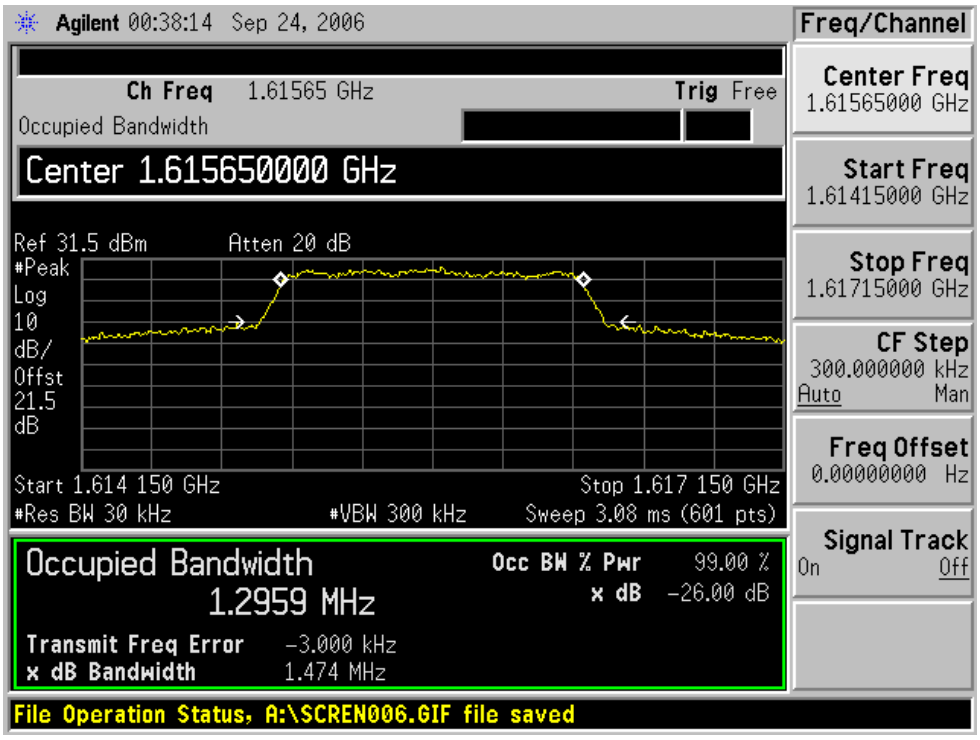
Middle Channel



High Channel



26 dB & Occupied Bandwidth



§2.1046 & §25.204 – POWER OUTPUT

Standard Applicable

According to §25.204 (a): in bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+40 dBW in any 4 kHz band for $\Theta \leqslant 0^\circ$

+40 + 3Θ dBW in any 4 kHz band for $0^\circ < \Theta \leqslant 5^\circ$

where Θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

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.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

*** 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:	23 °C
Relative Humidity:	65 %
ATM Pressure:	102.5 kPa

** The testing was performed by James Ma on 2007-01-04.*

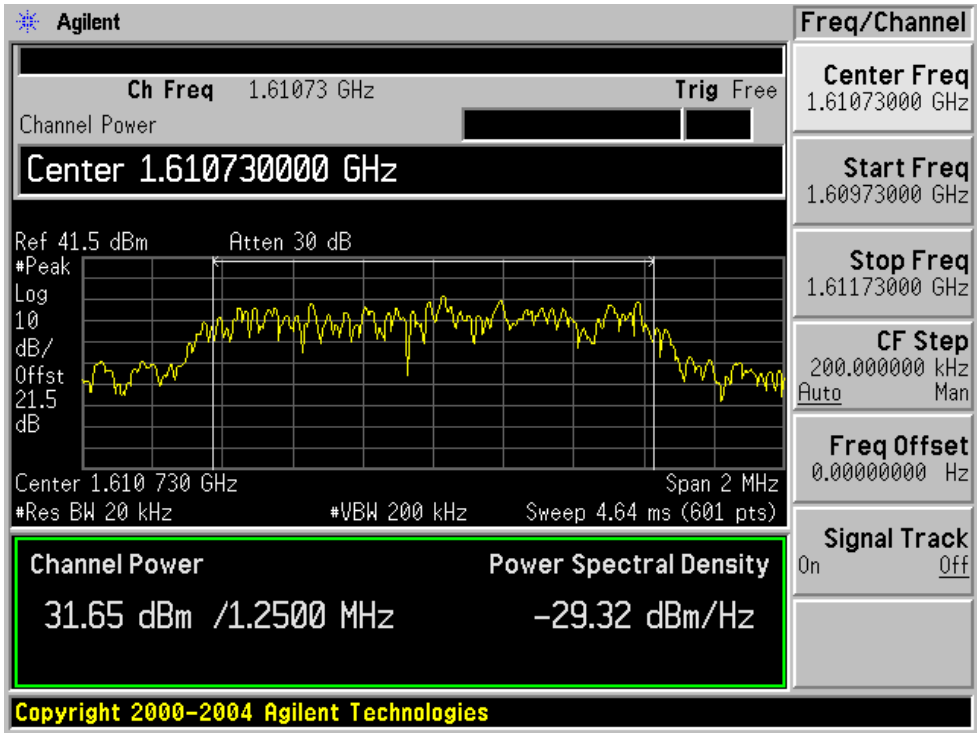
Antenna Gain = 2.3 dBi

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBW)
Low	1610.73	31.65	2.30	33.95	40
Mid	1615.65	32.53	2.30	34.83	
High	1620.57	30.95	2.30	33.25	

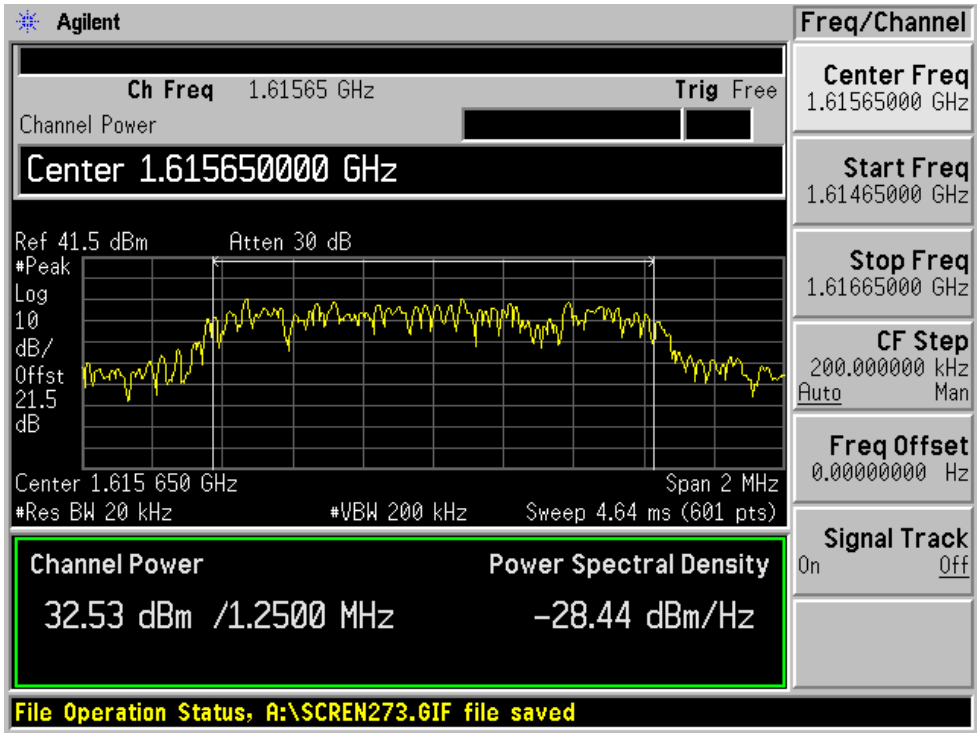
Antenna Gain = 4.5 dBi

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	e.i.r.p (dBm)	Limit (dBW)
Low	1610.73	31.65	4.50	36.15	40
Mid	1615.65	32.53	4.50	37.03	
High	1620.57	30.95	4.50	35.45	

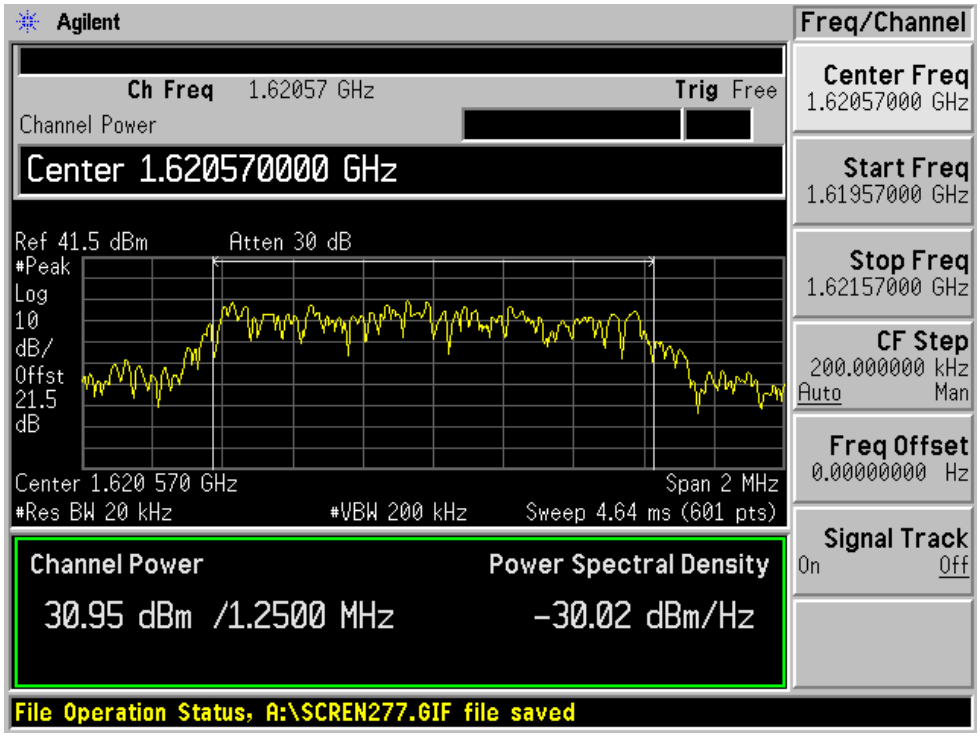
Low Channel



Middle Channel



High Channel



§25.216(b) & §25.216(g) – EMISSIONS FROM MOBILE EARTH SATIONS FOR PROTECTION OF AERONAUTICAL RADIONAVIGATION-SATELLITE SERVICE

Applicable Standard

According to §25.216(b), the e.i.r.p. density of emissions from mobile earth stations placed in service on or before July 21, 2002 with assigned uplink frequencies between 1610 MHz and 1626.5 MHz shall not exceed −64 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1587.42–1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth generated by such stations shall not exceed −74 dBW, averaged over any 2 millisecond active transmission interval, in the 1587.42–1605 MHz band.

According to §25.216(g), mobile earth stations manufactured more than six months after Federal Register publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1610–1626.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from −70 dBW/MHz at 1605 MHz to −10 dBW/MHz at 1610 MHz averaged over any 2 millisecond active transmission interval. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from −80 dBW at 1605 MHz to −20 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

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.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

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

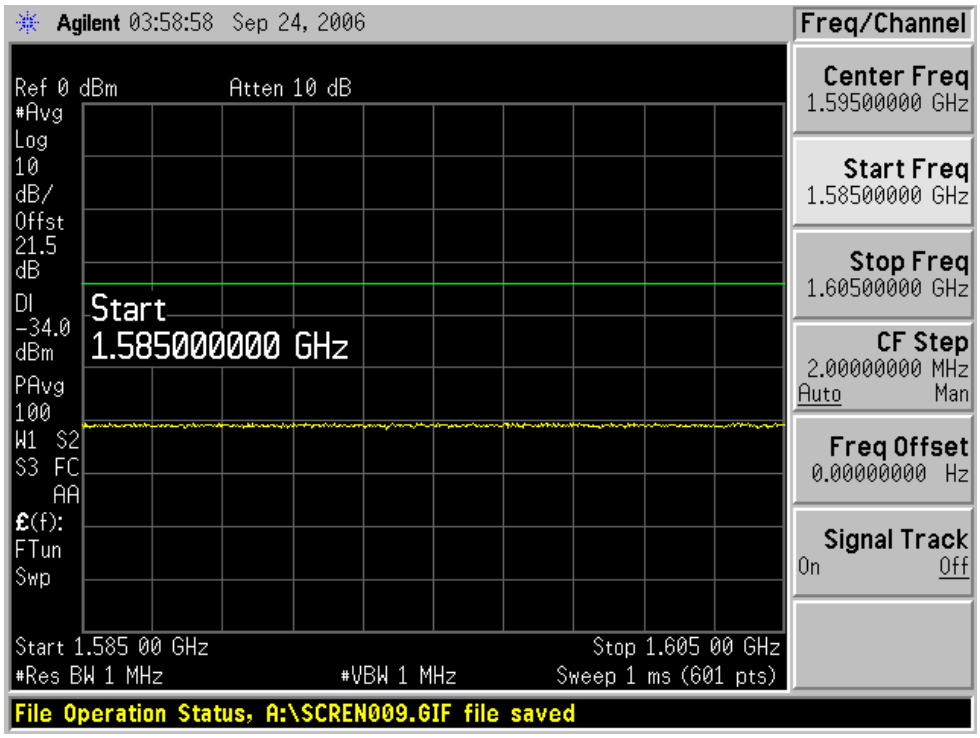
Measurement Result

Environmental Conditions

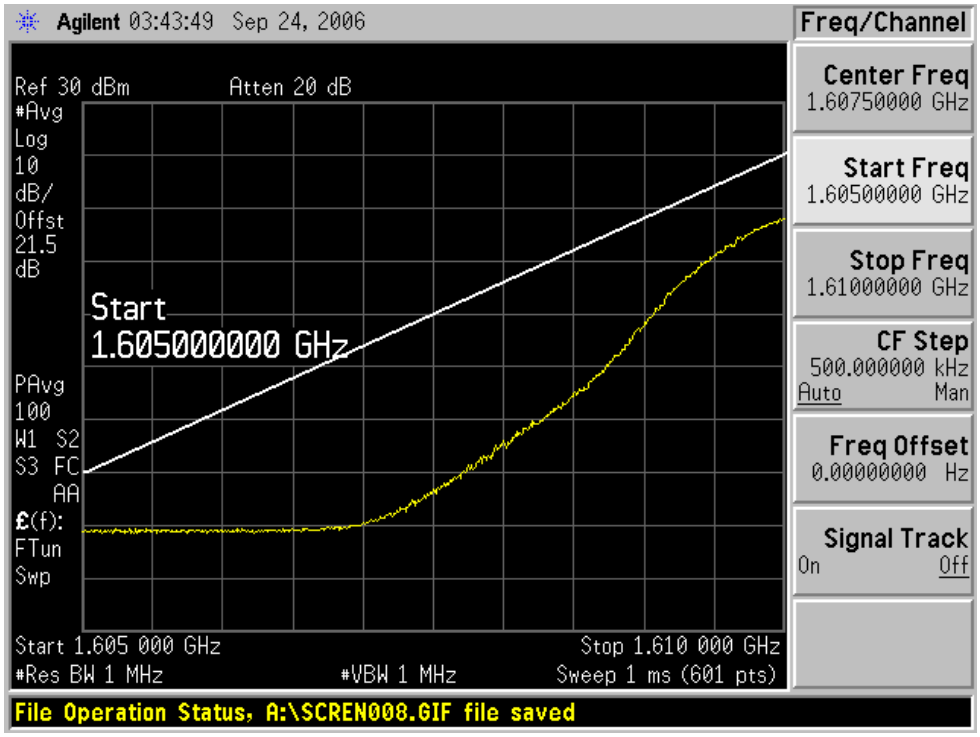
Temperature:	23 °C
Relative Humidity:	65 %
ATM Pressure:	102.5 kPa

** The testing was performed by James Ma on 2007-01-04.*

1559 MHz-1605 MHz



1605MHz-1610 MHz



§2.1055 – FREQUENCY STABILITY & §25.202(d) – FREQUENCY TOLERANCE

Standard Applicable

According to §25.202(d) *Frequency tolerance, Earth stations.* The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
HP	Microwave Frequency Counter	5342A	2232A06380	2006-09-07
Tenney	Oven, Temperature	VersaTenn	12.222-193	2006-06-21

*** 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:	23 °C
Relative Humidity:	65 %
ATM Pressure:	102.5 kPa

** The testing was performed by James Ma on 2007-01-04.*

Measurement Result

Frequency Stability vs. Temperature

Reference Frequency: 1615.65 MHz, Limit: 0.001%

Environment Temp (C)	Power Supply (V)	Measured Freq (MHz)	Error (%)	Limit (%)
50	120	1615.651350	0.00008	0.001
40	120	1615.651150	0.00007	0.001
30	120	1615.651150	0.00007	0.001
20	120	1615.650850	0.00005	0.001
10	120	1615.650800	0.00005	0.001
0	120	1615.650325	0.00002	0.001
-10	120	1615.650465	0.00003	0.001
-20	120	1615.650750	0.00005	0.001
-30	120	1615.650892	0.00006	0.001

Frequency Stability vs. Extreme Voltage

Reference Frequency: 1615.65 MHz, Limit: 0.001%

Environment		Measured Freq. (MHz)	Error (%)	Limit (%)
Power Supply (V)	Temperature (C)			
138	20	1615.650950	0.00006	0.001
120	20	1615.650850	0.00005	0.001
102	20	1615.651050	0.00006	0.001