

FCC PART 90 TYPE APPROVAL MEASUREMENT AND TEST REPORT

For

Infinition Inc.

3630 Jean-Talon,
Trois-Rivières,
Québec, Canada, G8Y 2G7

FCC ID: PDGBR-1001
MODEL: BR-1001

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Product name: 10.5 GHz Ballistic Doppler Radar
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Report Number: R0702211-90	
Report Date: 2007-03-05	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Infinition Inc.*'s product, Model: *BR-1001* or the "EUT" as referred to in this report is a *10.5 GHz Ballistic Doppler Radar*(*tested operating frequency 10.460 GHz*). It is used for velocity measurements of ballistic and non ballistic moving targets.

The transmitter output power of the EUT can be set to a minimum of 0.2 W or a maximum of 2 W which allows it to fire short to medium range experimental projectiles or standard calibers.

Antenna Information:

Antenna Type	Gain (10.5GHz)
Flat Panel, microstrip	23 dBi

Mechanical Description

The *Infinition Inc.*'s product, Model: *BR-10001* measures approximately 495 mmL x 273 mmW x 127 mmH and weighs 14.14 kg.

** The test data gathered are from a production sample, serial number: BR10012211, provided by the manufacturer.*

EUT Photo



Additional photos in Exhibit C

** The test data gathered are from production sample, serial number: Br10012211, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Infinition Inc.* in accordance with Part 2, Subpart J, and Part 90, Subpart F of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for Radiated Emissions, Frequency Stability, Output Power, Spurious Emissions at Antenna Terminal, and Occupied Bandwidth.

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 ± 2.0 dB for Conducted Emissions tests and ± 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

None.

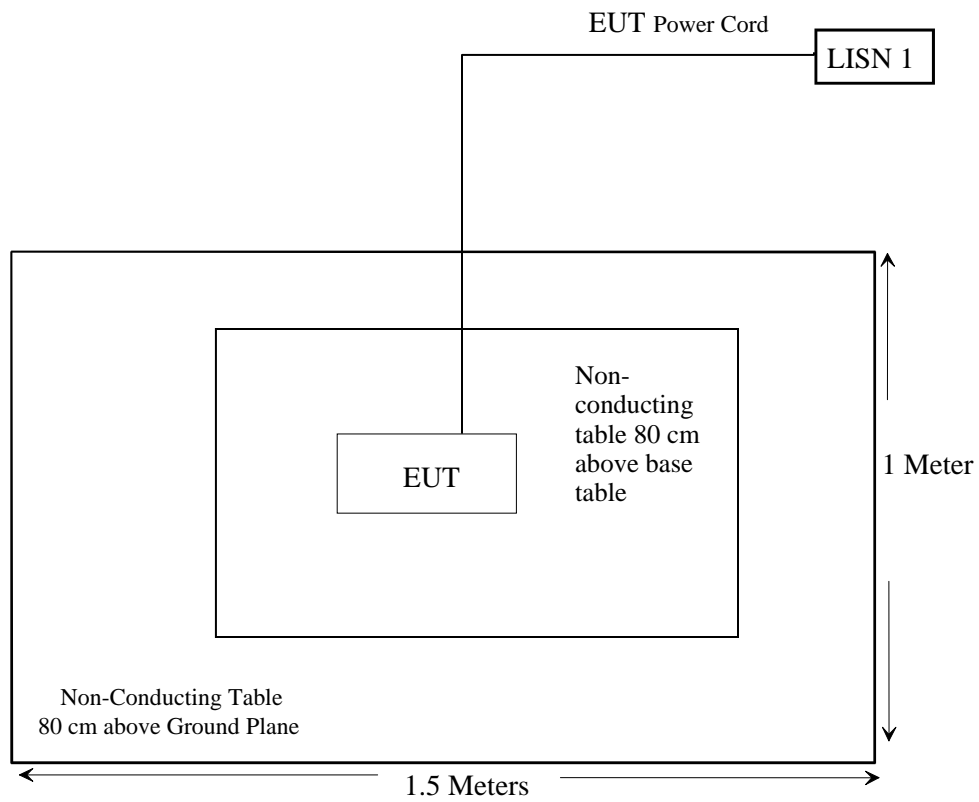
Power Supply Information

None.

External I/O Cabling List and Details

None.

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
§2.1046 & §90.205	RF Power Output	Compliant
§2.1049	Occupied Bandwidth	Compliant
§2.1051 & §90.210	Spurious Emission at Antenna Terminals	Compliant
§2.1053 & §90.210	Field Strength of Spurious Radiation	Compliant
§2.1055 & §90.213	Frequency Stability/ Tolerance	Compliant
§2.1047	Audio Frequency Response	NA*
§2.1047	Audio Low Pass Filter Response	NA*
§2.1047 & §90.207	Modulation Characteristics	NA**
§90.214	Transient Frequency Behavior	NA

Note:

* The EUT contains no audio circuit.

** The EUT has no modulation capability.

§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

23 dBi Antenna Gain

Maximum peak output power at antenna input terminal (dBm): 33.51(dBm)

Maximum peak output power at antenna input terminal (mW): 2243.88 (mW)

Predication distance (cm): 200 cm

Predication frequency (MHz): 10460 (MHz)

Maximum Antenna Gain, typical (dBi): 23 (dBi)

Maximum Antenna Gain (numeric): 199.53 (numeric)

Power density of predication frequency at 200 cm (mW/cm²): 0.891 (mW/cm²)

MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 1.00 (mW/cm²)

Result

The power density of predication frequency at 200 cm is 0.891 mW/cm² for a 23 dBi antenna which was according to calculation under the MPE limit for uncontrolled exposure of 1.00 mW/cm².

§2.1046 & §90.205 – POWER OUTPUT

Applicable Standard

q) *All other frequency bands.* Requested transmitter power will be considered and authorized on a case by case basis.

(r) The output power shall not exceed by more than 20 percent either the output power shown in the Radio Equipment List [available in accordance with §90.203(a)(1)] for transmitters included in this list or when not so listed, the manufacturer's rated output power for the particular transmitter specifically listed on the authorization.

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	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

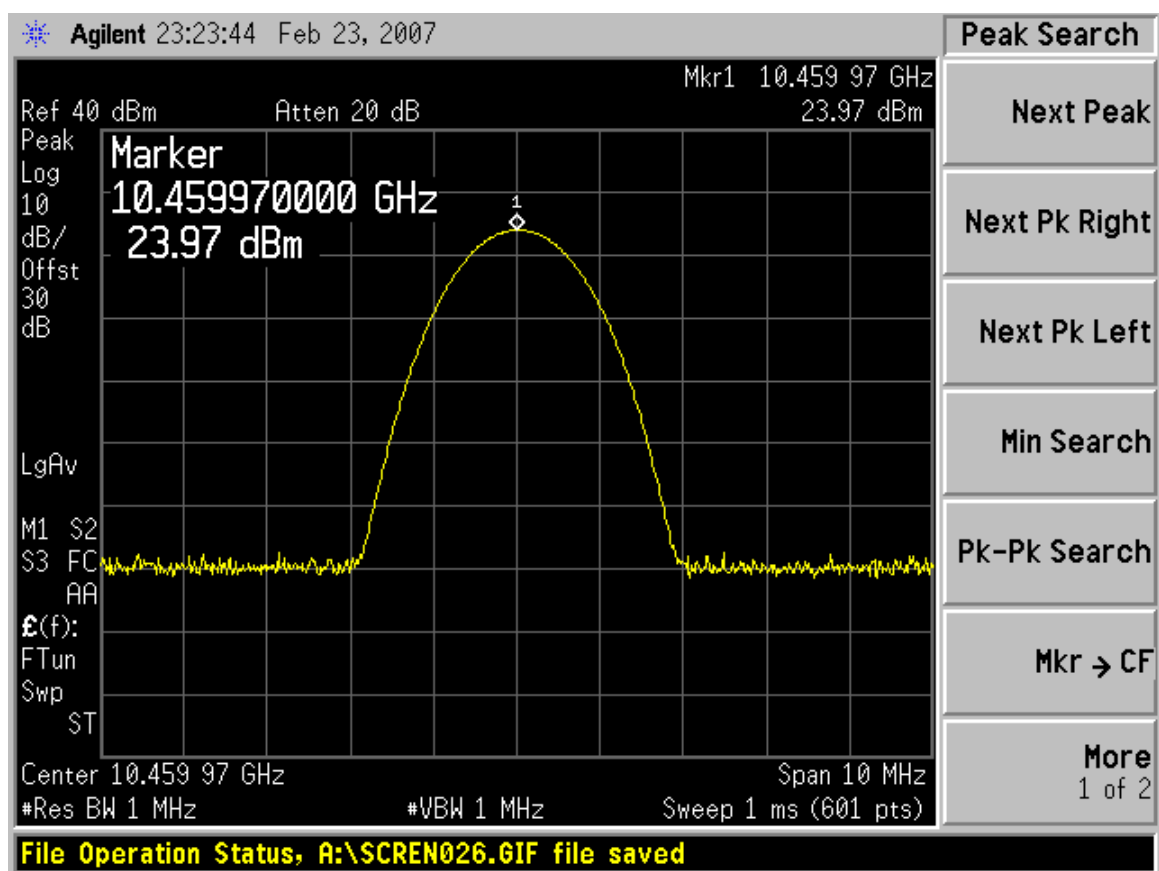
Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	1020 mbar

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

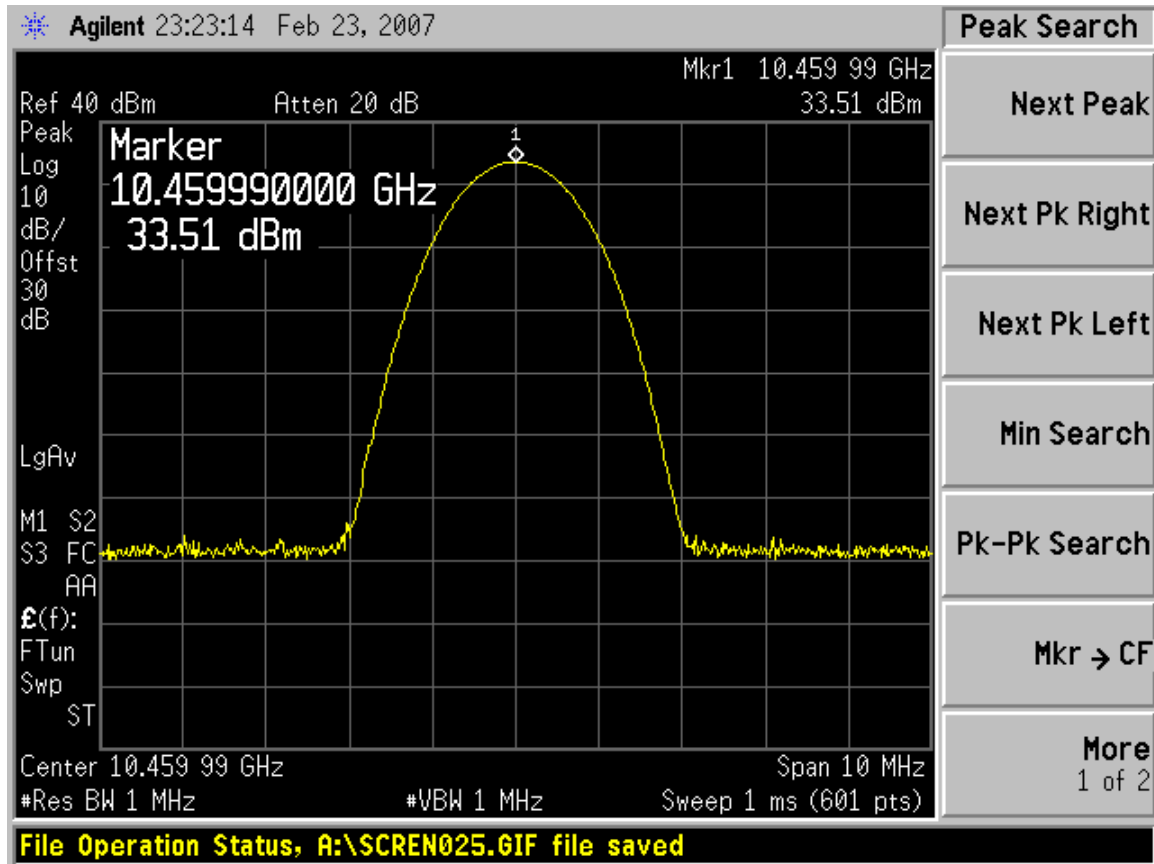
Minimum Standard: +/- 1.0 dB

Power Setting	Frequency (MHz)	Rated Power (dBm)	Conducted Output Power (dBm)	Delta (dB)
Low	10459	23.00	23.97	0.97
High	10459	33.00	33.51	0.51

Low Power Setting



High Power Setting



§2.1049 – OCCUPIED BANDWIDTH

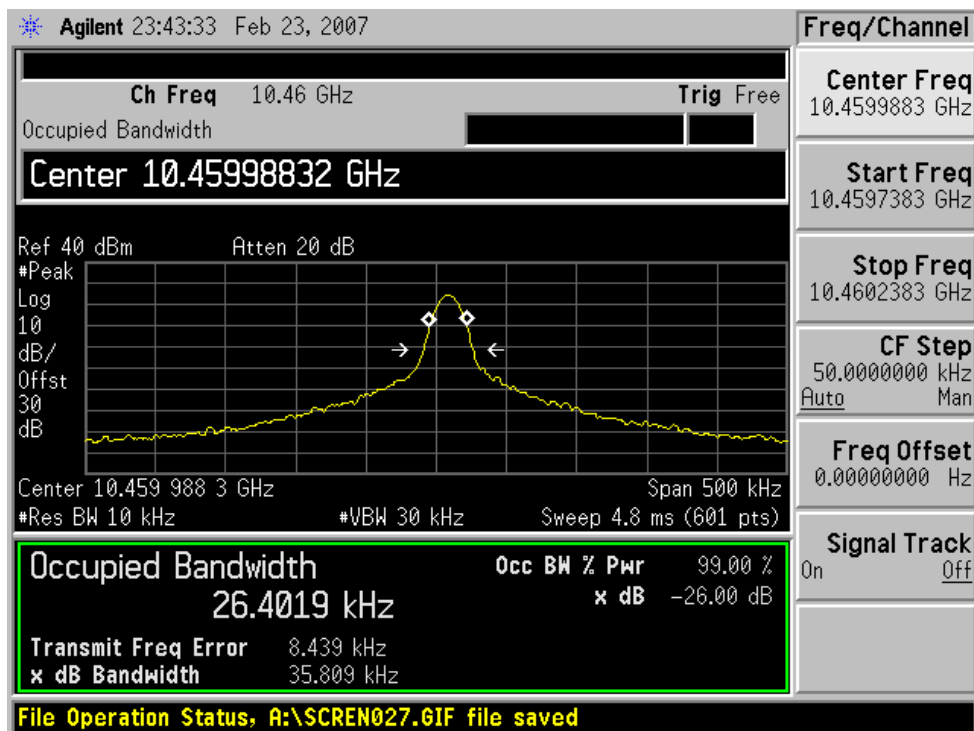
Applicable Standard

NA.

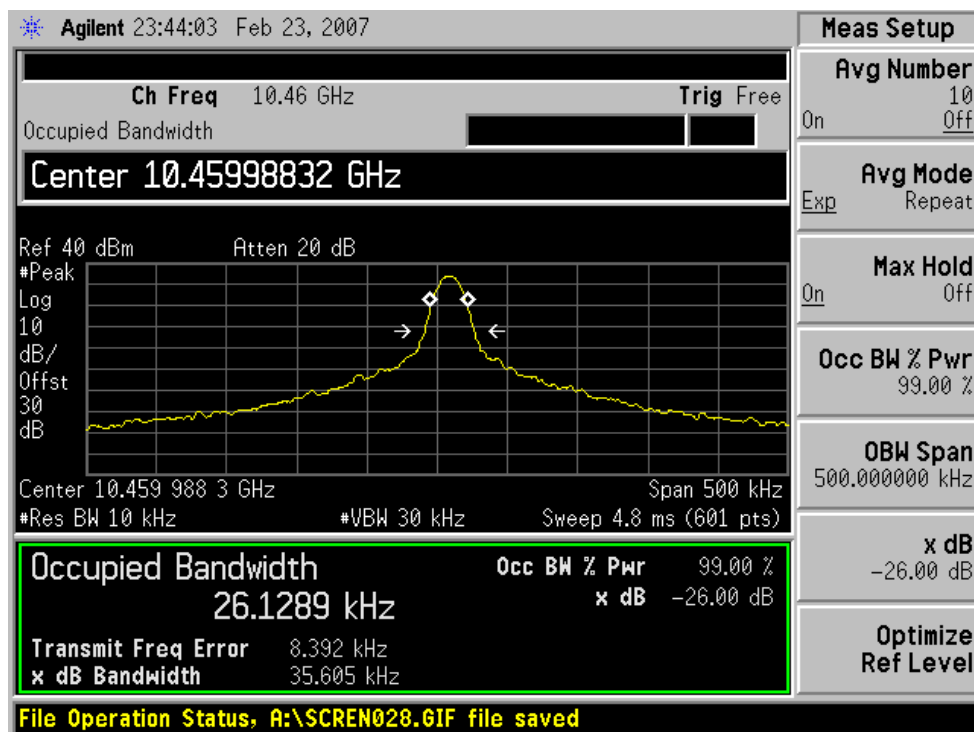
Measurement Procedure

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 from the antenna port to a Spectrum analyzer.

Low Power Setting



High Power Setting



§2.1051 & §90.210 – 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.

§90.210 (b) (c) 3) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

Measurement Procedure

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via an RF 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	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

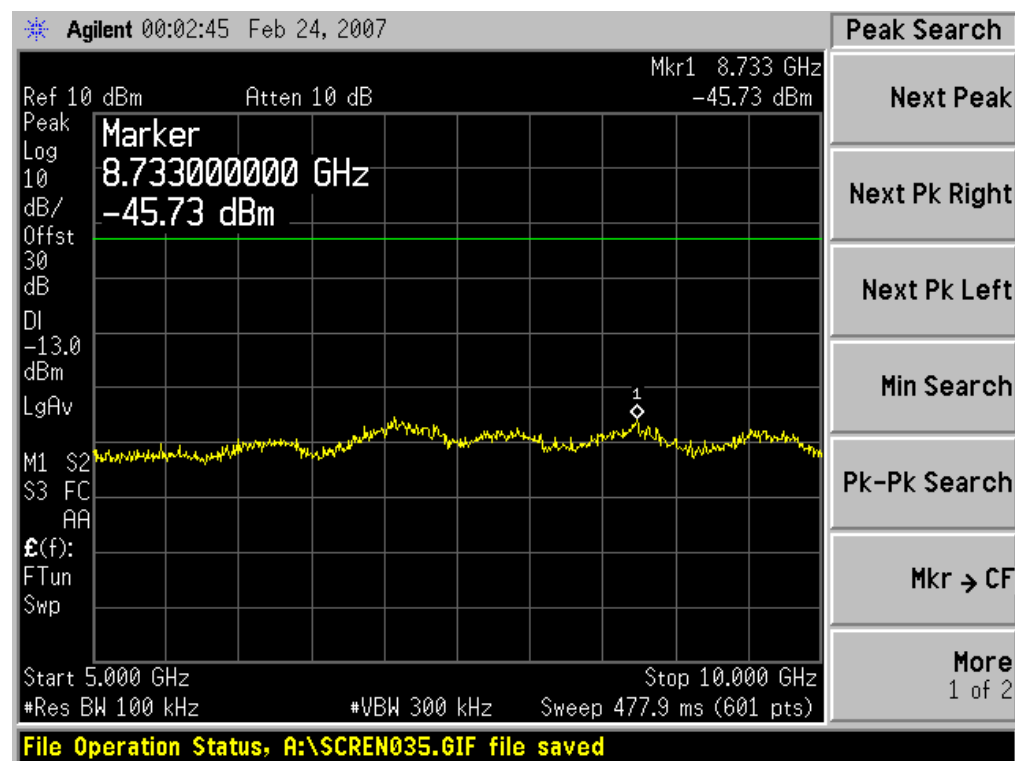
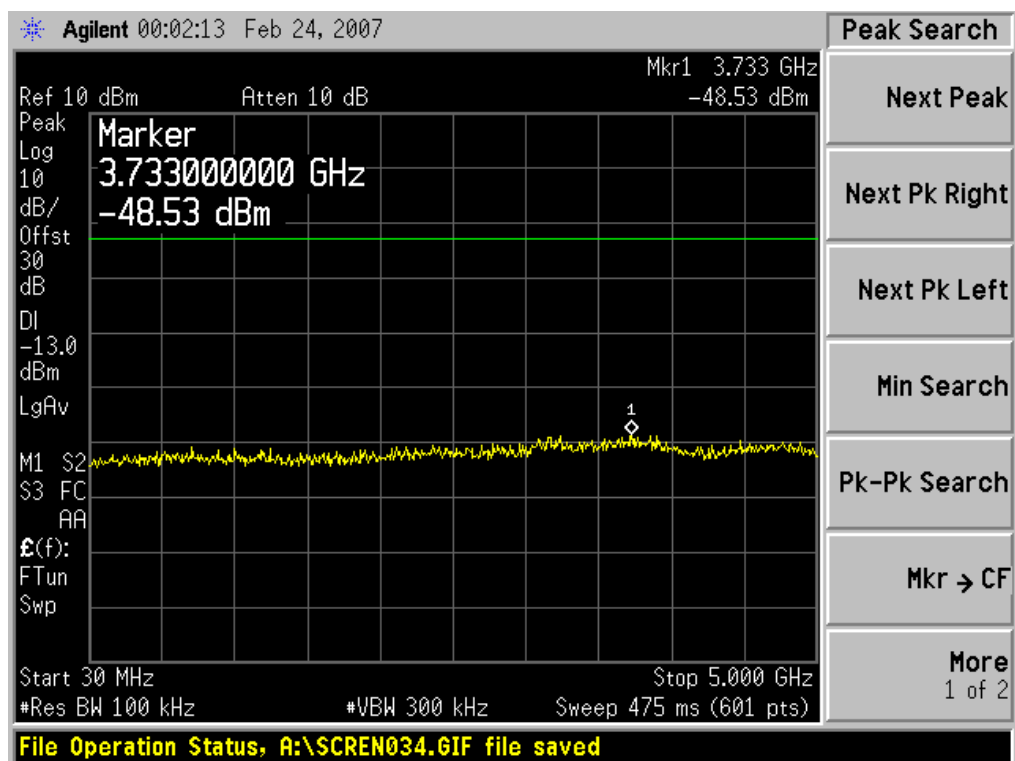
* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

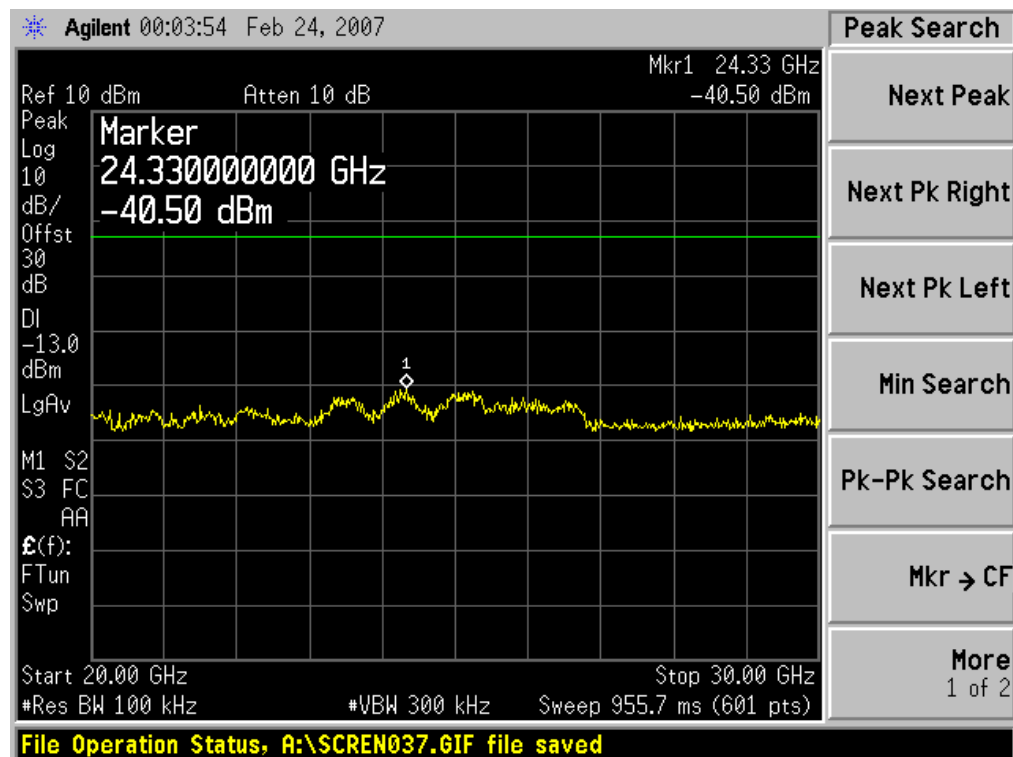
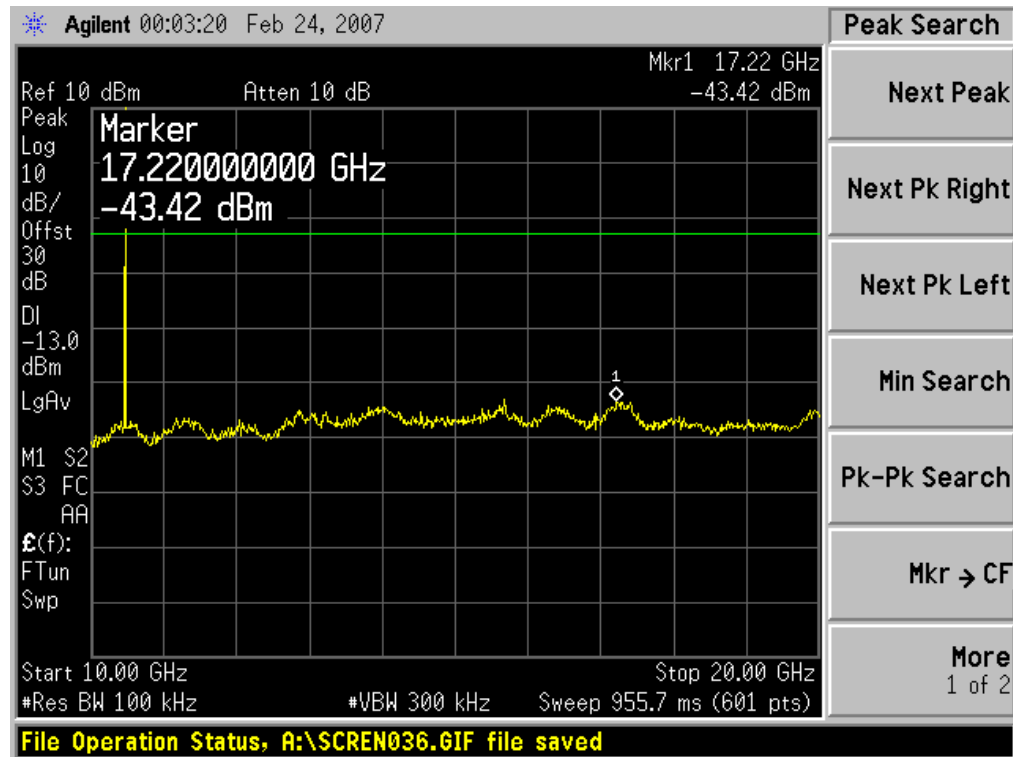
Measurement Result

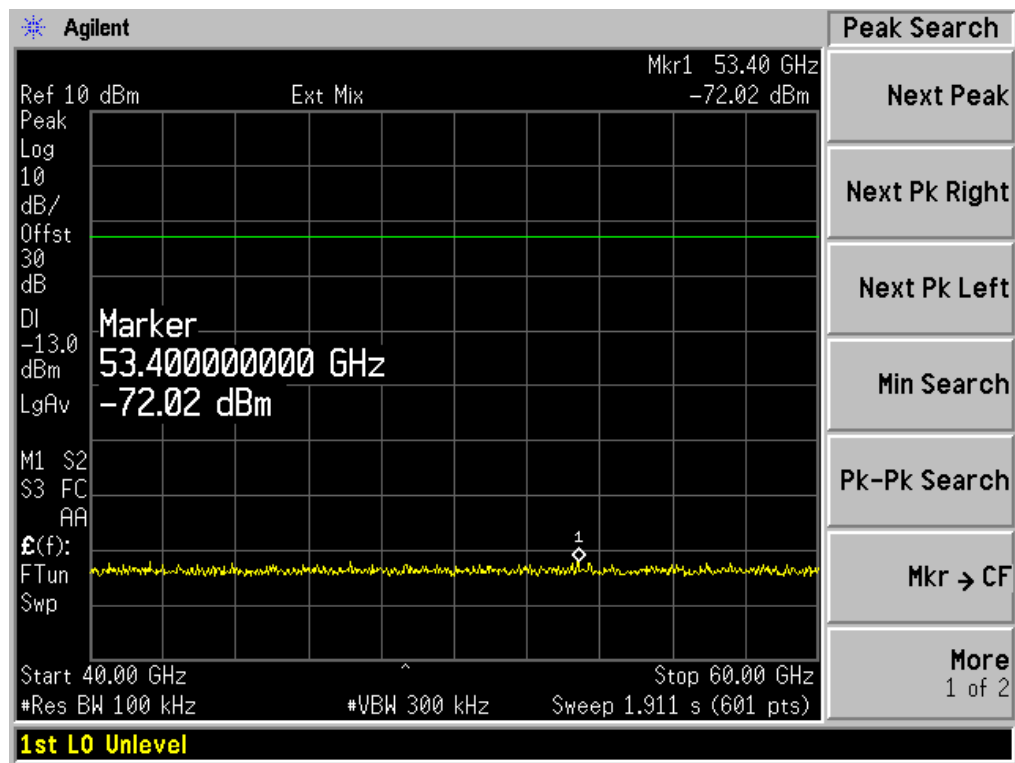
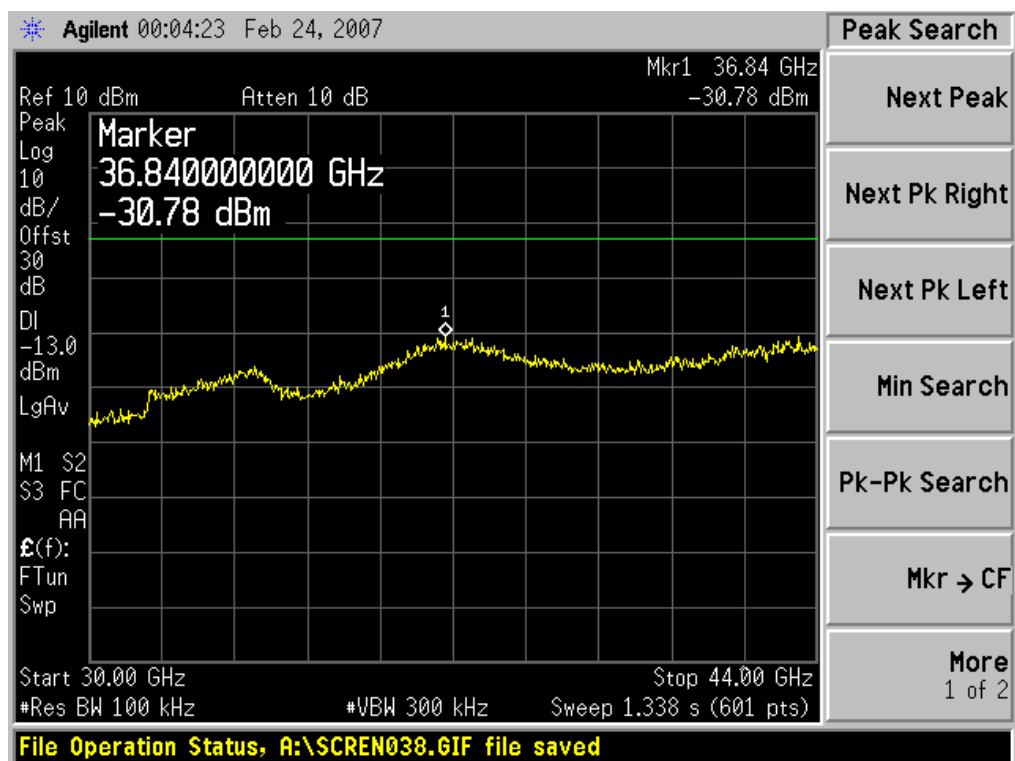
Environmental Conditions

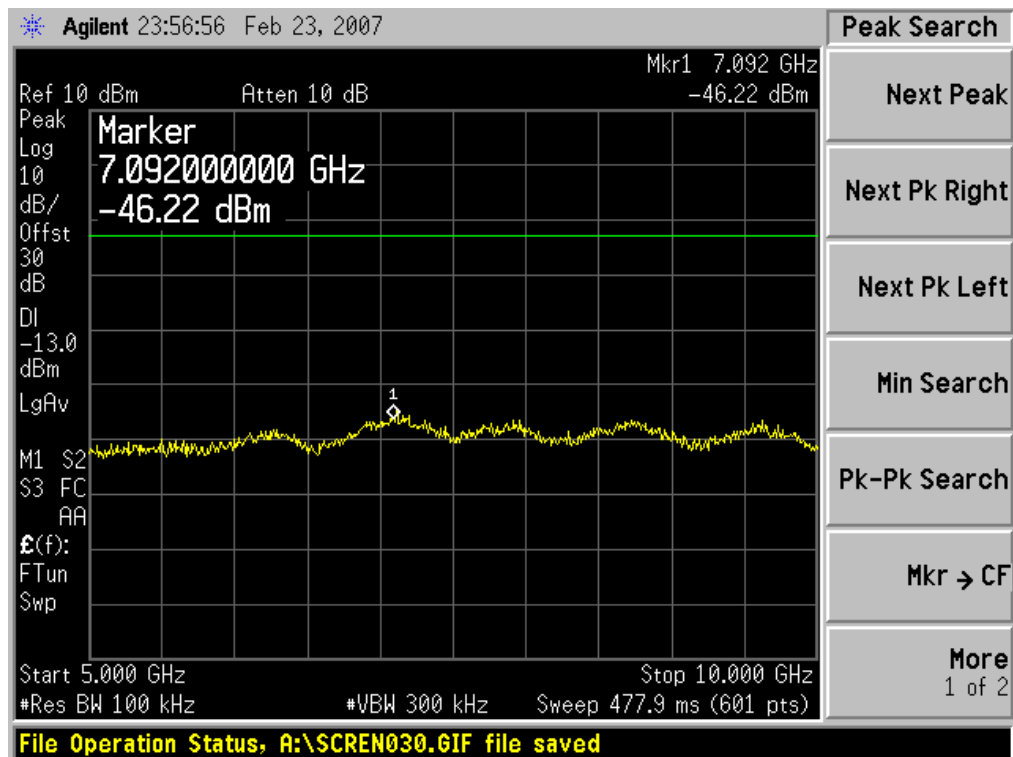
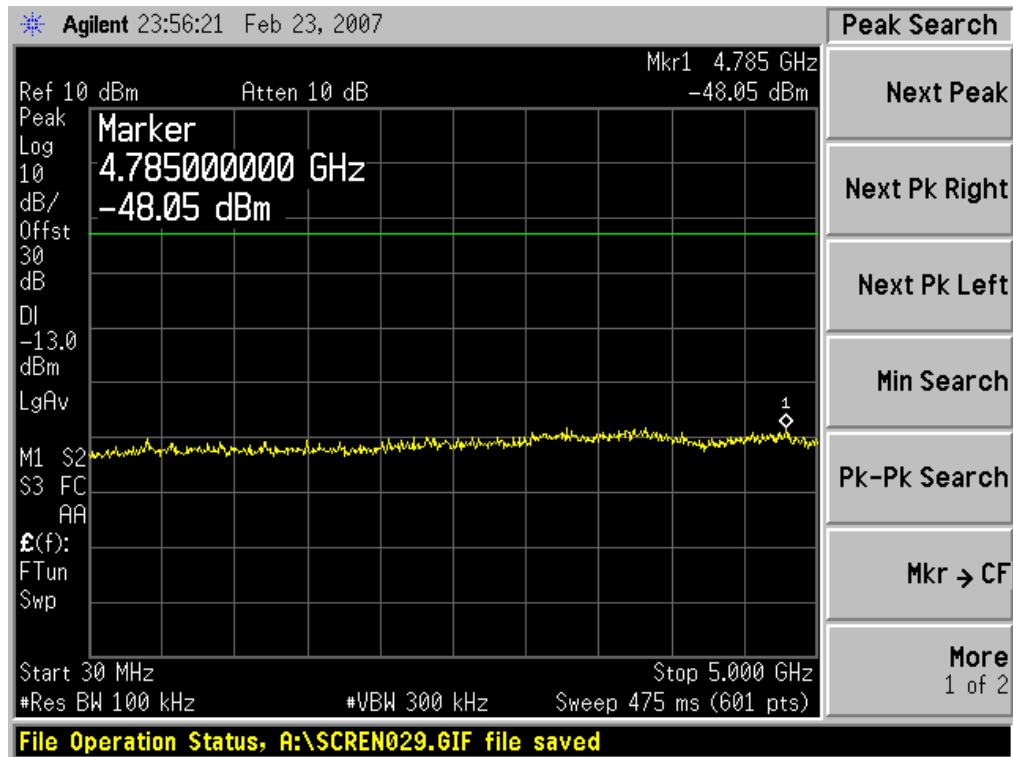
Temperature:	20 ° C
Relative Humidity:	40 %
ATM Pressure:	1020 mbar

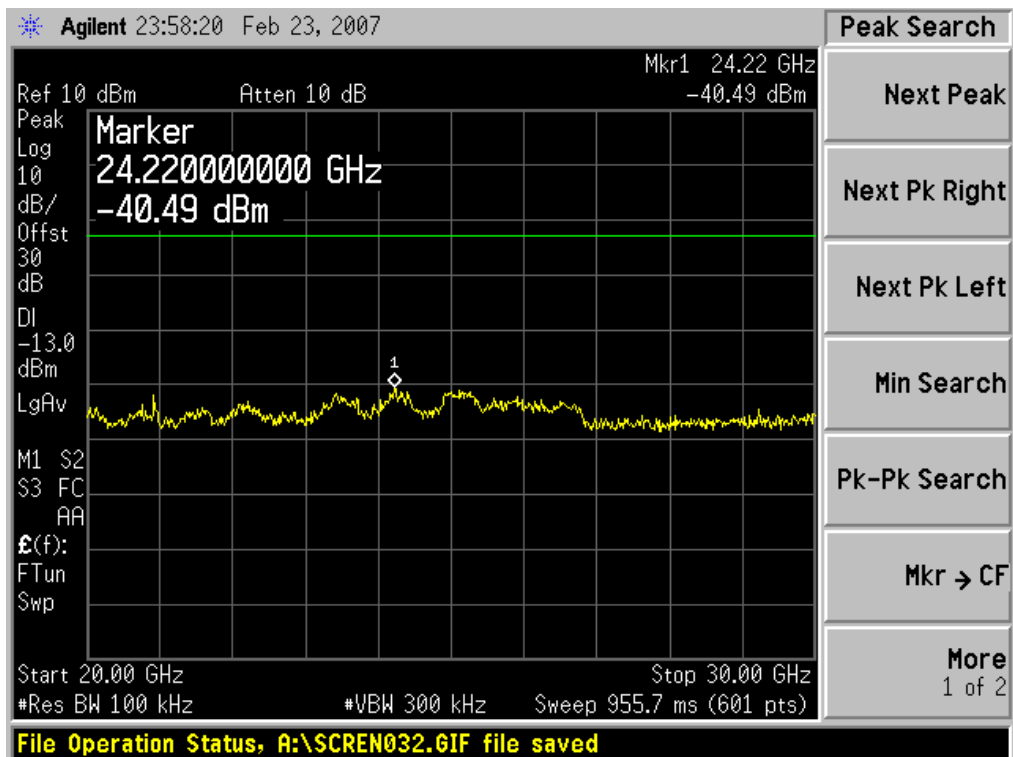
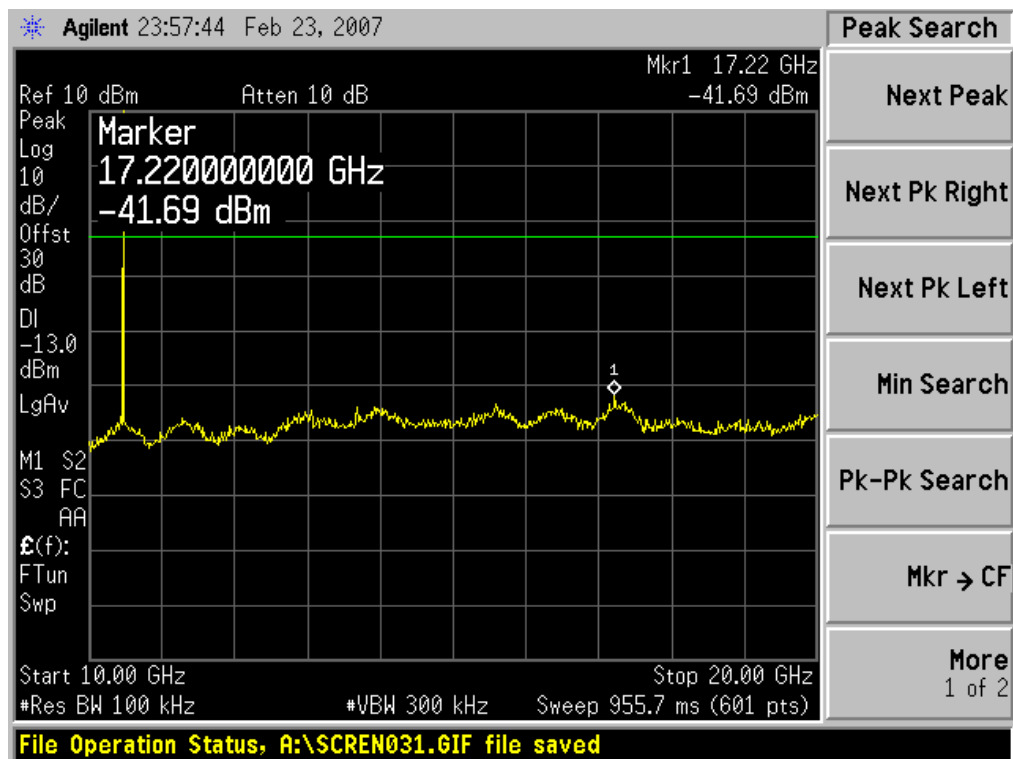
* *The testing was performed by James Ma on 2007-03-01.*

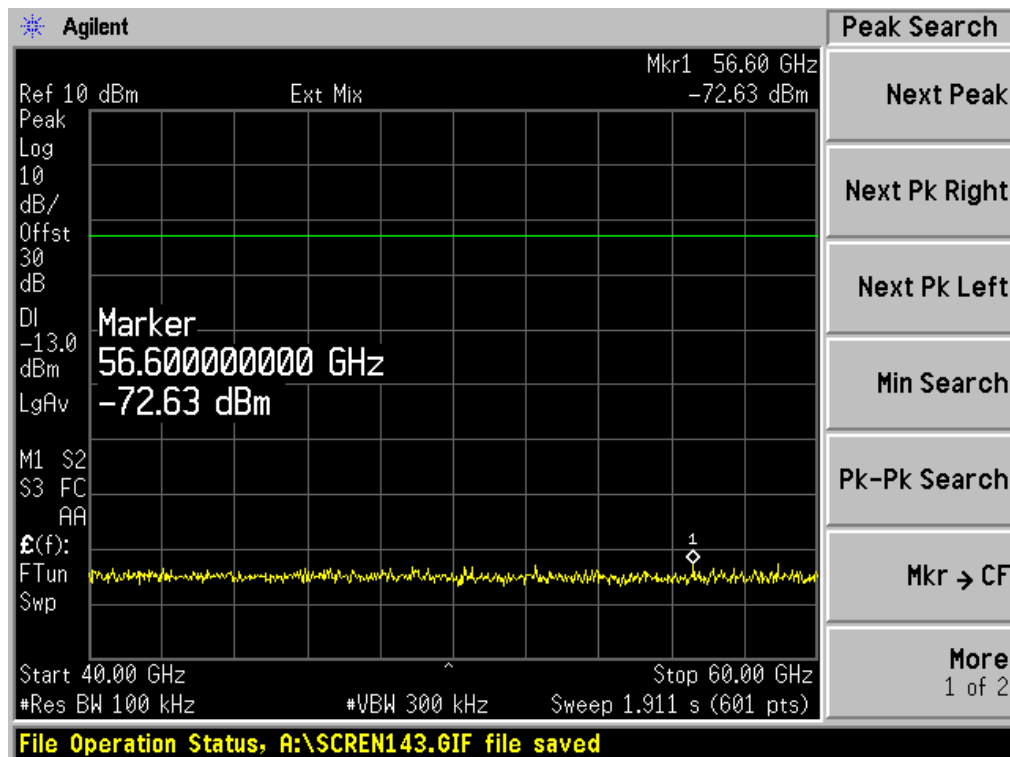
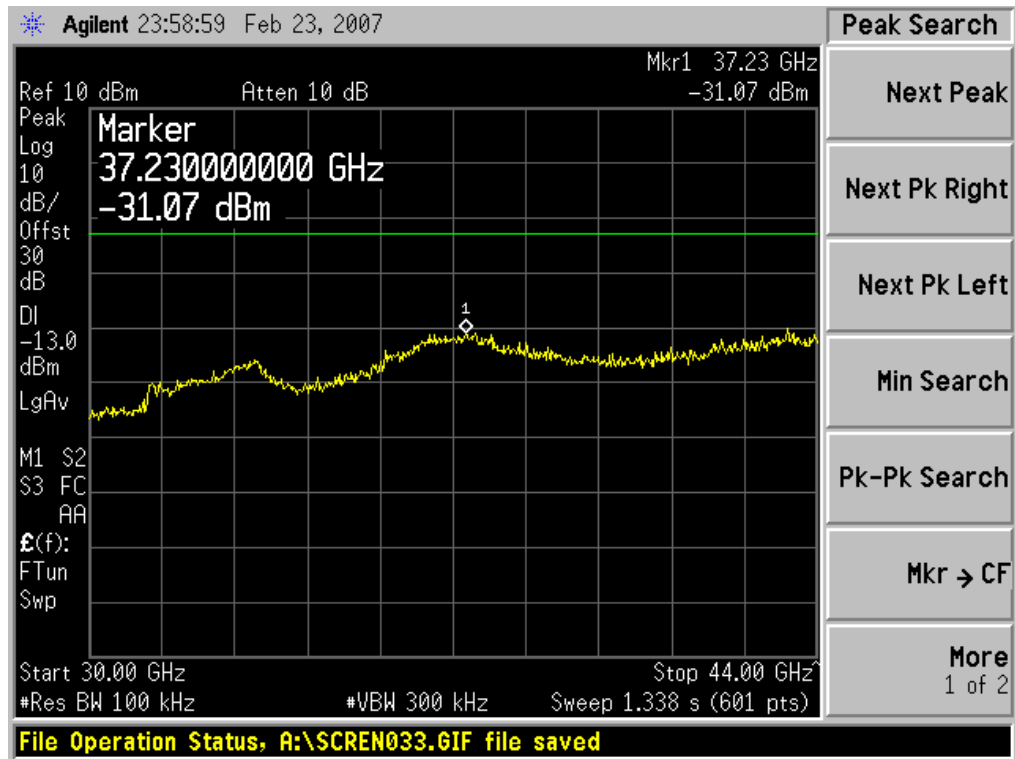
Low Power setting (0.2W)





High Power Setting (2.0 W)





§ 2.1053 & §90.210 – FIELD STRENGTH OF SPURIOUS RADIATION

Standard Applicable

§2.1053 & §90.210 (b) (c) 3) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

Measurement Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Equipment Lists

Manufacturer	Description	Model	Serial Number	Calibration Date
Sunol Science	Antenna, Horn, Std (1-18 GHz)	DRG-118/A	1132	2005-08-17*
WiseWave	Antenna, Horn (18-26.5 GHz)	ARH-4223-02	1055-02	2005-08-17*
WiseWave	Antenna, Horn (26.5-40.0 GHz)	ARH-2823-02	1055-01	2005-08-17*
WiseWave	Antenna, Horn (40 - 60.0 GHz)	ARH-1923-02	11648-01	2005-08-17*
HP	Generator, Signal	83650B	3614A00276	2006-05-10
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06

*2 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:	22 °C
Relative Humidity:	50 %
ATM Pressure:	1020 mbar

* The testing was performed by James Ma on 2007-02-26.

Test Results Summary**High Power Setting****-17.6 dB at 20920 MHz in the Vertical polarization****Low Power Setting****-17.8 dB at 20920 MHz in the Vertical Polarization****TX Spurious Emission Primary scan 30 MHZ - 52.50 GHZ****High Power (2.0 W)**

Indicated Frequency (MHz)	Amplitude (dBuV)	Azimuth Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
20920	33.50	100	1.7	V	20920	-45.60	23	8.0	-30.6	-13	-17.6
20920	33.20	120	1.5	H	20920	-45.70	23	8.0	-30.7	-13	-17.7
31380	33.00	280	2.0	V	31380	-45.70	23	8.5	-31.2	-13	-18.2
31380	32.60	300	1.6	H	31380	-46.30	23	8.5	-31.8	-13	-18.8

Low Power (0.2 W)

Indicated Frequency (MHz)	Amplitude (dBuV)	Azimuth Degree	Test Antenna Height Meter	Polar H/V	Substituted					Limit (dBm)	Margin (dB)
					Frequency (MHz)	Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
20920	33.20	100	1.7	V	20920	-45.8	23	8.0	-30.8	-13	-17.8
20920	33.00	120	1.5	H	20920	-45.9	23	8.0	-30.9	-13	-17.9
31380	32.70	280	2.0	V	31380	-46.5	23	8.5	-32.0	-13	-19.0
31380	32.40	300	1.6	H	31380	-46.9	23	8.5	-32.4	-13	-19.4

§2.1055 & §90.213 – FREQUENCY STABILITY

Applicable Standard

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

Specified by client: Transmitter Stability = +/- 15 PPM.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2006-03-06
ESPEC	Environmental Chamber	ESL-4CA	018010	NR
Yokogawa	Recorder, Hybrid Chart	DR230	12AB23509	2007-01-31

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

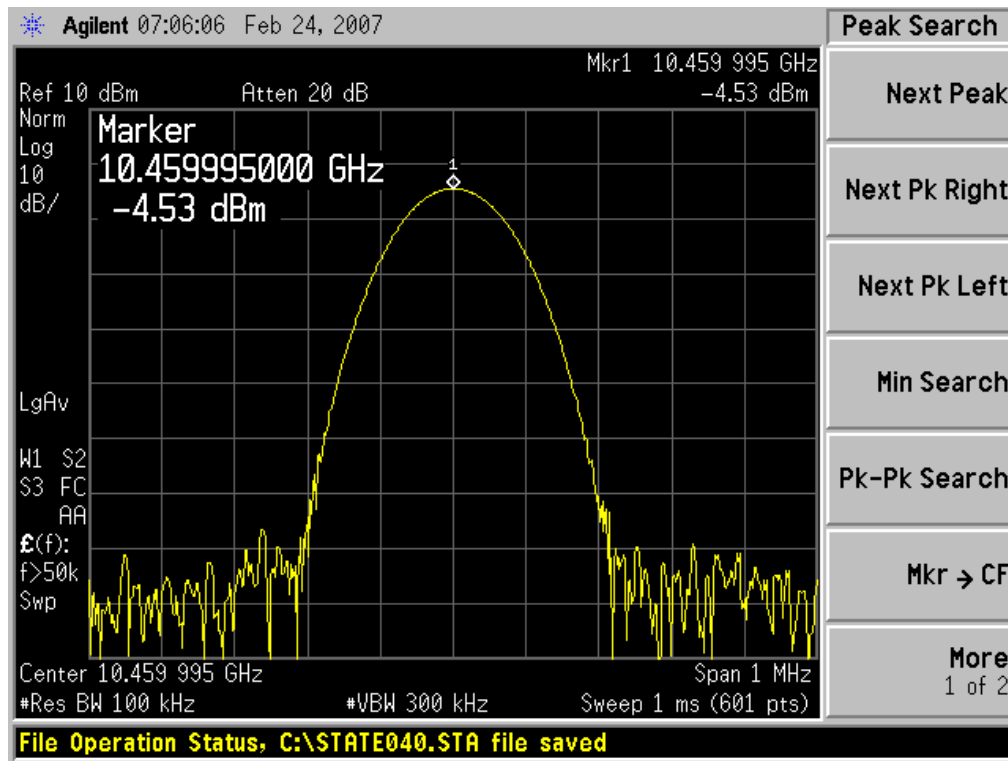
Measurement Result

Environmental Conditions

Temperature:	20 ° C
Relative Humidity:	40 %
ATM Pressure:	1020 mbar

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

Fundamental Frequency



Measurement Result**Frequency Stability vs. Temperature**

Reference Frequency: 10459.995 MHz @ 20 °C, Limit specified by client: ± 15 ppm

Condition		Ref Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (ppm)	Limit (ppm)
Voltage (VAC)	Temp. (°C)				
120.0	-30	10459.995000	10459.993000	-0.1912	15.00
120.0	-20	10459.995000	10459.997000	0.1912	15.00
120.0	-10	10459.995000	10459.993000	-0.1912	15.00
120.0	0	10459.995000	10459.992000	-0.2868	15.00
120.0	10	10459.995000	10459.992000	-0.2868	15.00
120.0	30	10459.995000	10460.034600	3.7859	15.00
120.0	40	10459.995000	10460.012200	1.6444	15.00
120.0	50	10459.995000	10460.090000	9.0822	15.00

Frequency Stability vs. Extreme Voltage

Reference Frequency: 10459.995 MHz @ 20 °C, Limit specified by client: ± 15 ppm

Condition		Ref. Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (ppm)	Limit (ppm)
Voltage (VAC)	Temperature (°C)				
102.0	20	10459.995000	10459.998000	0.2868	15.00
138.0	20	10459.995000	10459.997000	0.1912	15.00