Lab Code: 200167-0

FCC PART 15.225

EMI MEASUREMENT AND TEST REPORT

For

Escort Memory Systems

170 Technology Circle
Scotts Valley, California 95066

FCC ID: E36-COBALT-01

This Report Concerns:	Product Type:
☒ Original Report	RFID Reader / Writer

Test Engineer:	James Ma
Report No.:	R0601172
Report Date:	2006-07-27
Reviewed By:	Test Engineer: Daniel Deng
Prepared By:	Bay Area Compliance Laboratory Corporation 1274 Anvilwood Avenue Sunnyvale, CA 94089 Tel: (408) 732-9162 Fax: (408) 732 9164

Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP or any agency of the U.S. Government.

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

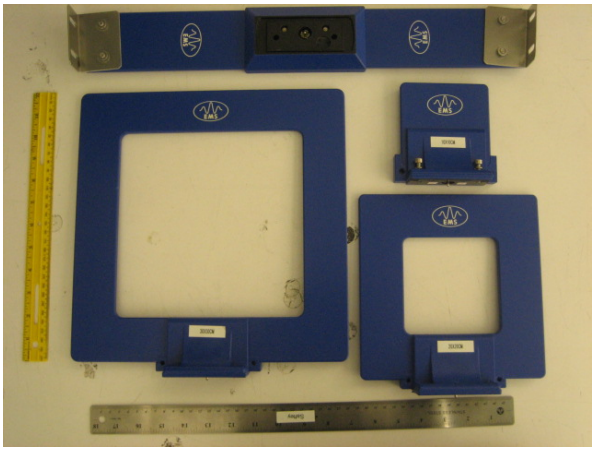
The *Escort Memory Systems'* product model: *Cobalt*, FCC ID: *E36-COBALT-01* is a feature-rich,, high frequency, Radio-Frequency Identification Controllers that provides read/write RFID data transmission and control solutions to shop floor, item-level tracking and material handling applications. The controller is designed to be compact, rugged and reliable, in order to meet and exceed the requirements of the industrial automation industry.

HF-CNTL-232-01 *HF-CNTL-422-01* *HF-CNTL-485-01*

HF-CNTL-USB-01 *HF-CNTL-IND-01*

HF-CNTL-(232, 422, 485, USB, IND)-01 Antennas

- ◇ HF-ANT-1010-01 10 cm x 10 cm
- ◇ HF-ANT-2020-01 20 cm x 20 cm
- ◇ HF-ANT-3030-01 30 cm x 30 cm
- ◇ HF-ANT-0750-01 07 cm x 50 cm



Additional Photos in Exhibit C

Product Features

- High performance, industrial, multi-protocol RFID controller
- Supports communication interface protocols: Subnet16™, Commercial TCP/IP, Ethernet/IP™ and Modbus® TCP
- Interface Options: RS232, RS422, RS485, USB and Ethernet
- Reads/Writes ISO 14443A, ISO 15693 and Philips® I•CODE® 1 tag ICs and compliant RFID tags
- Compatible with HMS-Series and LRP-Series RFID tags from Escort Memory Systems
- Supports Escort Memory Systems' ABx Fast & CBx™ command protocols
- Internationally recognized ISM frequency of 13.56 MHz.
- Rugged IP66 rated housing
- 8 LED status indicators for power, COM Activity, RF Activity, Subnet16 Node ID, system diagnostics and error codes
- Flash memory for software upgrades
- Auto configurable and software programmable

Mechanical Description

The *Escort Memory Systems* product model: Cobalt, FCC ID: *E36-COBALT-01*or the "EUT" as referred to in this report is a RFID Reader / Writer (HF-CNTL-422-01). The EUT measures approximately 101.6 mm (L) x 101.6 mm (W) x 38.1 mm (H). FCC ID: *E36-COBALT-01* covers *Cobalt HF* models *HF-CNTL-232-01, HF-CNTL-422-01, HF-CNTL-485-01, HF-CNTL-USB-01, and HF-CNTL-IND-01* wherein all models are identical in components and function, the difference between them being interface ports as detailed in Exhibit B of this report. Each model is designed to function with one of four antennas distributed by Escort Memory Systems. For the purpose of these tests HF-CNTL-422-01 was randomly chosen to represent the six, and was outfitted with antenna HF-ANT-3030-01 to represent the highest gain (worst case) configuration.

** The test data gathered is from production samples, serial number: 06A0397, provided by the manufacturer.*

Objective

This Type approval report is prepared on behalf of *Escort Memory Systems* 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 Bay Area Compliance Laboratory Corporation to collect radiated and conducted emissions measurement data is located at its facility in 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 test methods and procedures set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference have the reports on file and are listed under FCC file 31040/SIT 1300F2, IC registration number: 3062A, and VCCI Registration No.: C-1298 and R-1234. 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

SYSTEM TEST CONFIGURATION

Justification

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

EUT Exercise Software

Run RFID simulation program provided by 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	Laptop Computer	Latitude Cpi R-series	0002257D-38380-9AR-P0ZA

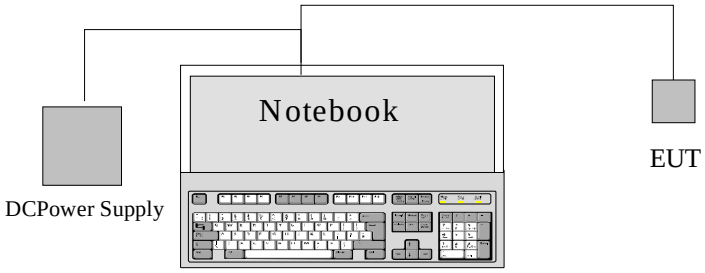
Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Escort Memory Systems	24V DC Power Supply	THF 120LS24	RA61013240

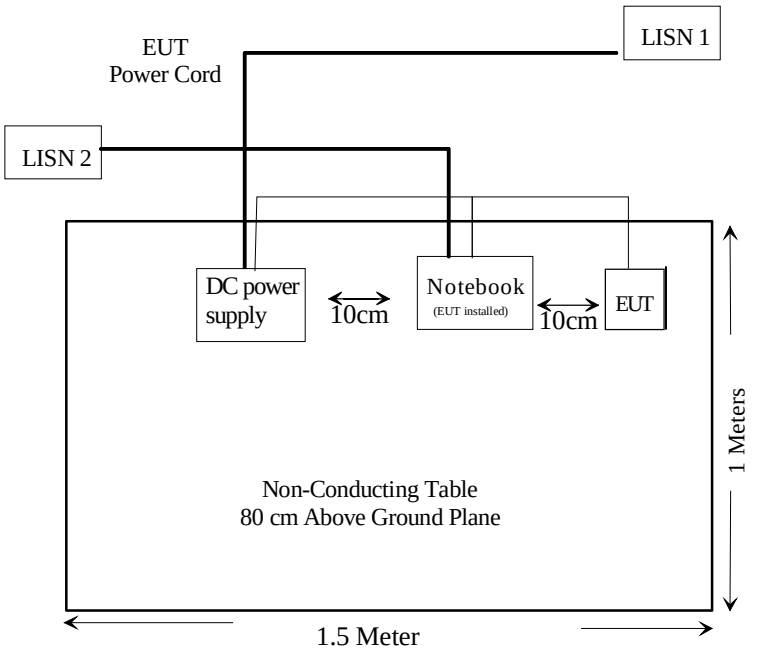
Interface Ports and Cabling

Cable Description	Length (M)	Port/From	To
Shielded Cable	2	Serial Port / Host Laptop	EUT
Shielded Power Cable	1.1	Serial Port / Host Laptop	DC power supply

Test Setup Configuration



Test Setup Block Diagram



SUMMARY OF TEST RESULTS

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(e)	Frequency Stability	Compliant

§ 15.203 – ANTENNA REQUIREMENTS

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.

Refer to statement below for compliance.

“The antennae for this device are an integral part of the device and the end user cannot modify or use unauthorized antennae due to its construction. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description”.

Antenna Connected Construction

This device has four antenna options each designed to fit only Cobalt series controllers by a proprietary mechanical fastening method and the use of a non-standard antenna connector, thus ensuring it is only outfitted as intended by the manufacturer.

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

EUT Setup

The radiated emission tests were performed in the closed chamber 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	Cal. Date
HP	Amplifier, Pre (.1~1300MHz)	8447D	2944A10198	2005-08-20
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10
ETS-Lindgren	Passive Loop Antenna (10KHz-30MHz)	6512	34167	2006-03-16
Sunol Sciences	30MHz~2GHz Antenna	JB1	A03105-3	2006-03-15

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the 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 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:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - 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:

Margin = Corrected Amplitude - Limit

Environmental Conditions

Temperature:	18°C
Relative Humidity:	58%
ATM Pressure:	1022 mbar

** Testing was performed by James Ma 2006-05-05.*

Summary of Test Results

According to the data in the following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.225. The EUT measured within the measurement uncertainty of ±4.0 dB, and had the worst margin reading of:

-0.5 dB at **40.66 MHz** in the **Vertical** polarization for FCC 15C

-4.3 dB at **149.15 MHz** in the **Vertical** polarization for FCC 15A

Radiated Emissions Test Result Data @ 3M

Measured with Loop Ant. for <= 30 MHz
Measured without Preamp < 30 MHz

Run # 1: Primary scan. 1 - 135.6 MHz Horizontal

Frequency MHz	Reading dBuV	Turntable Degrees	Ant. Height Meter	Polar. H / V	Ant. Factor dB/m	Cable Factor dB	Pre-Amp dB	Distance Factor dB	Corrected Reading dBuV/m	FCC 15C Limit (dBuV/m)	FCC 15C Margin (dB)
135.60	65.8	140	2.0	H	14.4	0.7	38.4	0.0	42.5	43.5	-1.0
108.47	67.8	60	1.6	H	11.7	0.6	38.4	0.0	41.7	43.5	-1.8
40.66	60.6	65	1.2	H	14.3	0.5	38.5	0.0	36.9	40.0	-3.1
27.12	17.8	0	1.0	H	34.0	0.3	0.0	40.0	12.1	29.5	-17.4
13.56	68.9	0	1.0	H	34.4	0.2	0.0	40.0	63.5	104.0	-40.5

Run # 2: Primary scan. 1 - 135.6 MHz Vertical

Frequency MHz	Reading dBuV	Turntable Degrees	Ant. Height Meter	Polar. H / V	Ant. Factor dB/m	Cable Factor dB	Pre-Amp dB	Distance Factor dB	Corrected Reading dBuV/m	FCC 15C Limit (dBuV/m)	FCC 15C Margin (dB)
40.66	64.2	120	1.0	V	13.3	0.5	38.5	0.0	39.5	40.0	-0.5
108.47	69.1	60	1.0	V	10.6	0.6	38.4	0.0	41.9	43.5	-1.6
135.60	60.7	110	1.0	V	14.1	0.7	38.4	0.0	37.1	43.5	-6.4

Run # 1: Primary scan. 30 - 1000MHz Horizontal

Frequency	Reading	Turntable	Ant Height	Polar	Ant. Factor	Cable Factor	Pre-Amp	Distance Factor	Corrected Reading	FCC 15A	FCC 15A
MHz	dBuV	Degree	Meter	H / V	dB	dB	dB	dB	dBuV/m	Limit (dBuV/m)	Margin (dB)
149.15	72.7	45	2.0	H	13.5	0.7	38.4	10.5	38.0	43.5	-5.5
162.70	65.8	45	1.8	H	13.0	0.7	38.4	10.5	30.6	43.5	-12.9
203.40	64.8	15	1.0	H	13.2	0.8	38.4	10.5	29.9	43.5	-13.6
176.30	64.1	45	1.8	H	12.4	0.7	38.4	10.5	28.3	43.5	-15.2
189.90	62.3	200	2.0	H	11.8	0.8	38.4	10.5	26.0	43.5	-17.5
298.30	55.9	160	1.0	H	13.5	1.0	38.4	10.5	21.5	46.4	-24.9
216.96	56.3	40	1.0	H	13.2	0.8	38.4	10.5	21.4	46.4	-25.0
244.00	55.7	160	1.0	H	11.4	0.9	38.4	10.5	19.1	46.4	-27.3

Run # 2: Primary scan. 30 - 1000MHz Vertical

Frequency	Reading	Turntable	Ant Height	Polar	Ant. Factor	Cable Factor	Pre-Amp	Distance Factor	Corrected Reading	FCC 15A	FCC 15A
MHz	dBuV	Degree	Meter	H / V	dB	dB	dB	dB	dBuV/m	Limit (dBuV/m)	Margin (dB)
149.15	74.1	125	1.0	V	13.3	0.7	38.4	10.5	39.2	43.5	-4.3
162.70	74.5	120	2.1	V	12.5	0.7	38.4	10.5	38.8	43.5	-4.7
203.40	73.1	0	1.0	V	13.0	0.8	38.4	10.5	38.0	43.5	-5.5
176.30	74.0	100	2.2	V	11.9	0.7	38.4	10.5	37.7	43.5	-5.8
189.90	68.6	122	1.0	V	11.4	0.8	38.4	10.5	31.9	43.5	-11.6
216.96	66.5	250	1.0	V	13.0	0.8	38.4	10.5	31.4	46.4	-15.0
298.30	62.9	240	1.0	V	13.5	1.0	38.4	10.5	28.5	46.4	-17.9
257.80	63.3	250	1.0	V	12.7	0.9	38.4	10.5	28.0	46.4	-18.4
244.00	61.8	250	1.6	V	11.7	0.9	38.4	10.5	25.5	46.4	-20.9

§ 15.207 – CONDUCTED EMISSIONS TEST

EUT Setup

The measurement was performed in the shielded room, using the same setup per ANSI C63.4-2001 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	Cal. Date
R&S	Receiver, EMI Test	ESCS30	100176	2006-03-13
R&S	LISN, Artificial Mains	ESH2-Z5	871884/039	2005-11-14

*** 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 emissions 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 were 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 table, the EUT complies with the FCC 15 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:

5.4 dB at **4.802000 MHz** in the **Neutral** conductor mode

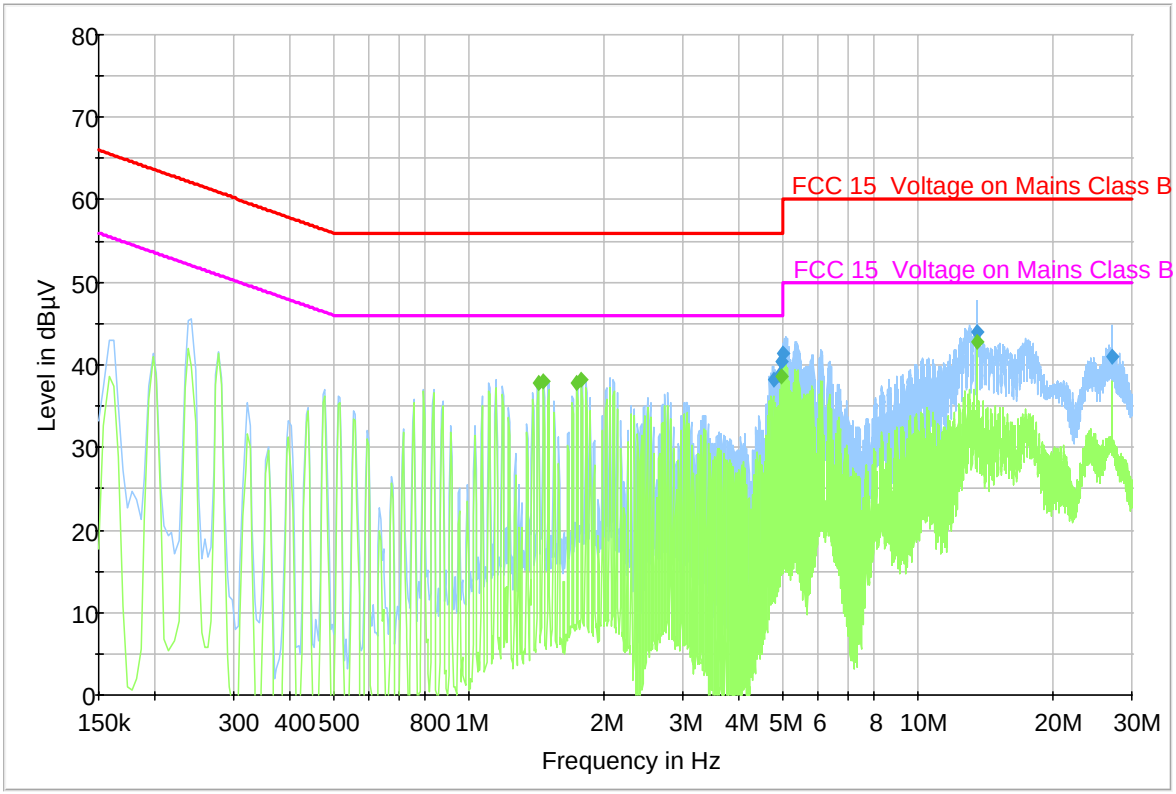
Environmental Conditions

Temperature:	18° C
Relative Humidity:	58%
ATM Pressure:	1022 mbar

Testing was performed by James Ma on 2006-05-05.

Conducted Emissions Test Data

Line



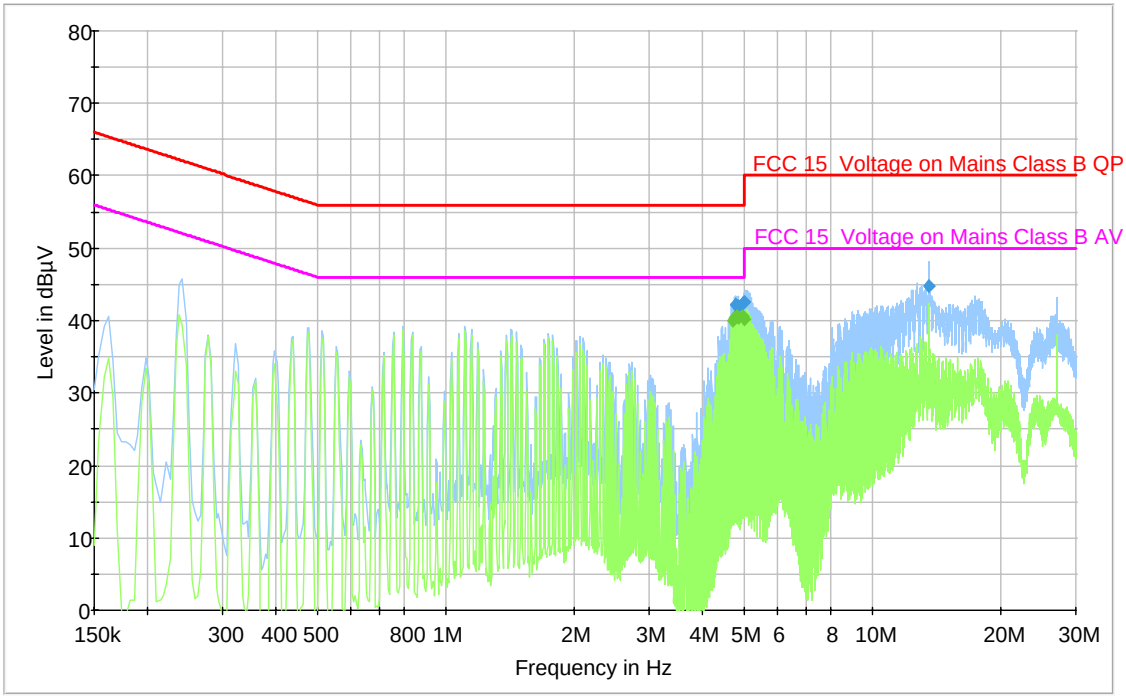
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
4.998000	41.3	L1	0.3	56.0	14.7
4.966000	40.5	L1	0.3	56.0	15.5
13.558000	43.9	L1	0.5	60.0	16.1
4.926000	38.9	L1	0.3	56.0	17.1
4.766000	38.1	L1	0.3	56.0	17.9
27.118000	41.0	L1	0.6	60.0	19.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
13.558000	42.8	L1	0.5	50.0	7.2
4.962000	38.6	L1	0.3	46.0	7.4
1.786000	38.3	L1	0.3	46.0	7.7
1.470000	38.0	L1	0.3	46.0	8.0
1.430000	37.8	L1	0.2	46.0	8.2
1.746000	37.8	L1	0.3	46.0	8.2

Neutral



QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
4.998000	42.6	N	0.3	56.0	13.4
4.962000	42.3	N	0.3	56.0	13.7
4.766000	42.2	N	0.3	56.0	13.8
4.798000	42.1	N	0.3	56.0	13.9
4.842000	42.0	N	0.3	56.0	14.0
13.562000	44.9	N	0.5	60.0	15.2

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
4.802000	40.7	N	0.3	46.0	5.4
4.962000	40.6	N	0.3	46.0	5.4
4.762000	40.5	N	0.3	46.0	5.6
4.842000	40.4	N	0.3	46.0	5.6
4.998000	40.2	N	0.3	46.0	5.8
4.722000	40.0	N	0.3	46.0	6.0

§ 15.225(e) - FREQUENCY STABILITY MEASUREMENTS

Standard Applicable

According to FCC §15.225(e), the frequency tolerance of the carrier signal shall be maintained within ± 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±5°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 No.	Cal. Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10
Tenney	Oven, Temperature	VersaTenn	12.222-193	2006-06-21
Hp	Counter, Microwave Frequency	5342A	2232A06380	2005-12-12

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

Environmental Conditions

Temperature:	18° C
Relative Humidity:	58%
ATM Pressure:	1022 mbar

Testing was performed by James Ma on 2006-05-05.

Test Results

Condition Voltage	Temperature	Ref Freq	Measured Freq	Freq Error	Limit
(v)	C	Hz	Hz	Hz	Hz
24.0	-20	13560000	13560003	3	1356
24.0	-10	13560000	13560002	2	1356
24.0	0	13560000	13560001	1	1356
24.0	20	13560000	13560002	2	1356
24.0	30	13560000	13560003	3	1356
24.0	50	13560000	13560002	2	1356
20.4	20	13560000	13560003	3	1356
27.6	20	13560000	13560003	3	1356