



FCC PART 15.225  
MEASUREMENT AND TEST REPORT

For

**El-Tech Inc. Co., Ltd.**

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**FCC ID: U9LCFRF-XYZ**

<b>Report Type:</b> <input checked="" type="checkbox"/> Original Report	<b>Product Type:</b> RFID Transceiver (Reader/Writer)
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## GENERAL INFORMATION

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

This measurement and test report has been compiled on behalf of *El-Tech Inc. Co., Ltd.* and their product model: CFRF-XYZ, FCC ID: *U9LCFRF-XYZ* (referred to as the EUT in the rest of this report) which is a Radio-Frequency Identification Controller that provides read/write RFID data transmission for item-level tracking and material handling applications. The controller is designed for deployment within the industrial automation industry and operates at 13.56 MHz.

The EUT can power RFID tag(s) via inductive coupling, transmit data to a RFID tag(s) via 10% ASK or 100 gap modulation and receive data from a tag(s) via field load modulation (Backscatter).

The reader may be used with different antennae for a variety of tag detection patterns. A host, such as a computer or other device can be used to control the RF card reader. Various commands such as reading, writing and configuration may be sent to the reader depending on the needs of the user. After a command is received, the reader will perform all the air-interface operations to communicate with the tag for errors, packetized into the selected serial protocol and sent the host.



*Additional Photos in Exhibit C*

## Product Features

- Supports communication interface protocols: Subnet16™, Commercial TCP/IP, Ethernet/IP™ and Modbus® TCP
- Interface Options: RS232, RS422, RS485, USB and Ethernet
- Internationally recognized ISM frequency of 13.56 MHz.
- 8 LED status indicators for power, COM Activity, RF Activity, Subnet16 Node ID, system diagnostics and error codes
- Flash memory for software upgrades

## Mechanical Description

The *El-Tech Inc. Co., Ltd.* product model: CFRF-XYZ, FCC ID: *U9LCFRF-XYZ* or the "EUT" as referred to in this report is a RFID Transceiver. The EUT measures approximately 85 mm (L) x 42 mm (W) x 3 mm (H), and weighs approximately 10g.

*\* The test data gathered is from production samples, serial number: B1145, assigned by test laboratory.*

## Objective

This measurement and test report is prepared on behalf of *El-Tech Inc. Co., Ltd.* in accordance with Part 2, Subpart J, and Part 15 Subpart C of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules, Part 15, sec 15.35, sec 15.203, sec 15.205, sec 15.207, sec 15.209 and sec 15.225.

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

No Related Submittals.

## Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, 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 measurements were performed at Bay Area Compliance Laboratory, Corp.

## 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 values range from  $\pm 2.0$  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.

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

## Test Facility

The test site used by BACL Corp. to collect radiated and conducted 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/ts/htdocs/210/214/scopes/2001670.htm>

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## SYSTEM TEST CONFIGURATION

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### Justification

The EUT was configured for testing according to ANSI C63.4-2003.

### EUT Exercise Software

An RFID simulation program was provided by the customer.

### Special Accessories

N/A

### Equipment Modifications

No modifications were made to the EUT

### Remote Support Equipment

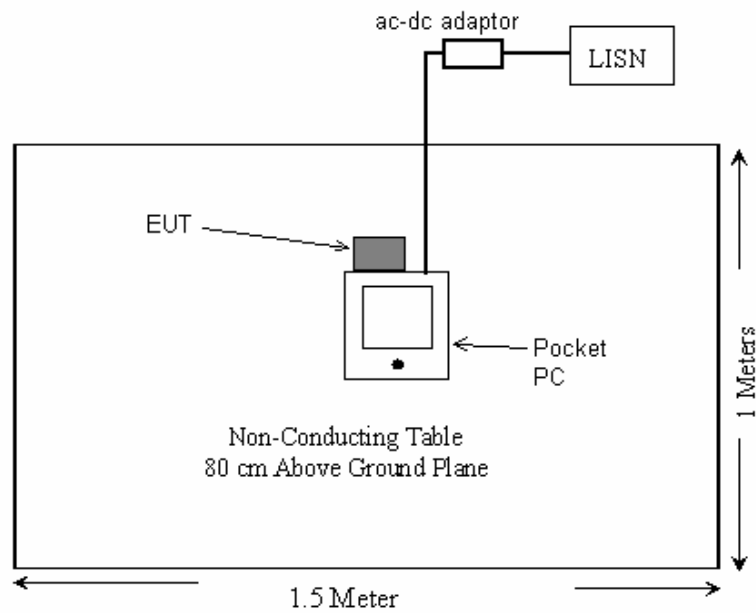
N/A

### Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Pocket PC	AXIM X5 HC01U	TW-0P0372-70161-34E-A1W3
EI-tech	RFID tag	N/A	N/A

### Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Dell	AC-DC adaptor	ADP-13CB A	CN-0J1361-48661-34A-02PB

**Test Setup Block Diagram**



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Results
§15.203	Antenna Requirement	Compliant
§ 15.35 § 15.205 § 15.209 § 15.225(a)(b)(c)(d)	Radiated Emission	Compliant
§ 15.207	Conducted Emission	Compliant
§15.225(e)	Frequency Stability	Compliant

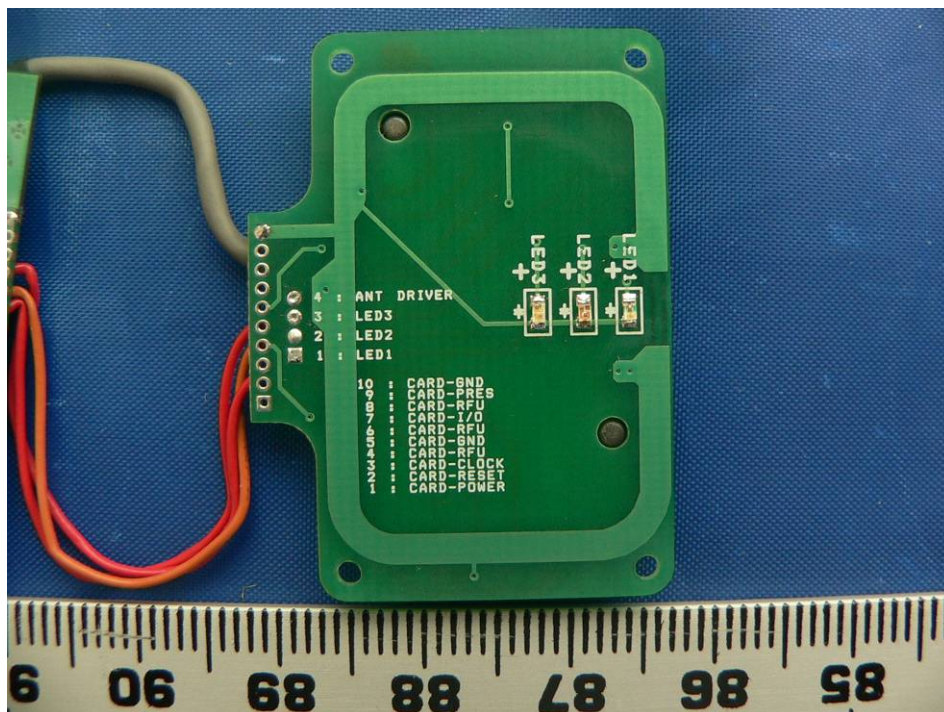
## § 15.203 – ANTENNA REQUIREMENT

### Applicable Standard

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### Applicable Standard

**Result:** Compliant, the antenna is integrated into the construction of the PCB and cannot be accessed, modified, or replaced by the end user without resulting in permanent damage to the device. Please see photo below for details.



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

### Applicable Standard

§15.225 (a) the field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

§15.225 (b) within the band 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

§15.225 (c) Within the band 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

§15.225 (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

### EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

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

The EUT was placed on the center of the back edge on the test table.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
HP	Amplifier, Pre (.1~1300MHz)	8447D	2944A10198	2007-01-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950 K03	100337	2007-03-08
Com-Power	Active Loop Antenna (10KHz-30MHz)	AL-130	17043	2006-03-16**
Sunol Sciences	30MHz~2GHz Antenna	JB1	A03105-3	2007-03-15

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

\*\* 2 year calibration cycle

## 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 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 following table of this report.

## Corrected Amplitude & Margin Calculation

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

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

## Environmental Conditions

Temperature:	22.1 °C
Relative Humidity:	49 %
ATM Pressure:	101.7 kPa

\* Testing was performed by Oscar Au 2007-05-03.

## Summary of Test Results

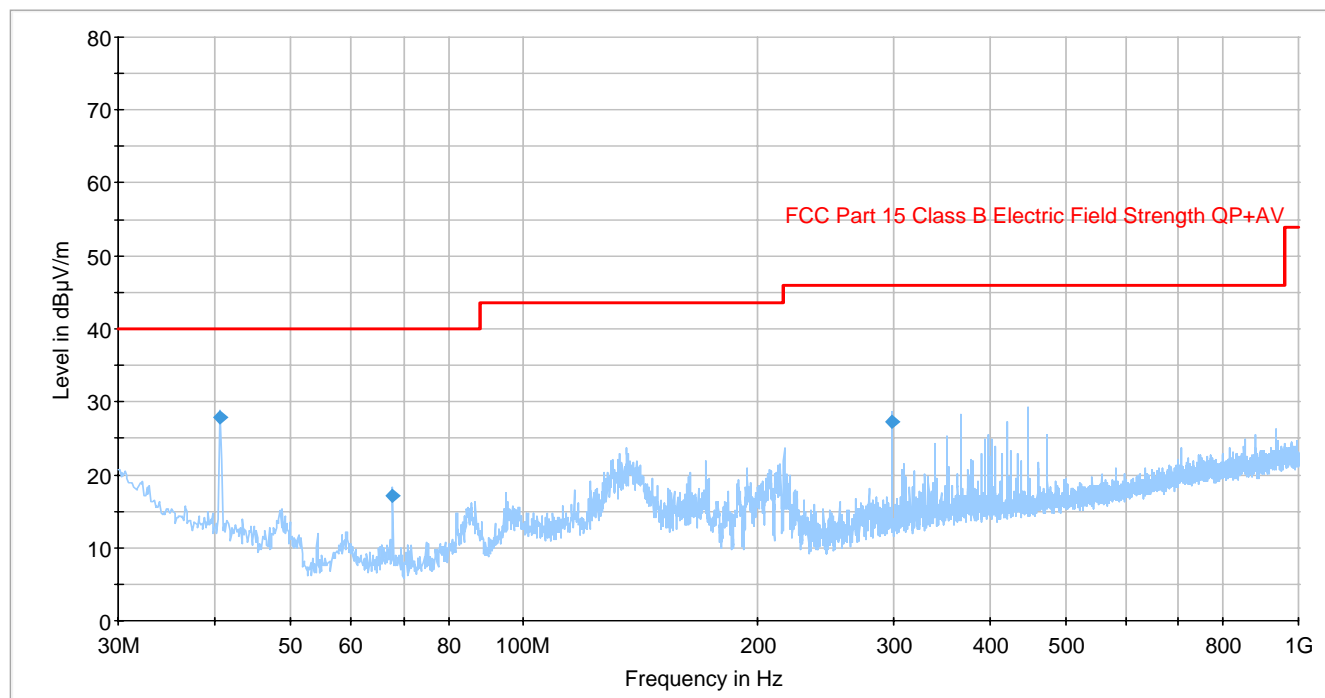
According to the data in the following table and plot, the EUT complied with FCC Title 47, Part 15, Subpart C, section 15.225. The EUT measurement results were outside the measurement uncertainty of  $\pm 4.0$  dB, and had the worst margin reading of:

**-6.5 dB at 40.61 MHz in the Vertical polarization**  
**-12.1 dB at 40.67 MHz in the Horizontal polarization**

**Radiated Emissions Test Result Data @ 3meter**

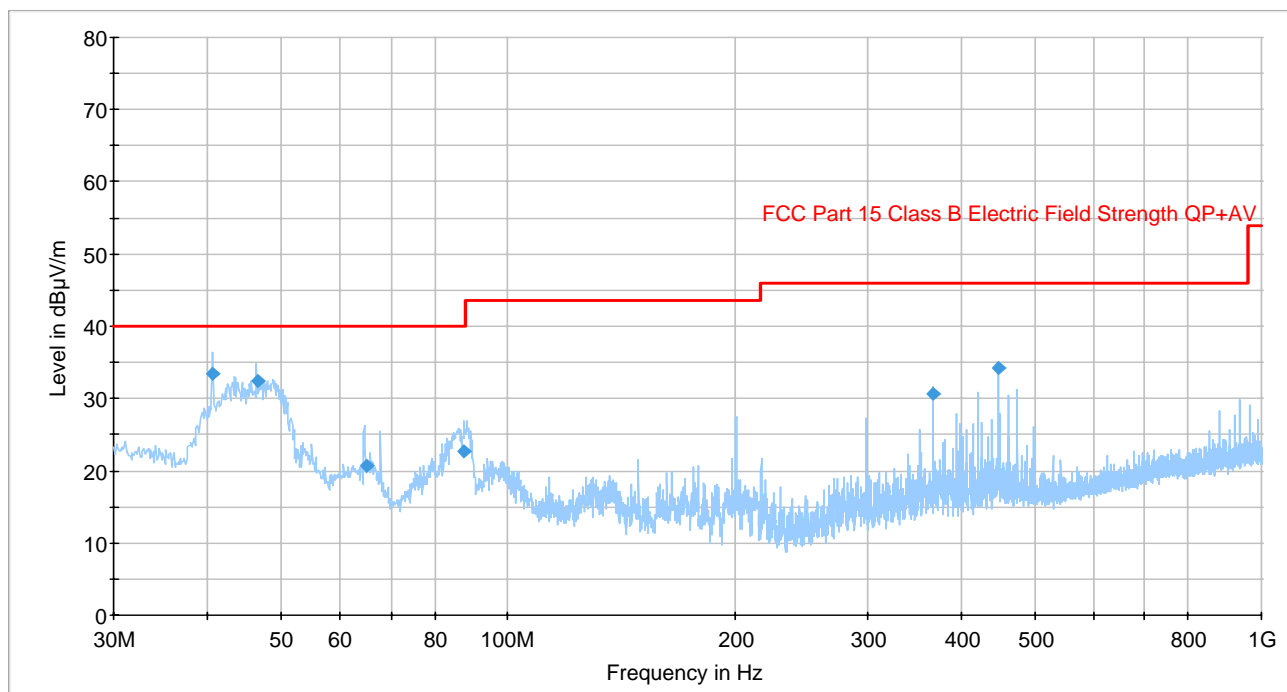
§15.225 (d)

30-1000MHz Horizontal Polarization



Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Limit (dBμV/m)	Margin (dB)
40.67	27.9	318.9	H	170	40	-12.1
298.57	27.3	148.6	H	0	46	-18.7
67.77	17.2	205.8	H	0	40	-22.8

## 30-1000MHz Vertical Polarization



Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Limit (dBμV/m)	Margin (dB)
40.61	33.5	101.8	V	279	40	-6.5
46.48875	32.4	112.8	V	12	40	-7.6
447.46375	34.3	111.6	V	0	46	-11.7
366.105	30.7	141.9	V	295	46	-15.3
87.6525	22.6	117.7	V	279	40	-17.4
64.97625	20.6	102	V	12	40	-19.4

For §15.225 (a) and §15.225 (d):

Frequency (MHz)	Reading (dBuV)	Turntable Azimuth Degrees	Antenna Height (m)	Polar H / V	Electric Antenna Factor (dB)	Cable Loss (dB)	Distance Factor (dB)	Corrected Reading (dBuV/m)	Limit at 30m Limit (dBuV/m)	Part 15.225 Margin (dB)
27.1200	23.4	180	1.1	V	10.0	0.1	40.0	-6.6	29.5	-36.0
13.5600	46.2	180	1.0	V	11.4	0.1	40.0	17.6	84	-66.4

For §15.225 (b) and §15.225 (c):

No emissions were detected that were within 20dB of the specification limit.

## § 15.207 – CONDUCTED EMISSIONS TEST

### 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 EUT was placed on the test table and connected to the DC power supply, which connected to 120Vac/60Hz power source.

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

### Test Equipment

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950 K03	100337	2007-03-08
Solar Electronics Co.	LISN	9252-50-R-24N	0511213	2006-07-07

\* **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 host system was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with 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 of specification limits). Quasi-peak readings are distinguished with a "QP".

### Summary of Test Results

According to the data in the following tables and plots, the EUT complied with the FCC 15 Conducted margin for Class B devices, and these test results are deemed as satisfactory evidence of compliance with the worst margin reading of:

**-14.6 dB at 0.3480 MHz in the Line conductor mode**

### Environmental Conditions

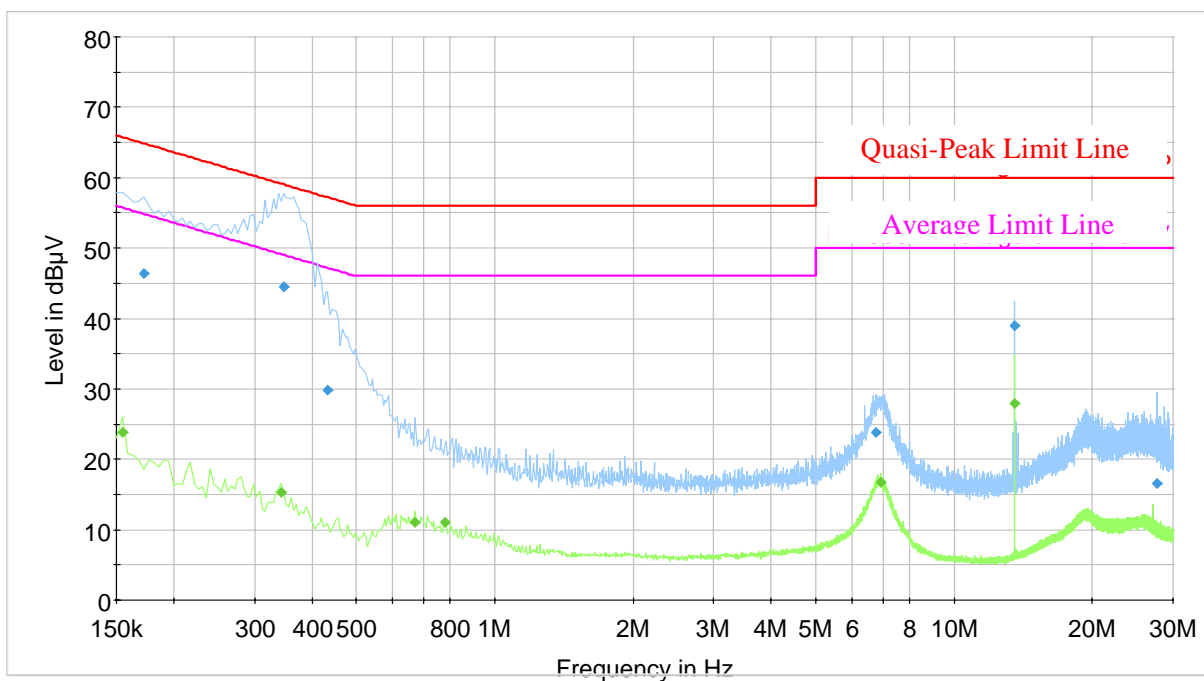
Temperature:	22.5 °C
Relative Humidity:	48 %
ATM Pressure:	102.1 kPa

*Testing was performed by Oscar Au on 2007-05-03.*



## Conducted Emissions Test Data

### Line

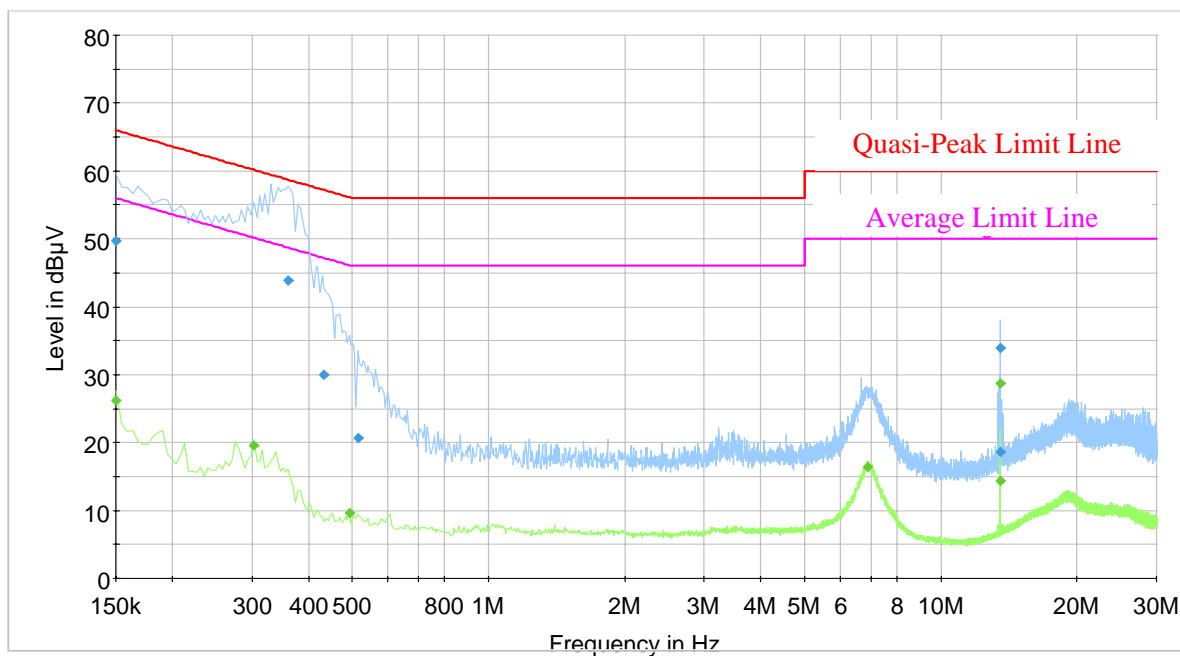


### QP Measurements

Frequency (MHz)	Quasi Peak (dBμV)	Line	Limit (dBμV)	Margin (dB)
0.348000	44.4	L	59.0	-14.6
0.172500	46.4	L	64.8	-18.4
13.560000	39.0	L	60.0	-21.0
0.433500	29.8	L	57.2	-27.3
6.747000	23.8	L	60.0	-36.2
27.618000	16.6	L	60.0	-43.4

### Average Measurements

Frequency (MHz)	Average (dBμV)	Line	Limit (dBμV)	Margin (dB)
13.555500	28.0	L	50.0	-22.0
0.154500	23.8	L	55.8	-32.0
6.940500	16.8	L	50.0	-33.2
0.343500	15.4	L	49.1	-33.8
0.672000	11.1	L	46.0	-34.9
0.780000	11.0	L	46.0	-35.0

**Neutral****QP Measurements**

Frequency (MHz)	Quasi Peak (dBμV)	Line	Limit (dBμV)	Margin (dB)
0.361500	43.8	N	58.7	-14.9
0.150000	49.7	N	66.0	-16.3
13.564500	33.9	N	60.0	-26.1
0.433500	30.0	N	57.2	-27.1
0.514500	20.6	N	56.0	-35.4
13.551000	18.6	N	60.0	-41.4

**Average Measurements**

Frequency (MHz)	Average (dBμV)	Line	Limit (dBμV)	Margin (dB)
13.564500	28.8	N	50.0	-21.2
0.150000	26.2	N	56.0	-29.8
0.303000	19.6	N	50.2	-30.5
6.891000	16.4	N	50.0	-33.6
13.551000	14.4	N	50.0	-35.6
0.492000	9.7	N	46.1	-36.4

## § 15.225(e) - FREQUENCY STABILITY MEASUREMENT

### Standard Applicable

According to FCC §15.225(e), 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 feed through 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 ( $25 \pm 5^\circ\text{C}$ ), an external variable DC 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	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-03-10
Tenney	Oven, Temperature	VersaTenn	12.222-193	2006-06-21
Hp	Counter, Microwave Frequency	5342A	2232A06380	2006-12-12

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

### Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	45 %
ATM Pressure:	101.6 kPa

Testing was performed by Oscar Au on 2007-05-04.

**Test Results**

<b>Condition Voltage (V)</b>	<b>Temperature (°C)</b>	<b>Reference Freq. (Hz)</b>	<b>Measured Freq. (Hz)</b>	<b>Freq. Error (Hz)</b>	<b>Limit (Hz)</b>
120	-20	13560000	13560564	564	± 1356
120	-10	13560000	13560523	523	± 1356
120	0	13560000	13560488	488	± 1356
120	10	13560000	13560457	457	± 1356
120	20	13560000	13560125	125	± 1356
120	30	13560000	13559864	-136	± 1356
120	40	13560000	13559681	-319	± 1356
120	50	13560000	13560548	548	± 1356
102	20	13560000	13560354	354	± 1356
138	20	13560000	13560651	651	± 1356