COMMUNICATION CERTIFICATION LABORATORY
1940 West Alexander Street
Salt Lake City, UT 84119
801-972-6146

Test Report

Certification

Test Of:

RAV Controller
Converge Controller

Test Specification:

FCC PART 15, Subpart C

Test Report Serial No: 864

Applicant:

ClearOne Communications, Inc.
5225 Wiley Post Way, Suite 500
Salt Lake City, UT 84116

Date of Test: June 25 and July 25 - 26, 2007

Issue Date: August 2, 2007

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Communication Certification Laboratory to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: ClearOne Communications, Inc.
- Manufacturer: ClearOne Communications, Inc.
- Brand Name: ClearOne
- Model Number: RAV Controller and Converge Controller
- FCC ID Number: FBIRAV1

On this 2nd day of August 2007, I, individually, and for Communication Certification Laboratory, certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the Communication Certification Laboratory EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

COMMUNICATION CERTIFICATION LABORATORY

Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: ClearOne Communications, Inc.
5225 Wiley Post Way, Suite 500
Salt Lake City, UT 84116

Contact Name: Roger Midgley
Title: Project Manager

1.2 Manufacturer:

Company Name: ClearOne Communications, Inc.
5225 Wiley Post Way, Suite 500
Salt Lake City, UT 84116

Contact Name: Roger Midgley
Title: Project Manager

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name: ClearOne
Model Number: RAV Controller
Serial Number: None
Options Fitted: N/A

2.2 Description of EUT:

The RAV Controller is a wireless device to control a RAV audio conferencing system. The transmitter of the RAV Controller operates between 902 and 928 MHz and falls under §15.249 of the FCC regulations.

The RAV Controller and Converge Controller are identical, except in branding. Both units are battery powered and have no provisions for connecting to the AC mains or a device connected to the AC Mains.

2.3 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: ClearOne MN: RAV Controller (Note 1)	FBIRAV1	RAV Conferencing System Controller	See Section 2.4
BN: ClearOne MN: Converge Controller (Note 1)	FBIRAV1	Converge Conferencing System Controller	See Section 2.4

Note: (1) EUT

2.4 Interface Ports of the EUT

There are no wired interface ports on the EUT.

2.8 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification.

Signature: _____

Typed Name: Roger Midgley

Title: Project Manager

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: FCC PART 15, Subpart C (47 CFR 15)

Limits and methods of measurement of radio interference characteristics of radio frequency devices.

Purpose of Test: The tests were performed to demonstrate initial compliance.

3.2 Methods & Procedures:

3.2.1 §15.203 Antenna Requirement

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 Sections 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 Section 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.

3.2.2 §15.249 Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, 5725 – 5875 MHz, and 24.0 – 24.25 GHz

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 – 928 MHz	50	500
2400 – 2483.5 MHz	50	500
5725 – 5875 MHz	50	500
24.0 – 24.25 GHz	250	2500

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) The frequency tolerance of the carrier signal shall be maintained within + 0.001% 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.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

(c) Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

(e) As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field

strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

(f) Parties considering the manufacture, importation, marketing or operation of equipment under this section should also note the requirement in Section 15.37(d).

3.3 Test Procedure

The emissions testing was performed according to the procedures in ANSI C63.4 (2003). Testing was performed at CCL's Wanship open area test site #2, located at 550 West Wanship Road, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated June 6, 2006 (90504).

CCL participates in the National Voluntary Laboratory Accreditation Program (NVLAP) and has been accredited under NVLAP Lab Code:100272-0, which is effective until September 30, 2007.

For radiated emissions testing at 30 MHz or above that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 6 VDC (4 – AA batteries)

4.2 Operating Modes:

Each mode of operation was exercised to produce worst-case emissions. The worst-case emissions were with the RAV Controller constantly transmitting.

4.3 EUT Exercise Software:

ClearOne software was used to control the transmitter.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Port	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.249	Radiated Power	30 to 9280	Complied

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1 General Comments:

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

6.2 Test Results:

6.2.1 Antenna requirement

The antenna is an internal trace on the PCB; therefore, the EUT meets the requirement.

6.2.2 Radiated Disturbance Data (Vertical Polarity)

Transmitting at 904.3 MHz

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
904.3	Peak	54.6	28.2	82.8	94.0	-11.2
1808.6	Peak	14.1	29.7	43.8	54.0	-10.2
2712.9	Peak	17.6	32.1	49.7	54.0	-4.3
3617.2	Peak	15.7	34.5	50.2	54.0	-3.8
4521.5	Peak	11.3	36.1	47.4	54.0	-6.6
5425.8	Peak	6.9	38.0	44.9	54.0	-9.1
6330.1	Peak	9.5	39.1	48.6	74.0	-25.4
6330.1	Average	-4.2	39.1	34.9	54.0	-19.1
7234.4	Peak	9.1	40.9	50.0	74.0	-24.0
7234.4	Average	-3.7	40.9	37.2	54.0	-16.8
8138.7	Peak	8.5	42.7	51.2	74.0	-22.8
8138.7	Average	-2.3	42.7	40.4	54.0	-13.6
9403.0	Peak	10.7	42.9	53.6	74.0	-20.4
9403.0	Average	-1.9	42.9	41.0	54.0	-13.0

Transmitting at 913.2 MHz

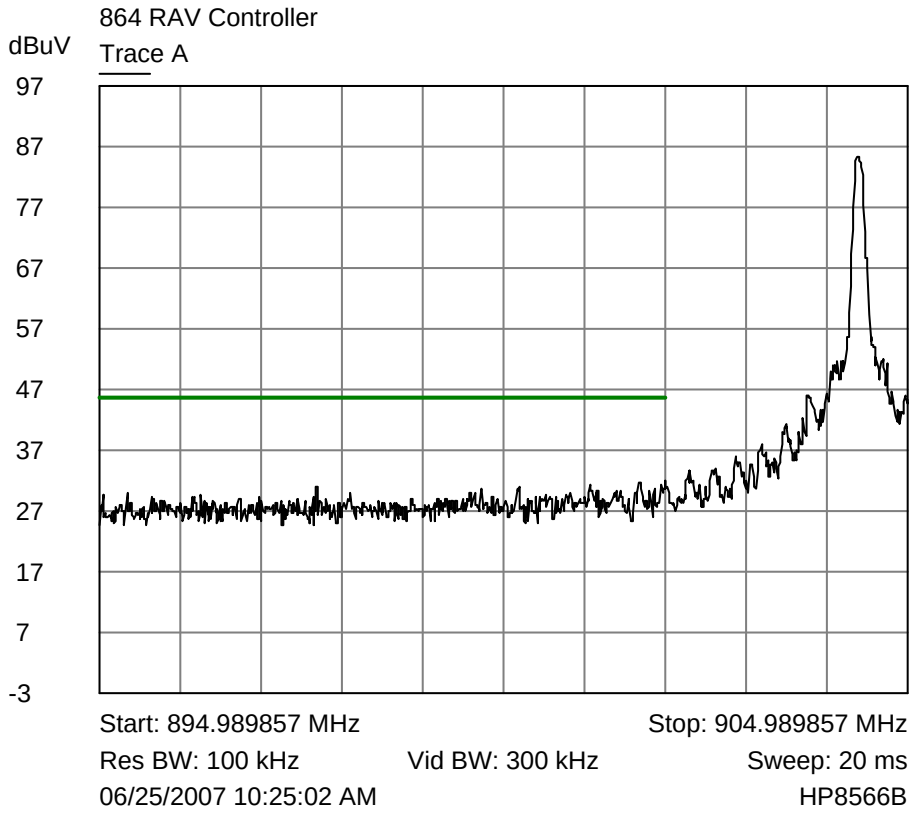
Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
913.2	Peak	57.2	28.1	85.3	94.0	-8.7
1826.6	Peak	15.5	29.8	45.3	54.0	-8.7
2739.8	Peak	16.1	32.2	48.3	54.0	-5.7
3653.1	Peak	16.5	34.5	51.0	54.0	-3.0
4566.4	Peak	10.7	36.1	46.8	54.0	-7.2
5479.7	Peak	6.8	38.0	44.8	54.0	-9.2
6393.0	Peak	9.5	39.1	48.6	74.0	-25.4
6393.0	Average	-4.2	39.1	34.9	54.0	-19.1
7603.6	Peak	9.1	40.9	50.0	74.0	-24.0
7603.6	Average	-3.7	40.9	37.2	54.0	-16.8
8219.7	Peak	8.5	42.7	51.2	74.0	-22.8
8219.7	Average	-2.3	42.7	40.4	54.0	-13.6
9132.0	Peak	10.7	42.9	53.6	74.0	-20.4
9132.0	Average	-1.9	42.9	41.0	54.0	-13.0

Transmitting at 926.1 MHz

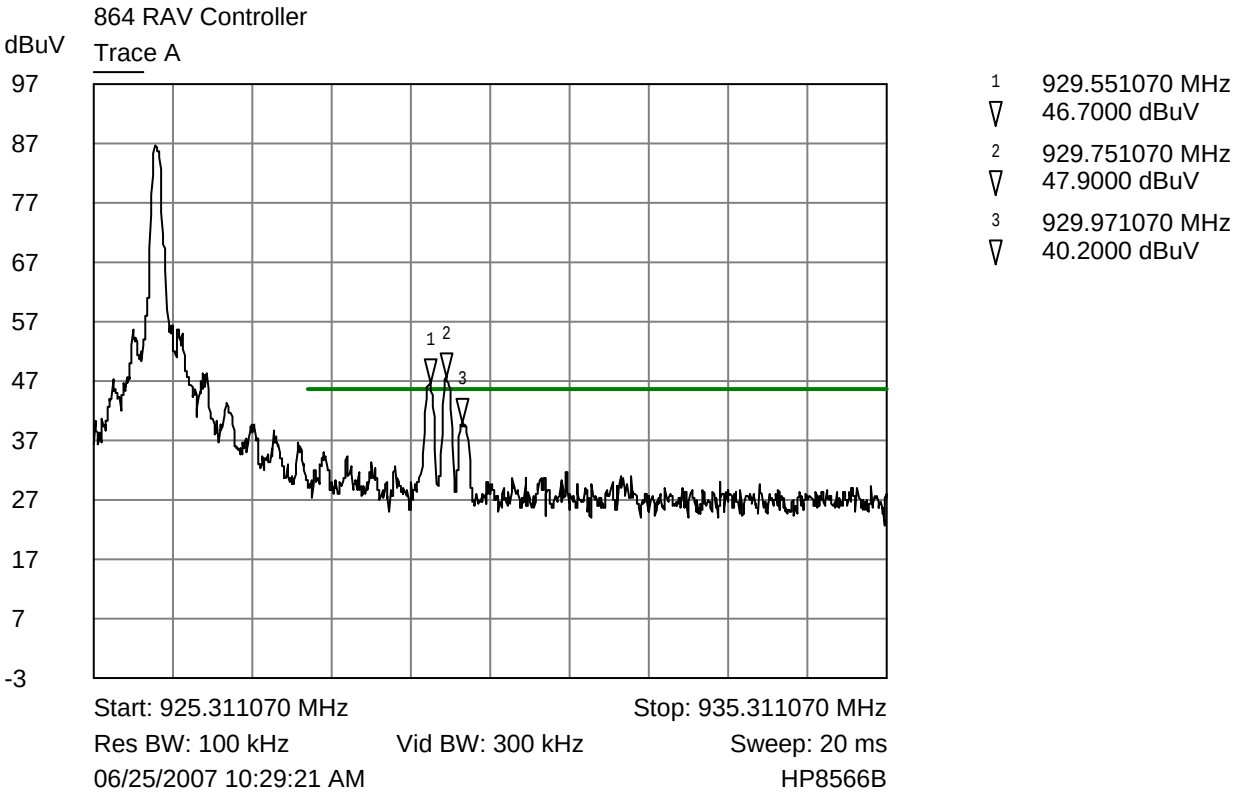
Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
926.1	Peak	59.7	28.2	87.9	94.0	-6.1
1852.2	Peak	16.8	29.9	46.7	54.0	-7.3
2778.3	Peak	17.4	32.2	49.6	54.0	-4.4
3704.4	Peak	16.1	34.7	50.8	54.0	-3.2
4630.5	Peak	11.1	36.4	47.5	54.0	-6.5
5556.6	Peak	6.4	38.1	44.5	54.0	-9.5
6482.7	Peak	9.5	39.1	48.6	74.0	-25.4
6482.7	Average	-4.2	39.1	34.9	54.0	-19.1
7408.8	Peak	9.1	40.9	50.0	74.0	-24.0
7408.8	Average	-3.7	40.9	37.2	54.0	-16.8

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
8334.9	Peak	8.5	42.7	51.2	74.0	-22.8
8334.9	Average	-2.3	42.7	40.4	54.0	-13.6
9261.0	Peak	10.7	42.9	53.6	74.0	-20.4
9261.0	Average	-1.9	42.9	41.0	54.0	-13.0

The plots below show the lower and upper channels residing totally within the operating band of 902 - 928 MHz.



Trace A Lower channel band edge plot



Trace A Upper channel band edge plot

Note: Points 1 – 3 in the plot above are ambient noise emissions at the test site and are not associated with this device.

RESULT

The EUT complied with the specification limit by a margin of 3.0 dB and the operating band of the EUT is totally within the allowed frequency range.

6.2.3 Radiated Disturbance Data (Horizontal Polarity)

Transmitting at 904.3 MHz

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
904.3	Peak	59.8	28.2	88.0	94.0	-6.0
1808.6	Peak	15.3	29.7	45.0	54.0	-9.0
2712.9	Peak	19.8	32.1	51.9	54.0	-2.1
3617.2	Peak	17.9	34.5	52.4	54.0	-1.6
4521.5	Peak	12.9	36.1	49.0	54.0	-5.0
5425.8	Peak	6.5	38.0	44.5	54.0	-9.5
6330.1	Peak	9.5	39.1	48.6	74.0	-25.4
6330.1	Average	-4.2	39.1	34.9	54.0	-19.1
7234.4	Peak	9.1	40.9	50.0	74.0	-24.0
7234.4	Average	-3.7	40.9	37.2	54.0	-16.8
8138.7	Peak	8.5	42.7	51.2	74.0	-22.8
8138.7	Average	-2.3	42.7	40.4	54.0	-13.6
9403.0	Peak	10.7	42.9	53.6	74.0	-20.4
9403.0	Average	-1.9	42.9	41.0	54.0	-13.0

Transmitting at 913.2 MHz

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
913.2	Peak	61.2	28.1	89.3	94.0	-4.7
1826.6	Peak	16.4	29.8	46.2	54.0	-7.8
2739.8	Peak	19.5	32.2	51.7	54.0	-2.3
3653.1	Peak	17.7	34.5	52.2	54.0	-1.8
4566.4	Peak	12.1	36.1	48.2	54.0	-5.8
5479.7	Peak	7.3	38.0	45.3	54.0	-8.7
6393.0	Peak	9.5	39.1	48.6	74.0	-25.4
6393.0	Average	-4.2	39.1	34.9	54.0	-19.1

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
7603.6	Peak	9.1	40.9	50.0	74.0	-24.0
7603.6	Average	-3.7	40.9	37.2	54.0	-16.8
8219.7	Peak	8.5	42.7	51.2	74.0	-22.8
8219.7	Average	-2.3	42.7	40.4	54.0	-13.6
9132.0	Peak	10.7	42.9	53.6	74.0	-20.4
9132.0	Average	-1.9	42.9	41.0	54.0	-13.0

Transmitting at 926.1 MHz

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)
926.1	Peak	61.9	28.2	90.1	94.0	-3.9
1852.2	Peak	17.2	29.9	47.1	54.0	-6.9
2778.3	Peak	19.2	32.2	51.4	54.0	-2.6
3704.4	Peak	17.2	34.7	51.9	54.0	-2.1
4630.5	Peak	13.0	36.4	49.4	54.0	-4.6
5556.6	Peak	6.6	38.1	44.7	54.0	-9.3
6482.7	Peak	9.5	39.1	48.6	74.0	-25.4
6482.7	Average	-4.2	39.1	34.9	54.0	-19.1
7408.8	Peak	9.1	40.9	50.0	74.0	-24.0
7408.8	Average	-3.7	40.9	37.2	54.0	-16.8
8334.9	Peak	8.5	42.7	51.2	74.0	-22.8
8334.9	Average	-2.3	42.7	40.4	54.0	-13.6
9261.0	Peak	10.7	42.9	53.6	74.0	-20.4
9261.0	Average	-1.9	42.9	41.0	54.0	-13.0

RESULT

The EUT complied with the specification limit by a margin of 1.8 dB.

6.3 Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor), to the measured level from the receiver. The receiver amplitude reading is compensated for any amplifier gain. The basic equation with a sample calculation is shown below:

FS = RA + CF Where

FS = Field Strength
RA = Receiver Amplitude Reading (Receiver Reading - Amplifier Gain)
CF = Correction Factor (Antenna Factor + Cable Factor)

Assume a receiver reading of 42.5 dBμV is obtained from the receiver, an amplifier gain of 26.5 dB and a correction factor of 8.5 dB/m. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dBμV/m, FS = (42.5 - 26.5) + 8.5 = 24.5 dBμV/m.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Radiated Disturbance:

The radiated disturbance from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings. A preamplifier with a fixed gain of 26 dB and a power amplifier with a fixed gain of 22 dB were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors. A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 meters from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated disturbance. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there was multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

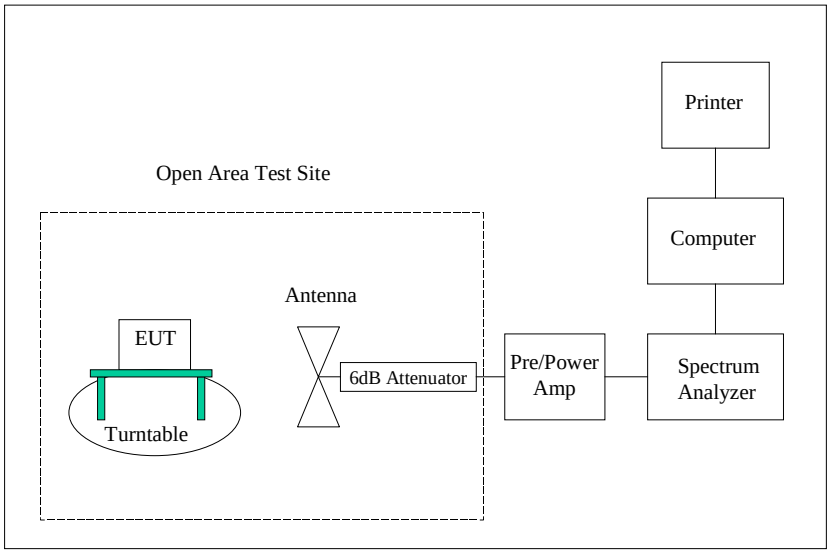
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/25/2006
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/28/2006
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	10/10/2006

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Biconilog Antenna	EMCO	3142	9601-1009	10/19/2006
Double Ridged Guide Antenna	EMCO	3115	9409-4355	04/30/2007
High Frequency Amplifier	Hewlett Packard	8449B	3008A00777	04/30/2007
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/26/2006
10 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable L	N/A	12/26/2006
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	09/06/2006
6 dB Attenuator	Hewlett Packard	8491A	32835	12/26/2006

An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Radiated Emissions Test Setup



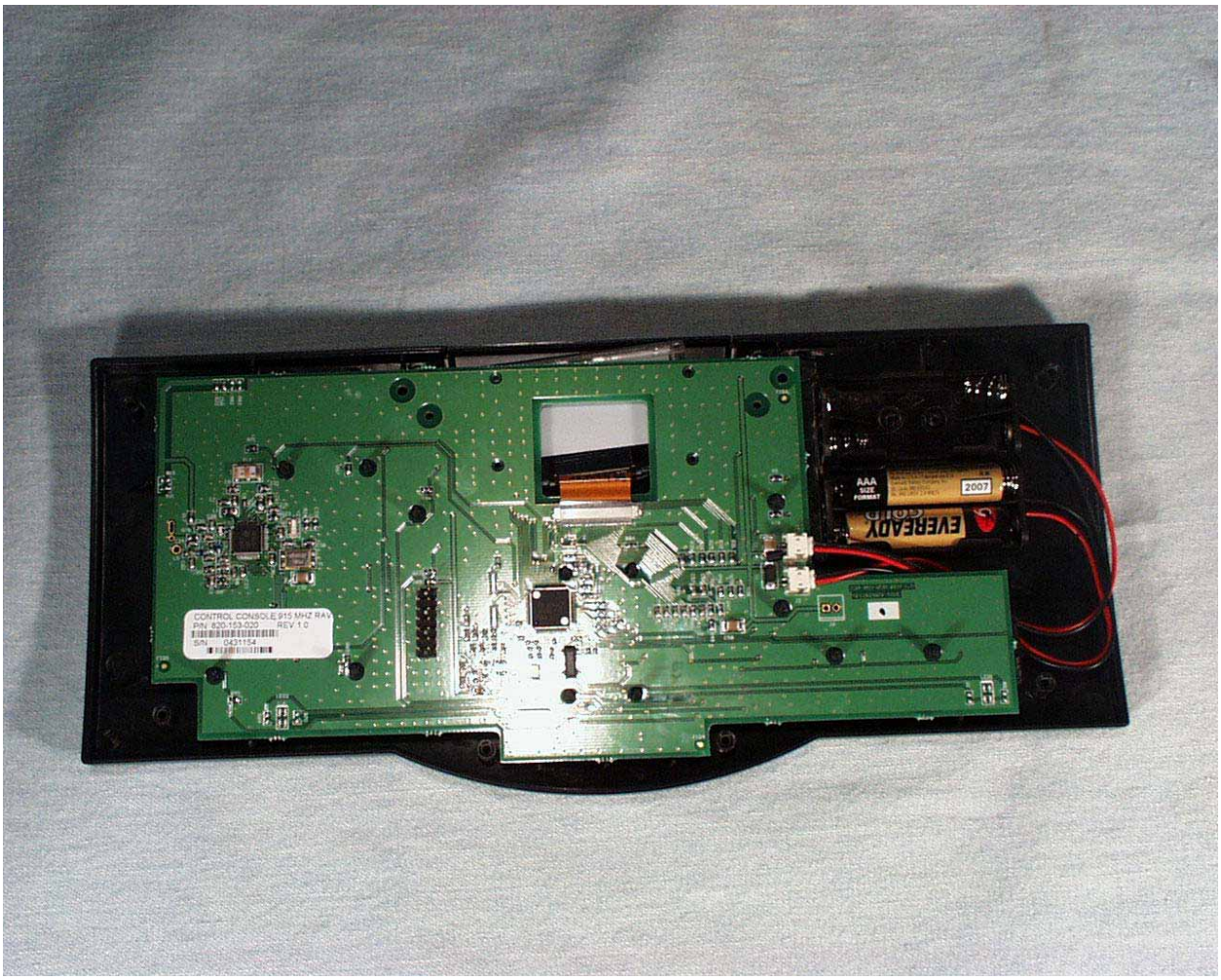
APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Worst Case Configuration

Photograph 2 – Back View Radiated Disturbance Worst Case Configuration

Photograph 3 – View of the Controller Assembly

Photograph 4 – Bottom Side of the PCB



Photograph 5 – Top Side of the PCB