Lab Code: 200167-0

FCC PART 90

TEST AND MEASUREMENT REPORT

For

Infinition Inc.

3630 Jean-Talon,Trois-Rivières,

Québec, Canada, G8Y 2G7

FCC ID: PDGBR-29015
MODEL: BR-29015

Report Type:	**Product Type:**
Original Report	10.5 GHz Ballistic Doppler Radar

Test Engineer:	Jack Liu
Report Number:	R1007202-90
Report Date:	2010-08-13
Reviewed By:	Victor Zhang RF Lead
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DOCUMENT REVISION HISTORY

Revision #	Report Number	Description of Revision	Date of Revision
0	R1007202-90	Original Report	2010-08-13

TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Infinition Inc.* and their product, Model: *BR-29015* which will henceforth be referred to as the "EUT" (Equipment Under Test). The EUT is a *10.5 GHz Ballistic Doppler radar*. 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 1 W or a maximum of 15 W which allows it to fire short to medium range experimental projectiles or standard calibers.

Antenna Information:

Antenna Type	Gain (10.5 GHz)
Flat Panel, microstrip	29 dBi

1.2 Mechanical Description

The EUT measures 83cm (L) x 45cm (W) x 10cm (H) and weighs approximately 21 kg.

The test data gathered are from a production sample, serial number: BR29015-10-152-002, provided by the manufacturer.

1.3 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.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

1.5 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.

1.6 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 range from ±2.0 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.

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

1.7 Test Facility

The test site used by BACL Corp. to collect immunity, conducted and radiated emissions measurement data is located at its facility in Sunnyvale, California, USA.

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

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. 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/Standards/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 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.

2.2 EUT Exercise Software

The EUT was operating in Low Power (1W) and High power (15W) mode during radiated and conducted testing.

2.3 Special Accessories

NA

2.4 Equipment Modifications

No modifications were made to the EUT.

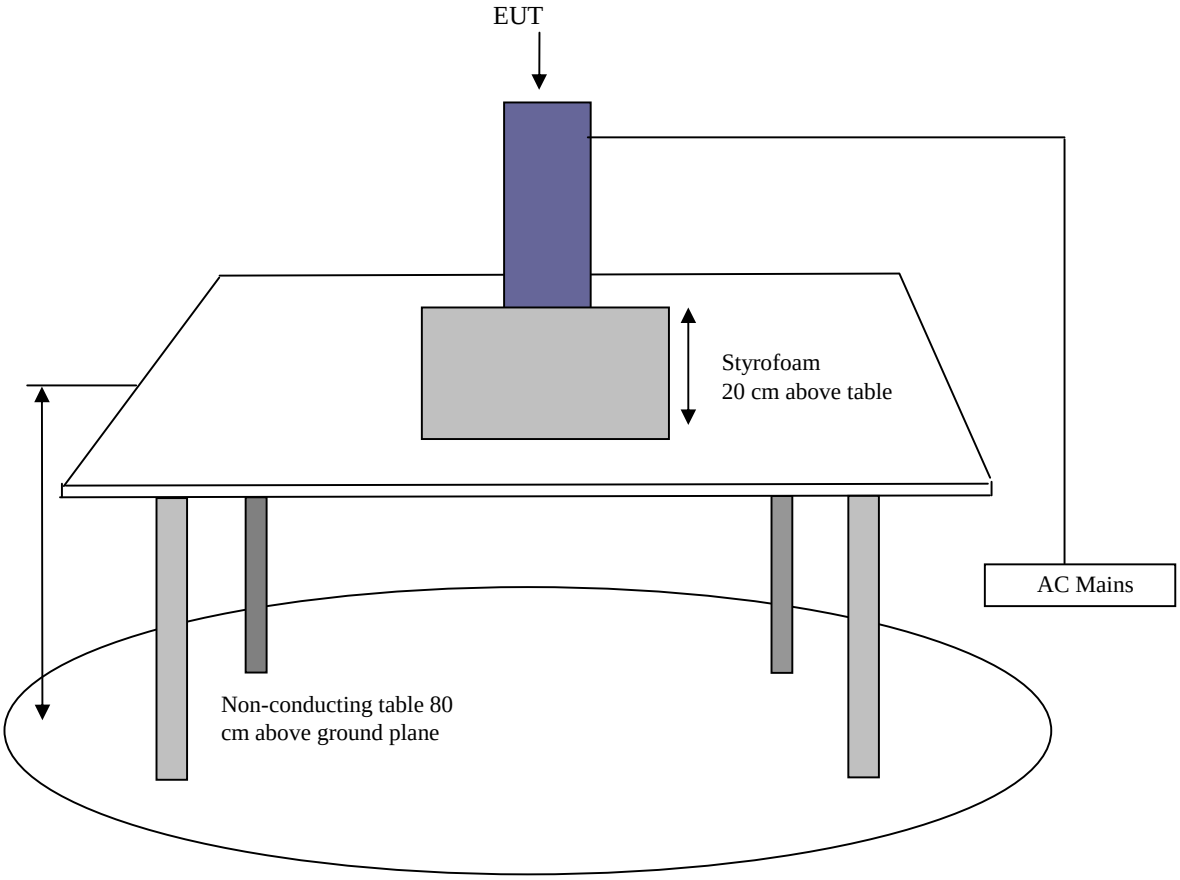
2.5 Internal Configuration Details

Manufacturers	Description	Model	Serial Numbers
Microwave Dynamics	Phase locked oscillator at 10.5 GHz	PLO-3020-10.50	5886-0909-001
Aldetec	High power microwave amplifier	ALS03904	001
Ciao Wireless	Low noise microwave amplifiers	CA1011-246L	133
Marki Microwave	Microwave mixer	M10614MA	--
Pulsar	10 dB Coupler	CS10-12-43511	--
Amveco	Transformer, 15V 3.332A	62083	--
Vicor	Switching power supply 150 W, 12 Vdc	VE-LU1-IV-CC	07090317000152
Infinition Inc.	Linear supply regulator board	Assy 1000000	--
Infinition Inc.	IF low noise amplifier board	Assy 1000030	--
Infinition Inc.	Radar control board	Assy 1000090	--

2.6 External I/O Cabling List and Details

None.

2.7 Radiated Testing Setup Block Diagram



3 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[1]
§2.1047	Audio Low Pass Filter Response	NA[1]
§2.1047 & §90.207	Modulation Characteristics	NA[2]
§90.214	Transient Frequency Behavior	NA

Note:
[1] The EUT contains no audio circuit.
[2] The EUT has no modulation capability.

4 FCC §1.1307(b) (1) & §2.1091 – RF EXPOSURE

4.1 Applicable Standard

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

4.2 MPE Prediction

Prediction of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

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

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

Maximum peak output power at antenna input terminal (dBm):	42.07(dBm)
Maximum peak output power at antenna input terminal (mW):	16106.456 (mW)
Predication distance (cm):	1050 cm
Predication frequency (MHz):	10500 (MHz)
Maximum Antenna Gain, typical (dBi):	29 (dBi)
Maximum Antenna Gain (numeric):	794.328 (numeric)
Power density of predication frequency at 200 cm (mW/cm^2):	0.923 (mW/cm^2)
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	1.00 (mW/cm^2)

4.3 Result

The High power density of predication frequency at 1050 cm is 0.923 mW/cm^2 for a 29 dBi antenna which was according to calculation under the MPE limit for uncontrolled exposure of 1.00 mW/cm^2.

5 FCC §2.1046 & §90.205 – POWER OUTPUT

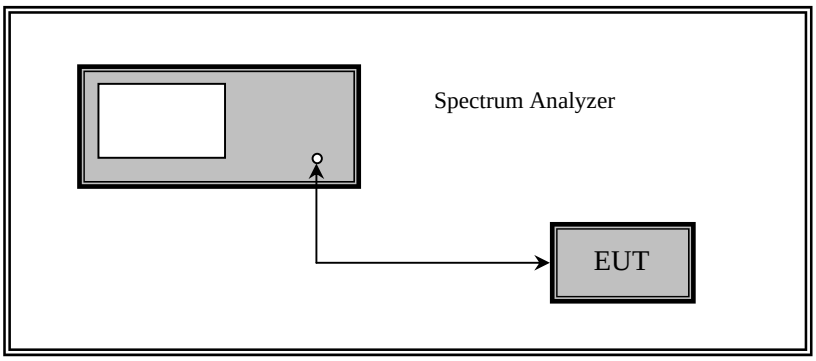
5.1 Applicable Standard

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

© 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 manufactu'er's rated output power for the particular transmitter specifically listed on the authorization.

5.2 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.



5.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

5.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.1-101.8kPa

The testing was performed by Jack Liu from 2010-07-20 to 2010-07-21.

5.5 Measurement Result

Minimum Standard: +/- 1.0 dB

Power Setting	Frequency (MHz)	Rated Power (dBm)	Conducted Output Power (dBm)	Delta (dB)
Low	10500	30.00	30.11	0.11
High	10500	42.00	42.07	0.07

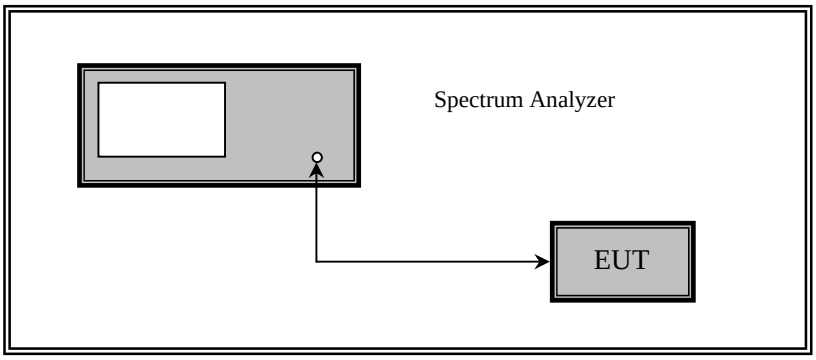
6 FCC §2.1049 – OCCUPIED BANDWIDTH

6.1 Applicable Standard

NA.

6.2 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.



6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

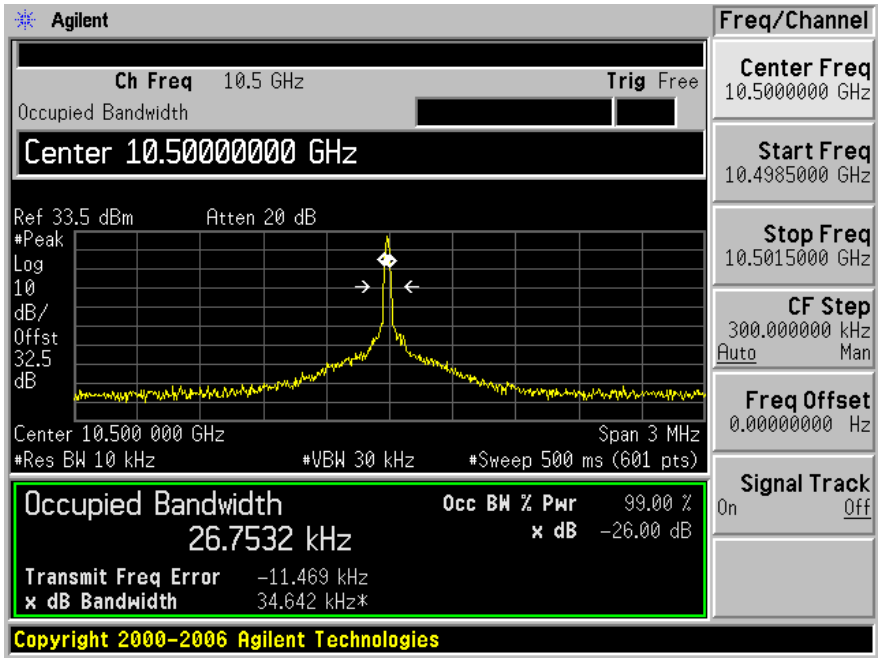
Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

6.4 Test Environmental Conditions

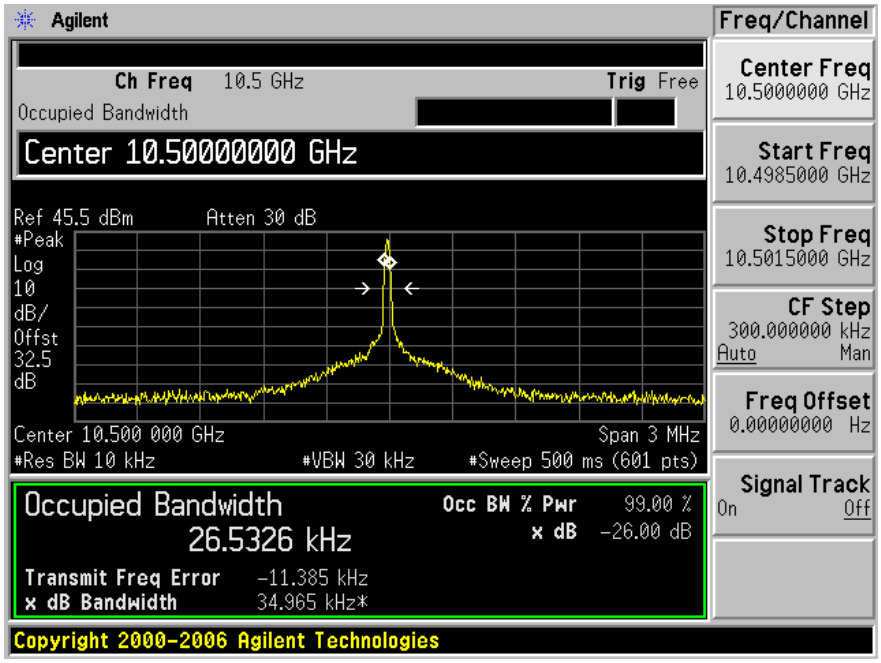
Temperature:	21~25 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.1-101.8kPa

The testing was performed by Jack Liu from 2010-07-20 to 2010-07-21.

Low Power Setting



High Power Setting



7 FCC §2.1051 & §90.210 – SPURIOUS EMISSIONS AT ANTENNA TERMINALS

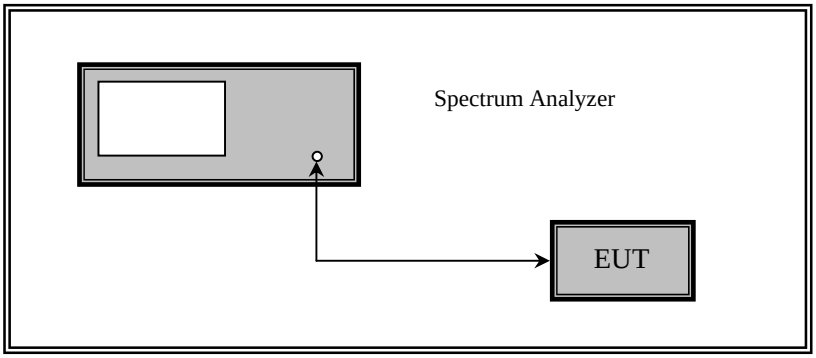
7.1 Applicable Standard

§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.

7.2 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.



7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

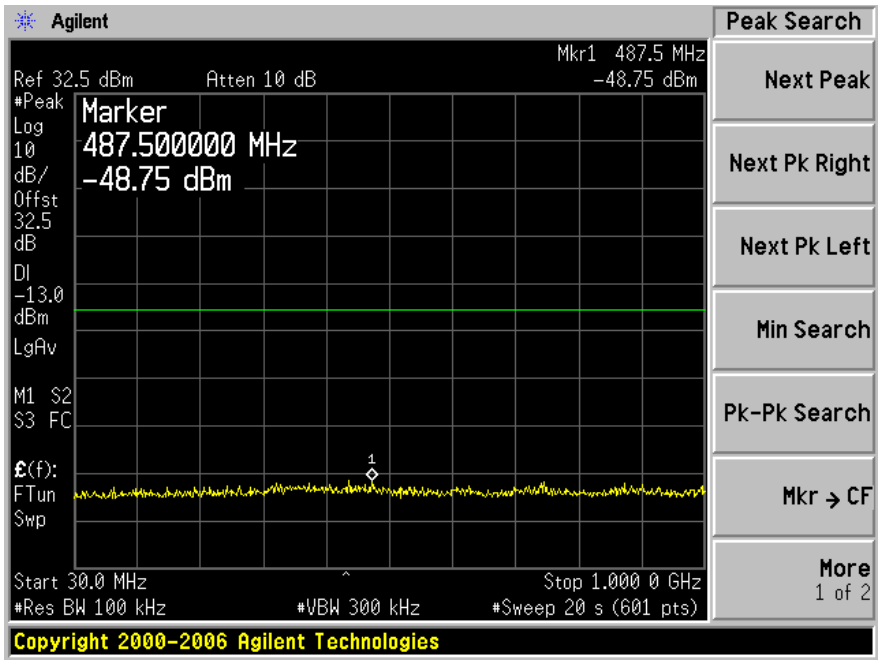
7.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.1-101.8kPa

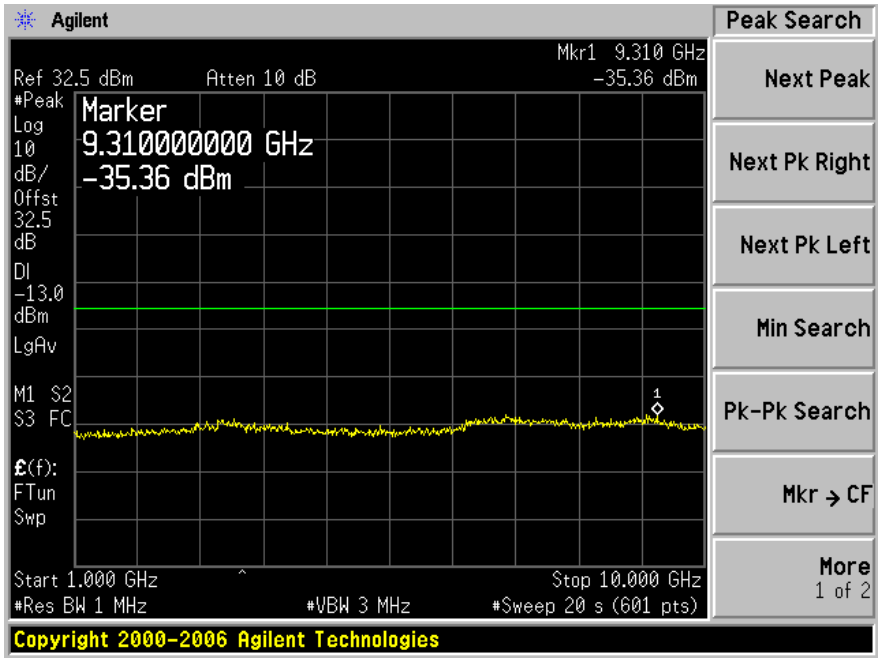
The testing was performed by Jack Liu from 2010-07-20 to 2010-07-21.

Low Power Setting:

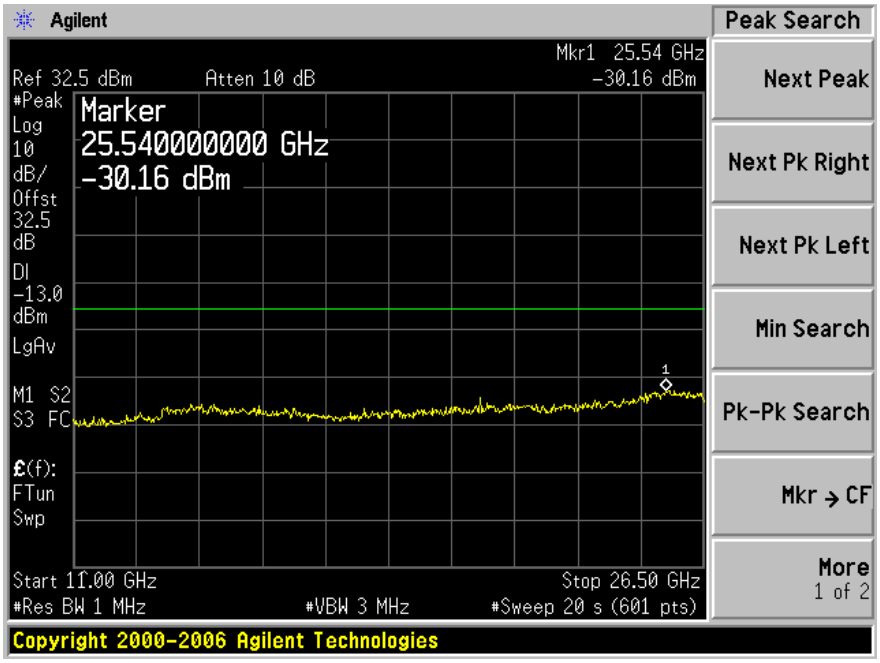
30 MHz~1 GHz



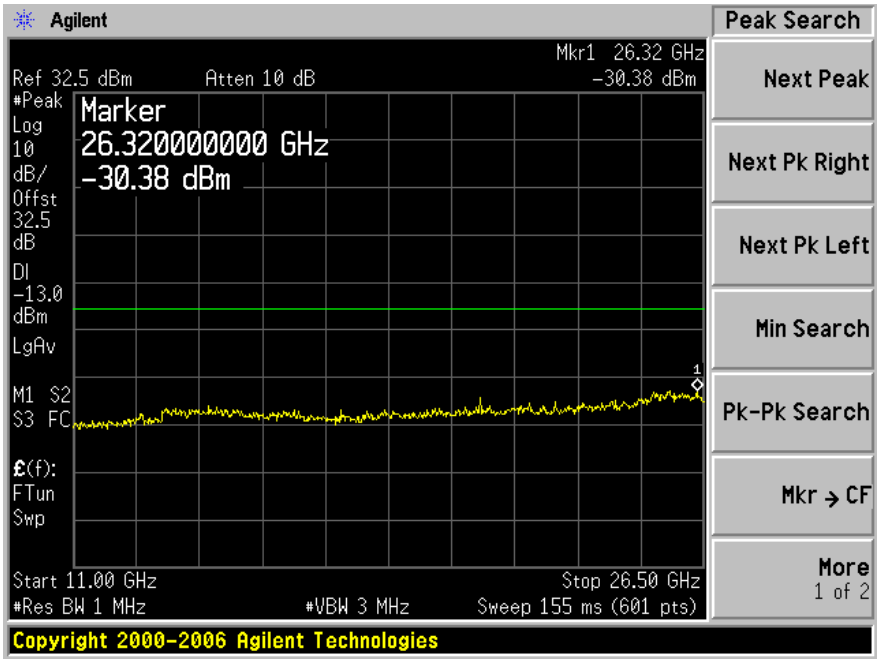
1 GHz~10 GHz



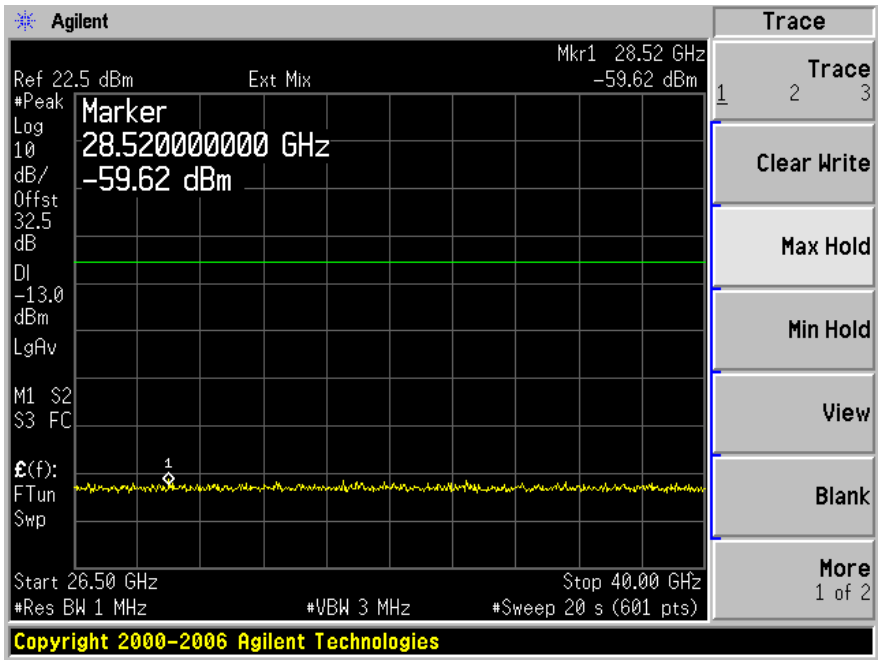
10 GHz~11 GHz



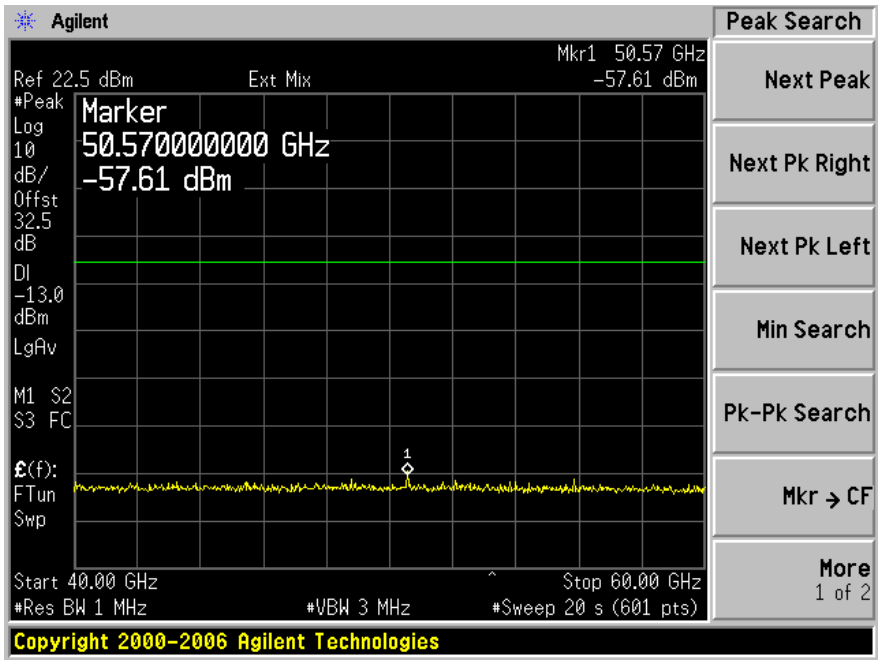
11 GHz ~26.5 GHz



26.5 GHz~40 GHz

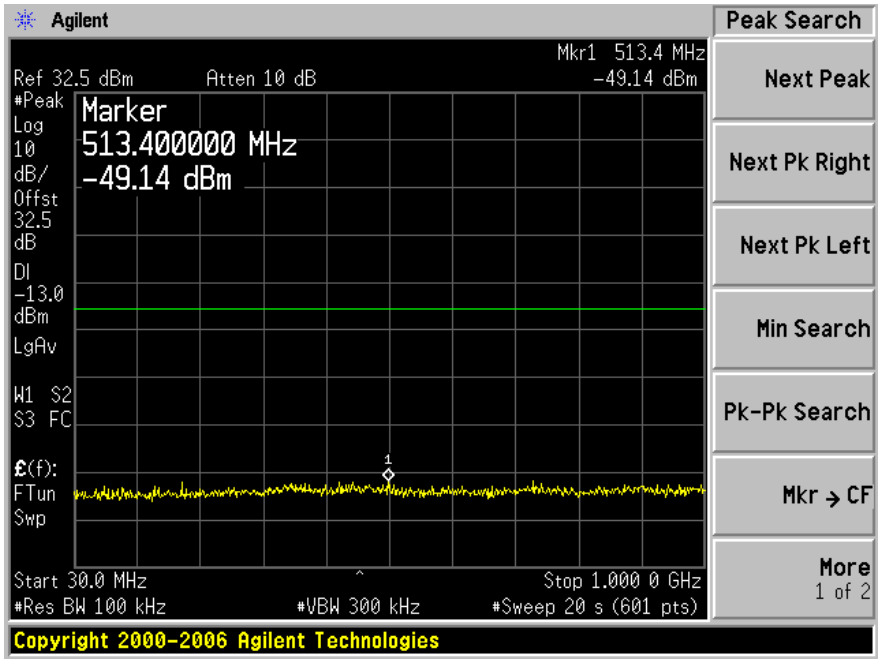


40 GHz~60 GHz

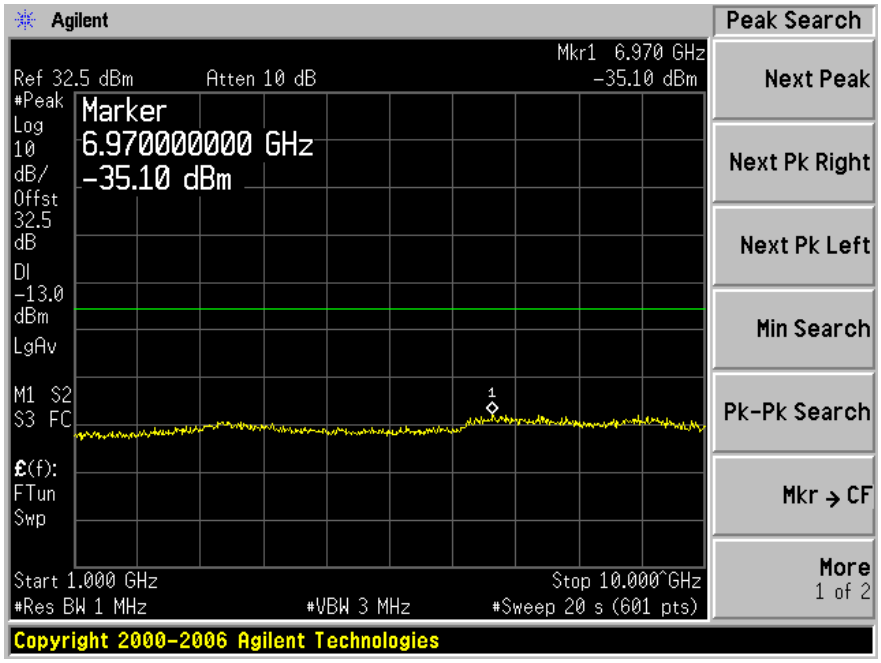


High Power Setting:

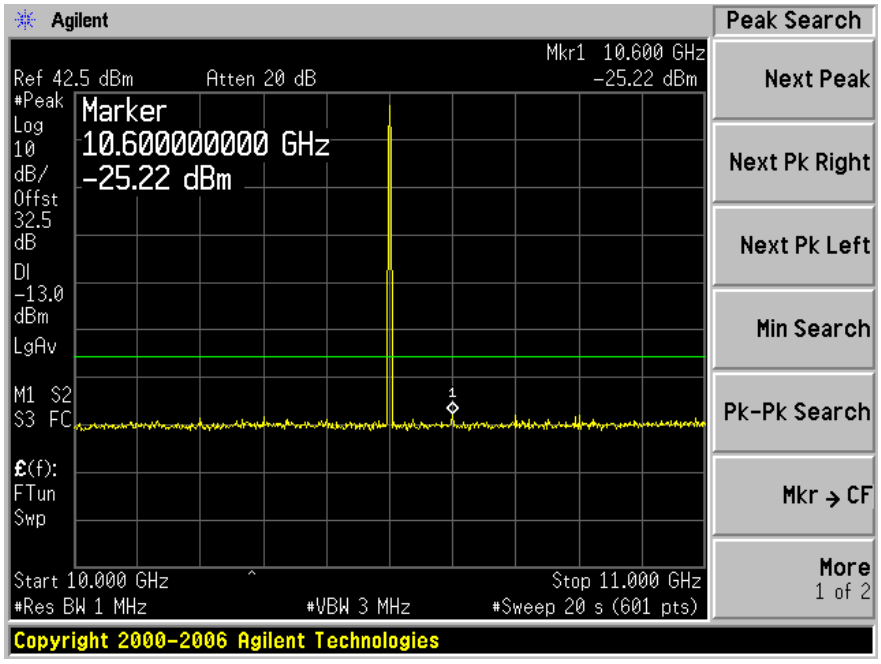
30 MHz~1 GHz



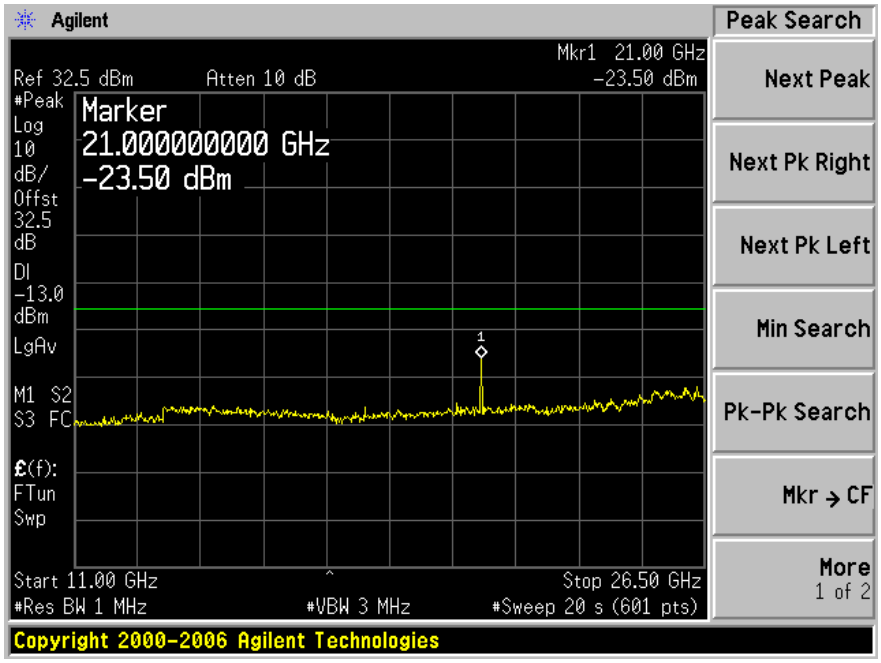
1 GHz~10 GHz



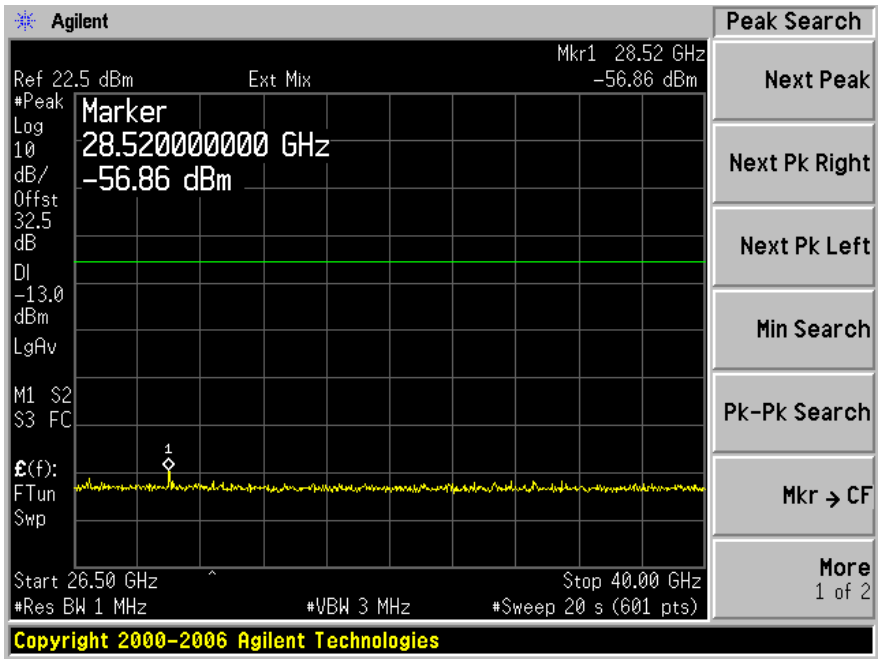
10 GHz~11 GHz



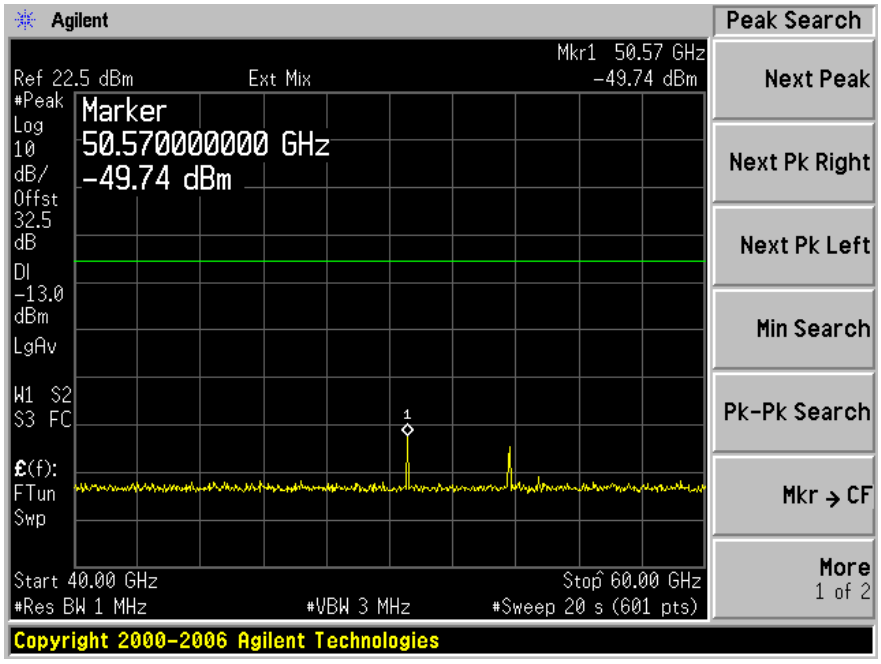
11 GHz ~26.5 GHz



26.5 GHz~40 GHz



40 GHz~60 GHz



8 FCC §2.1053 & §90.210 – FIELD STRENGTH OF SPURIOUS RADIATION

8.1 Applicable Standard

FCC §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.

8.2 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 (TXpwr in Watts/0.001) – the absolute level

8.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Number	Calibration Dates
Rohde & Schwarz	EMI Test Receiver	ESCI	100337	2010-03-24
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2009-05-05
Hewlett Packard	Pre amplifier	8447D	2944A06639	2009-06-05
A.R.A Inc	Horn antenna	DRG-1181A	1132	2009-10-27
HP	Pre Amplifier	8449B	3147A00400	2010-02-01
Wise Wave	Antenna, Horn	ARH-4223-02	10555-02	2009-05-16
Wise Wave	Pre, Amplifier	ALN-22093530-01	12263-01	2010-05-11
Wise Wave	Antenna, Horn	ARH-2823-02	10555-01	2009-05-16
Wise Wave	Pre, Amplifier	ALN-33144130-01	11424-01	2010-05-11

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

8.4 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.1-101.8kPa

**The testing was performed by Jack Liu from 2010-07-20 to 2010-07-21.*

8.5 Test Results Summary

High Power Setting:

-22.92 dB at 21000 MHz in the Horizontal polarization

Low Power Setting:

-30.63 dB at 21000 MHz in the Horizontal Polarization

8.6 Measurement Result

TX Spurious Emission Primary scan 30 MHz - 60 GHz

High Power (16 W)

Indicated Frequency (MHz)	S.A. Amp. (dBuV)	Turntable Azimuth Degree	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
			Height (cm)	Polar H/V	Frequency (MHz)	S.G. Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
21000	52.88	188	150	V	21000	-53.42	22	4.83	-36.25	-13	-23.25
21000	51.88	170	150	H	21000	-53.09	22	4.83	-35.92	-13	-22.92

Low Power (1 W)

Indicated Frequency (MHz)	S.A. Amp. (dBuV)	Turntable Azimuth Degree	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
			Height (cm)	Polar H/V	Frequency (MHz)	S.G. Level (dBm)	Ant. Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
21000	44.43	192	181	V	21000	-61.87	22	4.83	-44.7	-13	-31.7
21000	44.17	170	150	H	21000	-60.8	22	4.83	-43.63	-13	-30.63

9 FCC §2.1055 & §90.213 – FREQUENCY STABILITY

9.1 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.

9.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09
ESPEC	Oven, Temperature	ESL-4CA	18010	N/A

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

9.3 Test Environmental Conditions

Temperature:	21~25 °C
Relative Humidity:	30~35 %
ATM Pressure:	101.1-101.8kPa

The testing was performed by Jack Liu from 2010-07-20 to 2010-07-21

9.4 Measurement Result

Frequency Stability vs. Temperature

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

Test Condition		Ref Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (ppm)	Limit (ppm)
Voltage (Vac)	Temperature (°C)				
120.0	-30	10500.008000	10499.875	12.6667	15.00
120.0	-20	10500.008000	10499.883	11.9048	15.00
120.0	-10	10500.008000	10499.883	11.9048	15.00
120.0	0	10500.008000	10499.983	2.38095	15.00
120.0	10	10500.008000	10500.008	0	15.00
120.0	20	10500.008000	10500.008	0	15.00
120.0	30	10500.008000	10500.007	0.09524	15.00
120.0	40	10500.008000	10499.983	2.38095	15.00
120.0	50	10500.008000	10499.881	12.0952	15.00

Frequency Stability vs. Extreme Voltage

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

Test Condition		Ref Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (ppm)	Limit (ppm)
Voltage (Vac)	Temperature (°C)				
102.0	20	10500.008000	10499.880	12.1905	15.00
138.0	20	10500.008000	10500.008	0	15.00