

FCC PART 15.225

EMI MEASUREMENT AND TEST REPORT

For

ViVotech, Inc.

451 El Camino Real,
Santa Clara, CA 95050

FCC ID: Q5530XXP

2004-01-15

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Point-of-Sale Terminal Adapter
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Report Number: R0311052	
Test Date: 2003-11-03	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *ViVotech, Inc.* 's product, model *ViVOpay3000;ViVOpay3232* or the "EUT" as referred to in this report is a point-of sales terminal adapter. The EUT measures approximately 5.0" L x 3.9" W x 4.8" H and empowers most of the 30 million existing merchant POS systems worldwide to accept contactless credit/debit chip cards. Contactless radio-frequency (RF) technology provides quick and secure credit and debit card payments, ensuring increased transaction security compared with existing magnetic card technology and offering customers a faster and more convenient checkout process.

** The test data gathered are from production samples, serial number: 003, provided by the manufacturer.*

Objective

This test report is prepared on behalf of *ViVotech, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts A, B, and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules, Part 15, sec 15.35, sec 15.209 and sec 15.225 for radiated emission, conducted emission and frequency stability.

Related Submittal(s)/Grant(s)

No Related Submittals.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 10 meters.

Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2001.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

Interface Ports and Cabling

Cable Description	Length (M)	From	To
Ethernet Cable	10	RJ45 Port / EUT	Data Base Server
Shield Cable	10	Strip Port /EIT	POS

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2001.

EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components.

Special Accessories

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

Schematics and Block Diagram

Please refer to Appendix D.

Equipment Modifications

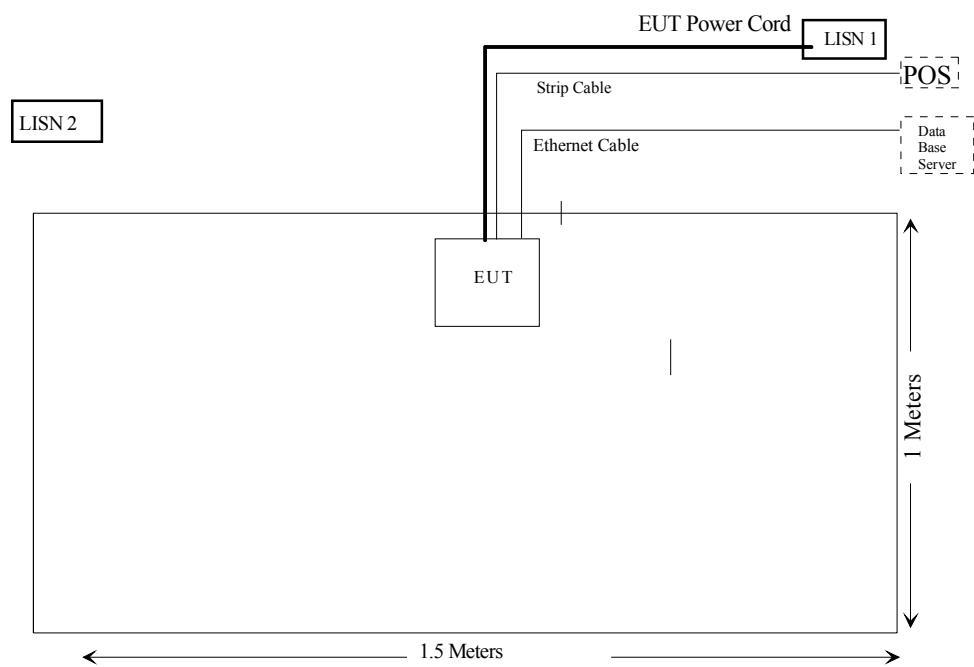
No modifications were made to the EUT.

Test Setup Configuration



EUT

Test Setup Block Diagram



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested, serial number: 003.

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§ 15.35 §15.205 § 15.209 § 15.225	Radiated Emission	Compliant
§15.207	Conducted Emission	Compliant
§15.225(c)	Frequency Stability	Compliant

§15.35, §15.205, §15.209, §15.225 - RADIATED EMISSION TEST

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in 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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

EUT Setup

The radiated emission tests were performed in the open area 10-meter test site, using the setup accordance with the ANSI C63.4-2001. The specification used was the FCC Class B limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33, the EUT was tested to 1 GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

<u>Frequency Range</u>	<u>RBW</u>	<u>Video B/W</u>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8568B	2601A02165	2003-07-03
HP	Amplifier	8447E	2944A10187	2003-09-23
HP	Quasi-Peak Adapter	85650A	3019A05393	2003-06-13
EMCO	Biconical Antenna	3110B	9309-1165	2003-10-11
EMCO	Log Periodic Antenna	3146	2101	2003-10-11
COM-Power	Loop Antenna	AL-130	17043	2003-04-03

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

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dB μ V of specification limitation), and are distinguished with a "QP" in the data table.

The EUT was operating at normal to represent worst case during final qualification test. Therefore, this configuration was used for final test data recorded in the table(s) listed under section 4.7 of this report.

5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain and §15.31 correction from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain} - \text{§15.31 correction}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

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

Summary of Test Results

According to the final data in following table, the EUT complied with the FCC 15.225, FCC 15.209 and FCC 15.35 standards, and had the worst margin of:

-12.8 dB μ V at 14.37 MHz in the Vertical polarization

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100mbar

Radiated Emissions Test Result Data

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15.225		
Frequency MHz	Reading dB μ V		Angle Degree	Height Meter	Polar H/V	Antenna dB μ V/m	Cable dB	Amp. dB	15.31 Correction dB	Reading dB μ V	Limit dB μ V
13.56	81.5	90	1.5	V	10.8	1.5	26.4	20.0	47.4	80*	-32.6
13.56	77.9	90	1.5	H	10.8	1.5	26.4	20.0	43.8	80*	-36.2
14.37	50.8	180	1.2	V	10.8	1.5	26.4	20.0	16.7	29.5	-12.8
15.59	49.1	180	1.5	V	10.8	1.5	26.4	20.0	15	29.5	-14.5
81.2	35.4	60	1.2	V	9.6	2.7	27.5	0.0	17.3	40	-22.7
54.6	32.7	210	1.5	V	10.5	2.0	27.3	0.0	15.2	40	-24.8

* Fundamental Frequency

Compliance Statement:

According to FCC Part 15, at 3-meter distance the emission from an intentional radiator shall not exceed the field strength level 40 dB μ V/m within 30-88 MHz, 43.5 dB μ V/m within 88-216 MHz, 46dB μ V/m within 226-960 MHz, 54dB μ V/m above 960 MHz. The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The levels of unwanted emission of this device were too low to be detected. This device was compliant with the FCC Part 15.

Note: The field strengths of emissions below 30MHz are tested by the loop antenna at 10 meter distance. Data corrected for test distance is in accordance with FCC 15.31 40dB/Decade.

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Refer to statement below for compliance.

“The antenna for this device is an integral antenna that the end user cannot access. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description”.

Antenna Connected Construction

This device has an integral antenna; it is a permanently attached antenna.

§15.207- CONDUCTED EMISSIONS TEST

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ± 2.4 dB.

EUT Setup

The measurement was performed at the shielded room, using the same setup per ANSI C63.4 - 2001 measurement procedure. The specification used was the FCC15 Class B limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

Spectrum Analyzer Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30Mhz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial LISN	ESH2-Z5	871884/039	2003-03-28
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2003-05-06

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

Test Procedure

During the conducted emission test, the power cord of host PC was connected to the auxiliary outlet of the first LISN. Other support equipment power cords were connected to the second LISN. Maximizing procedure was also performed on the highest emissions to ensure EUT compliance using all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dB μ V of specification limits). Quasi-peak readings are distinguished with a "QP".

Summary of Test Results

According to the data in following table, the EUT complied with the FCC15 Class B Conducted margin for a Class B device, and these test results is deemed as satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

-16.7 dB μ V at 0.23 MHz in the Line mode

Environmental Conditions

Temperature:	25° C
Relative Humidity:	52%
ATM Pressure:	1100mbar

Conducted Emissions Test Data

Frequency MHz	LINE CONDUCTED EMISSIONS			FCC 15 CLASS B	
	Amplitude dB μ V	Detector QP/Ave/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
0.23	36.3	Ave	Line	53	-16.7
0.23	41.6	QP	Line	63	-21.4
0.66	28.8	QP	Line	56	-27.2
0.66	18.8	Ave	Line	46	-27.2
13.50	32.8	QP	Neutral	60	-27.2
0.22	24.9	Ave	Neutral	53	-28.1
0.22	33.3	QP	Neutral	63	-29.7
21.90	30.1	QP	Line	60	-29.9
21.90	19.7	Ave	Line	50	-30.3
1.38	14.5	Ave	Neutral	46	-31.5
1.38	24.2	QP	Neutral	56	-31.8
13.50	17.0	Ave	Neutral	50	-33.0

Plot of Conducted Emissions Test Data

Plot of Conducted Emissions Test Data is presented hereinafter as reference.

Bay Area Compliance Laboratory Corp
Class B

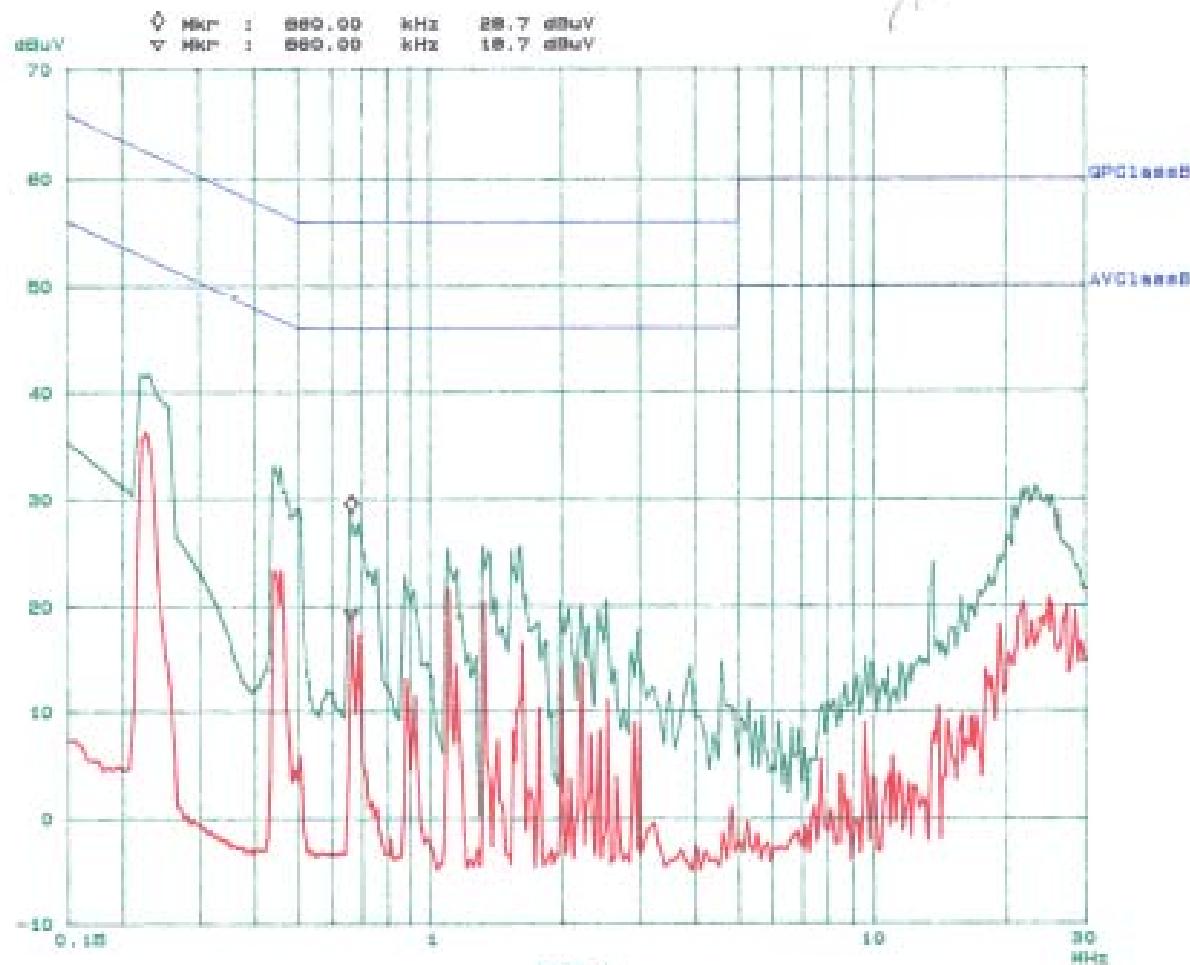
07. Nov 03 10:20

BUT: VivoPay 2000/3200 Reader
Manuf: Vivo tech
Op Cond: Normal
Operator: Benjamin
Comments: L

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	N-Times	Avg Int	Presses
100k	1M	50k	80k	OP+AV	20ms	10dBBLN	OPF
1M	3M	100k	80k	OP+AV	1ms	10dBBLN	OPF
3M	80M	100k	80k	OP+AV	1ms	10dBBLN	OPF

Final Measurement: x OP / + AV
Hesse Time: 1 s
Subranges: 25
Acc Margin: 6dB



Bay Area Compliance Laboratory Corp
Class B

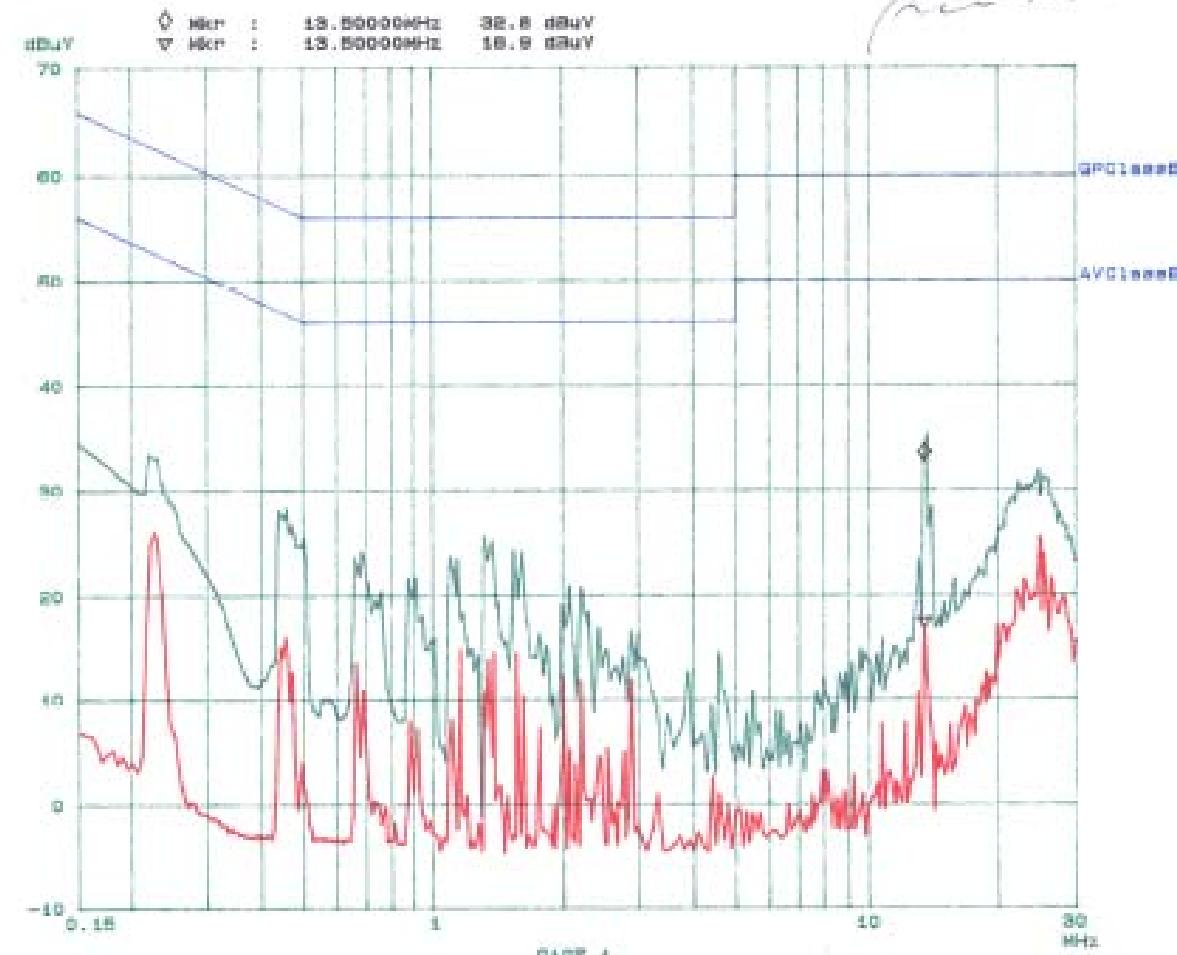
07. Nov 03 10:48

Unit: VivoPay 3000/3000 Reader
Manuf: Vivo tech
Op. Cond: Normal
Operator: Benjamin
Comment: N

Scan Settings (2 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	W-TIME	ATTEN	PREAMP
150k	1M	10k	8K	GP+AV	20ms	10dBm	OFF
1M	2M	10k	8K	GP+AV	1ms	10dBm	OFF
2M	8M	100k	8K	GP+AV	1ms	10dBm	OFF

Final Measurement: x GP / + AV
Meas. Time: 1 s
Subranges: 25
Acc. Margin: 6dB



§15.225(c) - FREQUENCY STABILITY MEASUREMENT

Standard Applicable

According to FCC §15.225(c), the frequency tolerance of the carrier signal shall be maintained within \pm 0.01% of the operating frequency over a temperature variation of -20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure

Frequency stability versus environmental temperature

The equipment under test was connected to an external AC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

Frequency Stability versus Input Voltage

At room temperature ($25\pm5^{\circ}\text{C}$), an external variable AC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8565EC	2517A0160	2003-01-22
Tenny	Temperature Chamber	Versa Tenna	N/A	2003-04-23

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

Test Results

Reference Frequency: 13.5600 MHz			
Environment Temperature (°C)	Power Supplied (Vac)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
50	110V	13.5606	44.2
40	110V	13.5606	44.2
30	110V	13.5605	36.8
20	110V	13.5605	36.8
10	110V	13.5605	36.8
0	110V	13.5605	36.8
-10	110V	13.5604	29.4
-20	110V	13.5604	29.4

Frequency Stability Versus Input Voltage

Power Supplied (Vac)	Reference Frequency: 13.5600 MHz					
	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	MHz	PPM	MHz	PPM	MHz	PPM
126.5V	13.5606	44.2	13.5608	59	13.5608	59
110V	13.5602	14.7	13.5603	22.12	13.5602	14.7
93.5V	13.5608	59	13.5607	51.6	13.5608	59

Conclusion: The EUT complied with the applicable Frequency Stability Limits.