COMMUNICATION CERTIFICATION LABORATORY

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

Test Report

Certification

Test Of:
L41xx

FCC ID Number:
NVA0708270338

Test Specifications:

47 CFR, Part 15, Subpart C

Test Report Serial No: 1008

Applicant:

Hypercom Corporation
1825 West Kathleen Road
Phoenix, AZ 85023
U.S.A.

Date of Test: August 20 and 21, 2007

Issue Date: August 27, 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 Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: Hypercom Corporation
- Manufacturer: Hypercom Corporation
- Brand Name: Hypercom
- Model Number: L41xx
- FCC ID Number: NVA0708270338

On this 27th 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

TABLE OF CONTENTS

PAGE

SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: Hypercom Corporation
1825 West Kathleen Road
Phoenix, AZ 85023
U.S.A.

Contact Name: Scott Spiker
Title: Vice President, Security, Quality and Compliance

1.2 Manufacturer:

Company Name: Hypercom Corporation
1825 West Kathleen Road
Phoenix, AZ 85023
U.S.A.

Contact Name: Scott Spiker
Title: Vice President, Security, Quality and Compliance

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Hypercom
Model Number:	L41xx
Serial Number:	10006987052 and 10006987036
Options Fitted:	N/A
Country of Manufacture:	China

2.2 Description of EUT:

The L41xx is a series of Point of Sale terminals. The L41xx has a display, keypad, magnetic card reader, and RFID system. Serial, USB, and Ethernet communication protocols are supported. Power is supplied from the POS system over the serial or USB cable; however, for this testing, a Skynet HYP-A037 power supply was used to power the L41xx and the laptop computer was used to represent the POS system. The L4150 was tested as a representative sample of the series. The L4150 was tested in different configurations so that every port was used in at least one configuration. The EUT was also tested when placed horizontally on the EUT table as on a counter, and also when placed vertically on the table as when mounted on a wall. This report shows the results from testing in the worst-case emission configuration. See Section 4.2 of this report.

This report covers the RFID transmitter circuitry subject to FCC Part 15, Subpart C. The other circuitry of this device that is subject to other standards is covered in separate reports.

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	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Hypercom MN: L41xx (Note 1)	NVA070827 0338	Point of Sale Terminal	See Section 2.4
BN: TRENDnet MN: TEG-S50TXE	DoC	5 port LAN switch	Ethernet/Cat 5 cables w/RJ45 connectors (Note 2)

Brand Name Model Number	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: HP Pavilion MN: N5195	DoC	Laptop Computer	Serial/Shielded Serial cable (Note 2) USB/USB cable (Note 2) Ethernet/Cat 5e cable

Note: (1) EUT
(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
RS-232 + Power	1	Shielded interface cable with DIN connector and DB9 connector with power interface/3 meters
100 Base T	1	Cat 5e cable with RJ45 connectors/7 meters
USB + Power	1	USB cable with IBM POS USB connector and USB host connector with power separated out to power interface connector/3 meters
USB	1	USB cable/1.5 meters

2.5 Modification Incorporated/Special Accessories on EUT:

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

Signature: _____

Typed Name: Scott Spiker

Title: Vice President, Security, Quality and Compliance

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: FCC PART 15, Subpart C (47 CFR 15).
Section 15.225 and 15.207

Operation within the band 13.110 – 14.010 MHz
Conducted emission limits at the AC Mains

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

3.2 Methods & Procedures:

3.2.1 §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.

(b) Within the bands 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.

(c) Within the bands 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.

(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.

(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.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

3.2.2 §15.207 Conducted Limits

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHZ to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5*	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency.

3.2.3 Test Procedure

The conducted disturbance at mains and telecommunications ports and radiated disturbance testing was performed according to the procedures in EN 55022: 2006, Sections 8 through 10. 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 is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2007.

For radiated disturbance testing 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: 120 VAC
AC Mains Frequency: 60 Hz

4.2 Operating Modes:

The L41xx was in a constant transmit state for testing.

4.3 EUT Exercise Software:

Internal firmware was used to exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Section	Test Performed	Frequency Range (MHz)	Result
15.225 (a)	Radiated Emissions	13.553 – 13.567	Complied
15.225 (b)	Radiated Emissions	13.410 – 13.553 and 13.567 – 13.710	Complied
15.225(c)	Radiated Emissions	13.110 – 13.410 and 13.710 – 14.010	Complied
15.225 (d)	Radiated Emissions	1.705 – 1000 excluding the frequency bands of paragraphs (a) through (c)	Complied
15.225 (e)	Frequency Stability	13.56	Complied
15.207	Line Conducted Emissions	0.15 to 30	Complied

5.2 Result

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

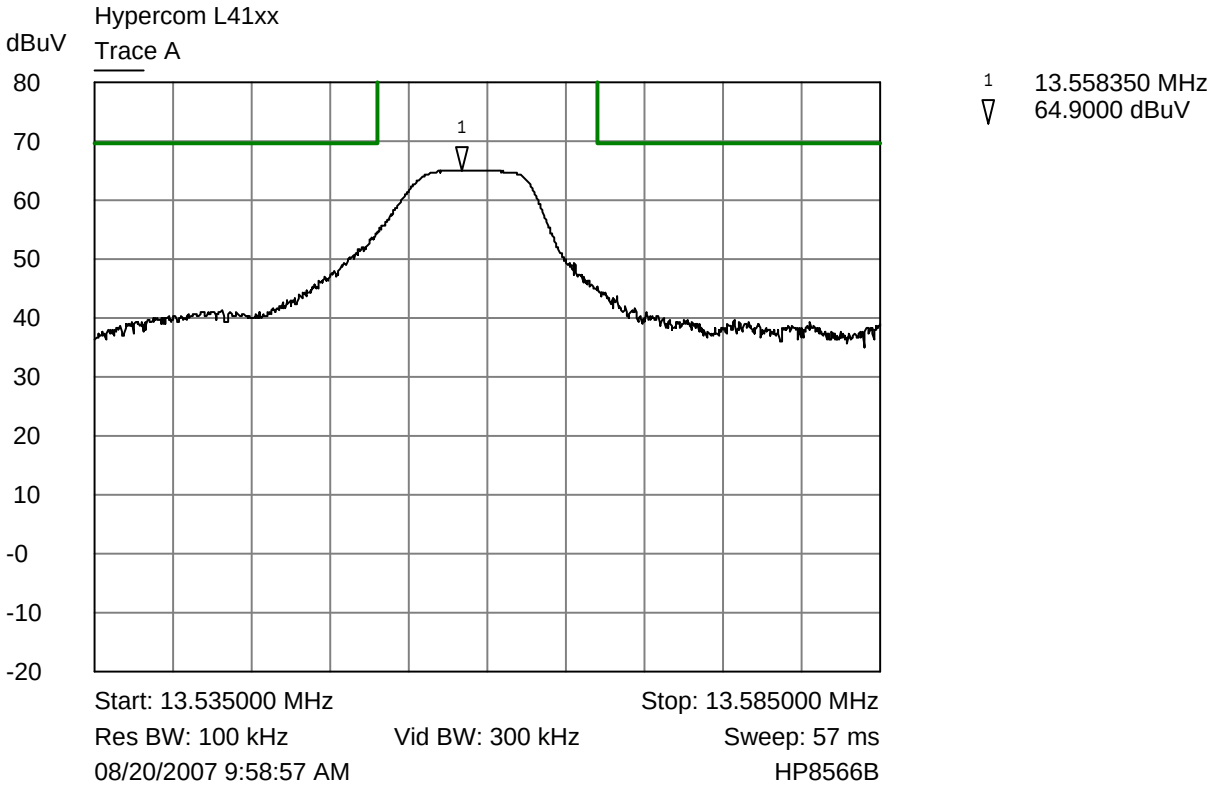
SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

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.

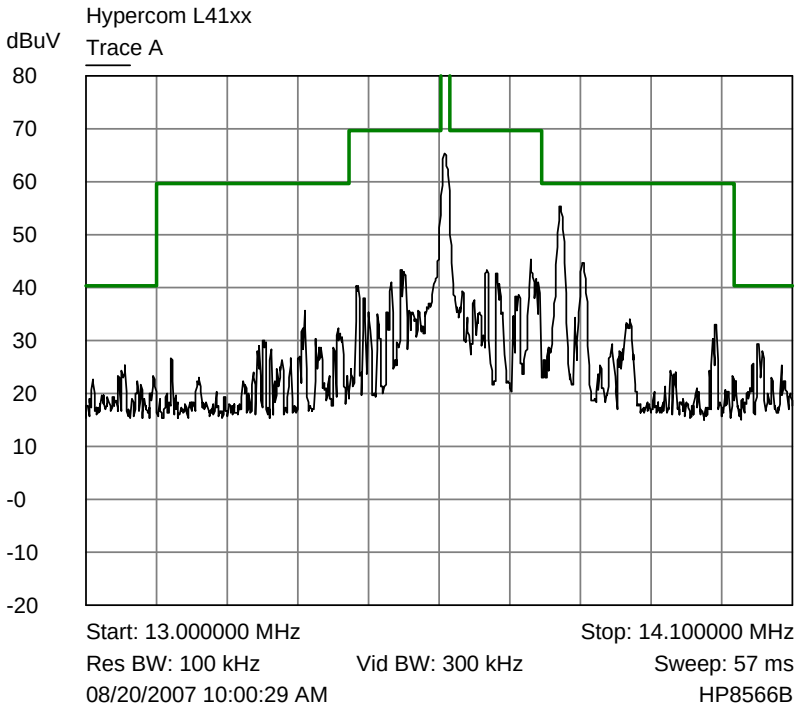
6.2 Test Results:

The emissions from the L4150 must meet the emission mask specified in §15.225. The plots of the fundamental frequency and operating band of the transmitter are shown below. The data of spurious emissions seen is shown in a tabular format after the plots.



QP adapter in normal for 9 kHz RBW, 10 meter measurement distance - Vertical placement on table

Trace A Peak Detection - Corrected Trace - Antenna and Cable CF of 10.8 dB



QP adapter in normal for 9 kHz RBW, 10 meter measurement distance

Trace A Peak Detection - Corrected Trace - Antenna and Cable CF of 10.8 dB

Radiated Interference Level Data

Frequency (MHz)	Detector (Note 1)	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m) (Note 3)	Margin (dB)
13.56	Peak	(Note 2)	54.1	10.8	64.9	103.1	-38.2
27.12	Peak	(Note 2)	21.4	9.4	30.8	48.6	-17.8
40.68	Peak	Vertical	17.0	14.2	31.2	40.0	-8.8
40.68	Peak	Horizontal	10.3	14.2	24.5	40.0	-15.5
54.24	Peak	Vertical	27.6	9.1	36.7	40.0	-3.3
54.24	Peak	Horizontal	9.6	9.1	18.7	40.0	-21.3
67.8	Peak	Vertical	17.8	8.2	26.0	40.0	-14.0
67.8	Peak	Horizontal	8.9	8.2	17.1	40.0	-22.9
81.36	Peak	Vertical	24.9	8.3	33.2	40.0	-6.8
81.36	Peak	Horizontal	12.9	8.3	21.2	40.0	-18.8
94.92	Peak	Vertical	23.0	9.3	32.3	43.5	-11.2
94.92	Peak	Horizontal	19.0	9.3	28.3	43.5	-15.2

Frequency (MHz)	Detector (Note 1)	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m) (Note 3)	Margin (dB)
108.48	Peak	Vertical	25.6	9.5	35.1	43.5	-8.4
108.48	Peak	Horizontal	17.3	9.5	26.8	43.5	-16.7
122.04	Peak	Vertical	19.8	8.6	28.4	43.5	-15.1
122.04	Peak	Horizontal	19.2	8.6	27.8	43.5	-15.7
135.60	Peak	Vertical	22.6	9.0	31.6	43.5	-11.9
135.60	Peak	Horizontal	15.6	9.0	24.6	43.5	-18.9

Note 1: The reference detector used for the measurements was peak and the data was compared to the quasi-peak limit.

Note 2: Active loop antenna was used for these measurements.

Note 3: At frequencies below 30 MHz, the measurement distance was 10 meters and the limit adjusted accordingly using an inverse proportionality factor of 40 dB per decade. At frequencies above 30 MHz, the measurement distance was 3 meters.

Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor) and the Average Factor to the measured level of 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 + AV Where

FS = Field Strength
RA = Receiver Amplitude Reading
CF = Correction Factor (Antenna Factor + Cable Factor)
AV = Averaging Factor

Assume a receiver reading of 44.2 dBμV is obtained from the receiver, with an average factor of –8.6 dB and a correction factor of 17.5 dB. The field strength is calculated by adding the correction factor and the average factor, giving a field strength of 53.1 dBμV/m, FS = 44.2 + 17.5 + (-8.6) = 53.1 dBμV/m

RESULT

In the configuration tested, the EUT complied with the requirements of §15.225 (a) – (d) with a nearest margin to the limit of 3.3 dB.

6.2.2 §15.225 (e) Frequency Stability Over Temperature and Voltage Fluctuations

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of –20° to +50°C at normal voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C.

The operating frequency of the L4100 is 13.56 MHz; therefore, the frequency must be maintained between 13.558644 MHz and 13.561,356 MHz.

13.56 MHz x 0.0001 = 1.356 kHz

Lower edge of range = 13.56 MHz – 1.356 kHz = 13.558644 MHz
Upper edge of range = 13.56 MHz + 1.356 kHz = 13.561356 MHz

Time of Measurement	120 VAC +20°C	120 VAC +50°C	120 VAC -20°C	102 VAC +20°C	138 VAC +20°C
Start up	13559598	13559606	13559631	13559633	13559601
2 minutes	13559594	13559585	13559663	13559618	13559597
5 minutes	13559595	13559585	13559676	13559609	13559597
10 minutes	13559588	13559593	13559665	13559600	13559591

RESULT

The maximum deviation from the fundamental frequency of 13.56 MHz was 415 Hz or 0.003%; therefore, the EUT meets the requirement of §15.225 (e).

6.2.3 §15.207 Conducted Emissions at the AC Mains Port

Frequency (MHz)	Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.18	Hot Lead	Peak (Note 1)	49.7	54.3	-4.6
0.62	Hot Lead	Quasi-Peak (Note 1)	41.7	46.0	-4.3
0.67	Hot Lead	Quasi-Peak (Note 1)	41.0	46.0	-5.0
1.53	Hot Lead	Quasi-Peak (Note 1)	43.5	46.0	-2.5
4.96	Hot Lead	Peak (Note 1)	42.5	46.0	-3.5
7.70	Hot Lead	Peak (Note 1)	43.4	50.0	-6.6
13.60	Hot Lead	Peak (Note 1)	46.3	50.0	-3.7
0.18	Neutral Lead	Peak (Note 1)	49.1	54.3	-5.2
0.56	Neutral Lead	Peak (Note 1)	41.2	46.0	-4.8
0.62	Neutral Lead	Peak (Note 1)	41.2	46.0	-4.8
0.68	Neutral Lead	Peak (Note 1)	43.5	46.0	-2.5
1.05	Neutral Lead	Peak (Note 1)	40.3	46.0	-5.7
8.25	Neutral Lead	Peak (Note 1)	40.1	50.0	-9.9
13.60	Neutral Lead	Peak (Note 1)	45.1	50.0	-4.9

The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.

The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 3.3 dB.

RESULT

The EUT complied with the specification limit by a margin of 2.5 dB.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Conducted Disturbance at Mains Ports:

The conducted disturbance at mains ports from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted disturbance at mains ports measurements are performed in a screen room using a (50 Ω/50 μH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of ITE with each ITE having its own power cord, the point of connection for the LISN is determined from the following rules:

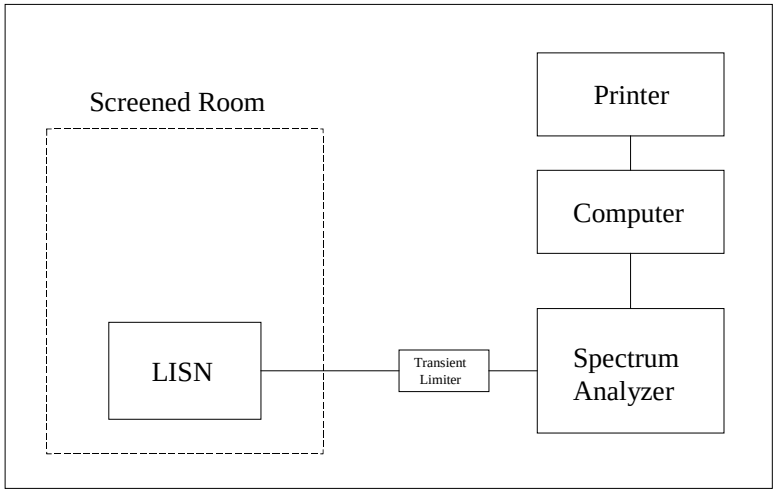
a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
c) Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
d) Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
e) When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

For AC mains port testing the desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor. The equipment is placed a minimum of 40 cm from all walls. Floor standing equipment is placed directly on the earth grounded floor.

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	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/28/2006
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	10/10/2006
LISN	EMCO	3825/2	9305-2099	03/16/2007
Conductance Cable Wanship Site #2	CCL	Cable J	N/A	12/26/2006
Transient Limiter	Hewlett Packard	11947A	3107A02266	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.

Conducted Emissions Test Setup



A1.2 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.

An active loop antenna was used to measure frequencies below 30 MHz at a distance of 10 meters from the EUT. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 10 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.

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
Biconilog Antenna	EMCO	3142	9601-1009	10/19/2006
Double Ridged Guide Antenna	EMCO	3115	9409-4355	04/30/2007

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
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