Nemko-CCL, Inc.

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

Test Report

Certification

Test Of: R3210

FCC ID Number: NVA00004

Test Specifications:

47 CFR, Part 15, Subpart C

Test Report Serial No: 150772-2.1

Applicant:

Hypercom
8888 East Raintree Dr., Suite 300
Scottsdale, AZ 85260-3943
U.S.A.

Date of Test:

March 23, 2010 and April 19 & 20, 2010

Issue Date: June 21, 2010

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL, Inc. 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
- Manufacturer: Hypercom
- Brand Name: Hypercom
- Model Number: R3210
- FCC ID Number: NVA00004

On this 21st day of June 2010, I, individually, and for Nemko-CCL, Inc., 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 Nemko-CCL, Inc. 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.

Nemko-CCL, Inc.

Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: Hypercom
8888 East Raintree Dr., Suite 300
Scottsdale, AZ 85260-3943
U.S.A.

Contact Name: Ron Pickard
Title: Sr. Regulatory Compliance Manager

1.2 Manufacturer:

Company Name: Hypercom
8888 East Raintree Dr., Suite 300
Scottsdale, AZ 85260-3943
U.S.A.

Contact Name: Ron Pickard
Title: Sr. Regulatory Compliance Manager

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name: Hypercom
Model Number: R3210
Serial Number: 801580073808

2.2 Description of EUT:

The R3210 is a contactless reader for use at a point of sale location. The R3210 can act as a stand-alone terminal or be connected to a POS terminal. Power and data are interfaced over a 6 conductor modular cable connected between the R3210 and POS terminal. The R3210 has a 13.56 MHz RFID transmitter and receiver. The R3210 uses passive RFID tags.

This report covers the RFID transmitter circuitry subject to FCC Part 15, Subpart C. The other circuitry of this device that is subject to FCC Part 15, Subpart B is covered in a separate report. See Nemko-CCL, Inc. report #152217-1.1

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 Number	FCC ID Number or Compliance	Description	Name of Interface Ports / Interface Cables
BN: Hypercom MN: R3210 (Note 1) SN: 801580073808	NVA00004	RFID Reader	See Section 2.4
BN: Hypercom MN: T4210 SN: None	Verification	POS Terminal	Serial/6 conductor cable with modular connectors (Note 2)
BN: HP Pavilion MN: N5195 SN: TW0390625Y	DoC	Laptop Computer	Serial/6 conductor cable with modular and DB9 connector s (Note 2)

2.4 Interface Ports on EUT:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
Power/Data	1	6 conductor cable with DB9 and modular connectors/15 cm or 1.5 meter coiled

2.5 Modification Incorporated/Special Accessories on EUT:

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

Signature: _____

Typed Name: Ron Pickard

Title: Sr. Regulatory Compliance Manager

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: FCC PART 15, Subpart C (47 CFR 15).
Section 15.203, 15.207, 15.225

Antenna requirements
Conducted Limits (AC Mains)
Operation within the band 13.110 – 14.010 MHz

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 §15.207 Conducted Limits (AC Mains)

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 §15.225 Operation Within the Band 13.110 – 14.010 MHz

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.

3.2.3 Test Procedure

The testing was performed according to the procedures in ANSI C63.4 (2003). Testing was performed at Nemko-CCL, Inc.Nemko-CCL's Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated March 11, 2009 (90504).

Nemko-CCL, Inc. participates in the National Voluntary Laboratory Accreditation Program (NVLAP) and has been accepted under NVLAP Lab Code: 100272-0, which is effective until September 30, 2010.

For radiated emission 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. A factor of 40 dB per decade is used for frequencies from 9 kHz to 30 MHz.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 120 Vac/60 Hz to Power Supply (7.5 Vdc to R3210)

4.2 Operating Modes:

The R3210 was in a constant modulated 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
15.203	Antenna Requirements	Structural requirement	Complied
15.207	AC Mains Conducted Emissions	0.15 – 30	Complied
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	0.009 – 1000 excluding the frequency bands of paragraphs (a) through (c)	Complied
15.225 (e)	Frequency Stability	13.56	Complied
15.225(f)	Powered RFID Tag Requirements	13.56	Not Applicable (Note 1)
Note 1: The EUT uses passive RFID tags so this paragraph is not applicable.			

Note: This equipment must also meet the requirements of FCC Part 15, Subpart B. Nemko-CCL tested this device to the FCC Part 15, Subpart B requirements and has documented the device's compliance in Nemko-CCL report #152217-1.1.

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 §15.203 Antenna Requirements

The antenna is etched on the PCB and is not replaceable so the requirements of this section are met.

6.2.2 Conducted Emissions (AC Mains)

The configuration with the R3210 clipped on to the T4210 was found to exhibit the worst-case conducted emissions at the AC mains. The data shown below is from testing in that configuration.

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.18	Hot Lead	Quasi-Peak (Note 2)	54.2	64.5	-10.3
0.18	Hot Lead	Average(Note 1)	32.3	54.5	-22.2
0.22	Hot Lead	Quasi-Peak (Note 2)	52.5	62.9	-10.4
0.22	Hot Lead	Average(Note 1)	32.4	52.9	-20.5
0.26	Hot Lead	Quasi-Peak (Note 2)	49.4	61.4	-12.0
0.26	Hot Lead	Average(Note 1)	29.8	51.4	-21.6
0.29	Hot Lead	Quasi-Peak (Note 1)	45.8	50.5	-4.7
23.05	Hot Lead	Quasi-Peak (Note 1)	45.1	50.0	-4.9
23.55	Hot Lead	Quasi-Peak (Note 1)	44.0	50.0	-6.0
0.16	Neutral Lead	Quasi-Peak (Note 2)	63.5	65.7	-2.2
0.16	Neutral Lead	Average(Note 1)	38.7	55.7	-17.0
0.17	Neutral Lead	Quasi-Peak (Note 2)	60.1	65.0	-4.9
0.17	Neutral Lead	Average(Note 1)	37.3	55.5	-18.2
0.19	Neutral Lead	Quasi-Peak (Note 2)	58.7	63.9	-5.2
0.19	Neutral Lead	Average(Note 1)	31.0	53.9	-22.9

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.22	Neutral Lead	Quasi-Peak (Note 2)	54.6	62.7	-8.1
0.22	Neutral Lead	Average(Note 1)	30.2	52.7	-22.5
0.25	Neutral Lead	Quasi-Peak (Note 2)	50.1	61.8	-11.7
0.25	Neutral Lead	Average(Note 1)	27.0	51.8	-24.8
0.29	Neutral Lead	Quasi-Peak (Note 1)	46.9	50.5	-3.6
23.03	Neutral Lead	Quasi-Peak (Note 1)	44.9	50.0	-5.1

Note 1: 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.

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

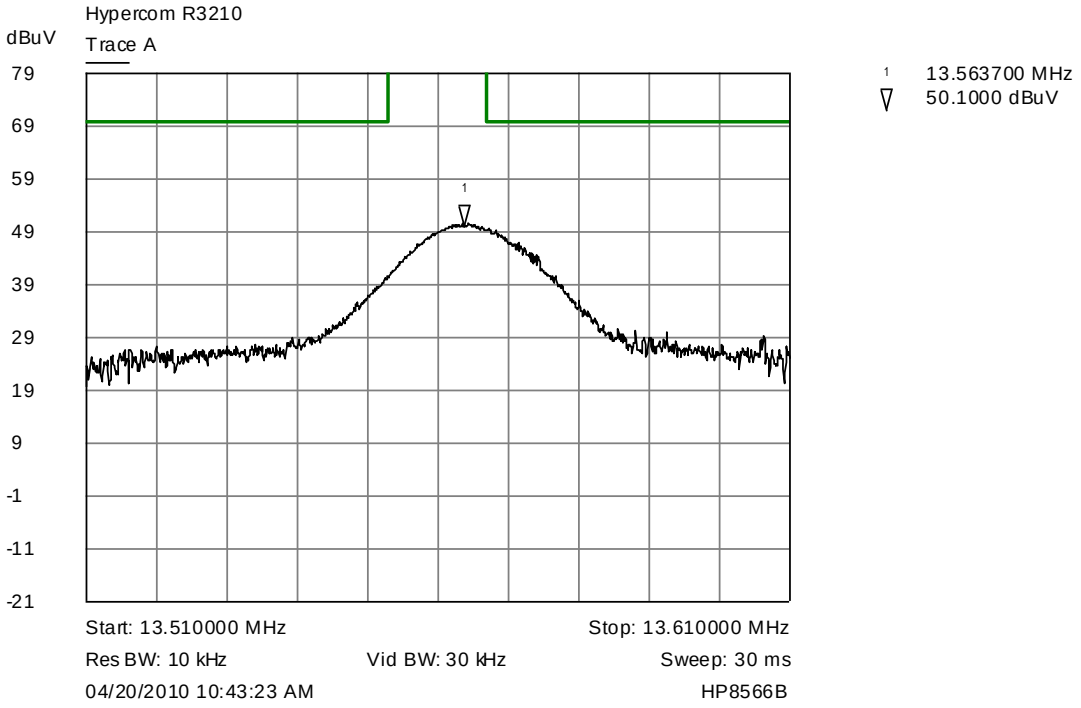
RESULT

The EUT complied with the requirements of §15.207 with a margin of 2.2 dB.

6.2.3 §15.225(a) – (d) Operation in the Band 13.110 – 14.010 MHz

The emissions from the R3210 must meet the emission mask specified in §15.225. The plots of the fundamental frequency and operating band of the transmitter are shown below. A bandwidth plot, although not specified in the regulations, is also shown. The bandwidth is 3.4 kHz. The data for the fundamental, harmonics, and spurious emissions is shown in tabular format after the plots.

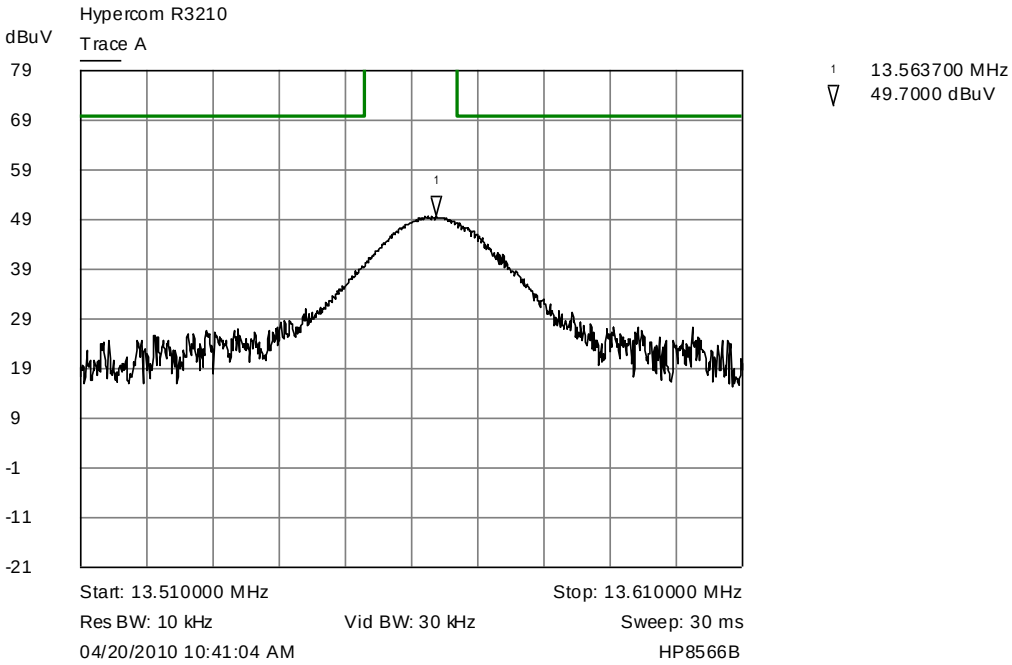
Clip-On Configuration



clip on - modulated

Trace A 10 meter corrected fundamental plot - FCC 15.225 emission mask

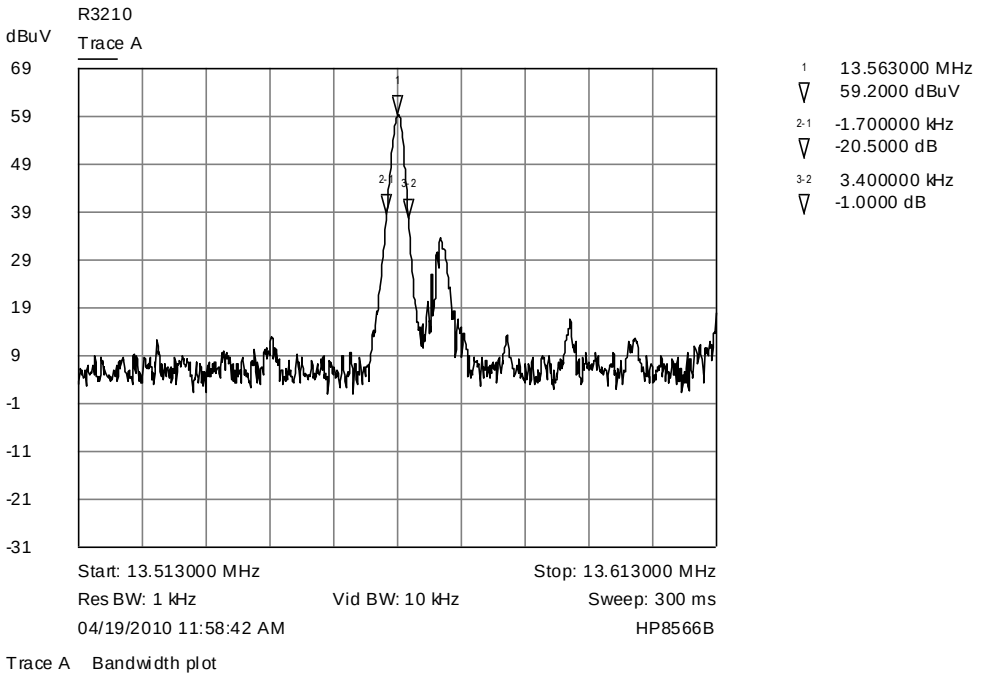
Stand-Beside Configuration



Stand beside - modulated

Trace A 10 meter corrected fundamental plot - FCC 15.225 emission mask

Bandwidth Plot



The data shown in the table below is the worst-case emission found in testing both the stand-beside and clip-on configurations.

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)	39.0	11.1	50.1	103.1	-53.0
27.12	Peak	(Note 2)	19.1	11.0	30.1	48.6	-18.5
40.68	Peak	Vertical	6.7	13.2	19.9	40.0	-20.1
40.68	Peak	Horizontal	6.0	13.2	19.2	40.0	-20.8
54.24	Peak	Vertical	16.2	9.1	25.3	40.0	-14.7
54.24	Peak	Horizontal	10.0	9.1	19.1	40.0	-20.9
67.8	Peak	Vertical	10.6	7.8	18.4	40.0	-21.6
67.8	Peak	Horizontal	8.7	7.8	16.5	40.0	-23.5
81.36	Peak	Vertical	12.6	7.7	20.3	40.0	-19.7
81.36	Peak	Horizontal	6.7	7.7	14.4	40.0	-25.6
94.92	Peak	Vertical	10.8	9.5	20.3	43.5	-23.2
94.92	Peak	Horizontal	7.2	9.5	16.7	43.5	-26.8

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	13.9	9.7	23.6	43.5	-19.9
108.48	Peak	Horizontal	10.8	9.7	20.5	43.5	-23.0
122.04	Peak	Vertical	9.8	8.7	18.5	43.5	-25.0
122.04	Peak	Horizontal	9.5	8.7	18.2	43.5	-25.3
135.60	Peak	Vertical	18.2	8.8	27.0	43.5	-16.5
135.60	Peak	Horizontal	9.4	8.8	18.2	43.5	-25.3

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

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

Note 3: 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).

6.2.4 §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 to allow for a variance in the voltage, at voltages of 6.375 to 8.625Vdc at a temperature of 20°C.

The operating frequency of the R3210 is 13.563 MHz; therefore, the frequency must be maintained between 13.5643566 MHz and 13.5616437 MHz.

13.563 MHz x 0.0001 = 1.3563 kHz

Lower edge of range = 13.563 MHz – 1.3563 kHz = 13.5616437 MHz
Upper edge of range = 13.563 MHz + 1.3563 kHz = 13.5643566 MHz

Time of Measurement	7.5 Vdc +20°C	7.5 Vdc +50°C	7.5 Vdc -20°C	6.38 Vdc +20°C	8.63 Vdc +20°C
Start up	13.563123	13.563048	13.563119	13.563125	13.563125
2 minutes	13.563125	13.563049	13.563117	13.563123	13.563129
5 minutes	13.563125	13.563042	13.563119	13.563123	13.563129
10 minutes	13.563125	13.563049	13.563125	13.563125	13.563123

To comply with FCC §15.31(e), the signal strength of the fundamental emission was measured during the tests of 15.225(e). No variance of the fundamental emission strength was seen.

RESULT

The EUT fundamental frequency stayed within +/-0.01% over the range of conditions and time specified in the regulations and the fundamental emission remained at the same field strength.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Conducted Disturbance at Mains Ports:

The conducted disturbances at mains port from the EUT were 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 devices with each device 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.

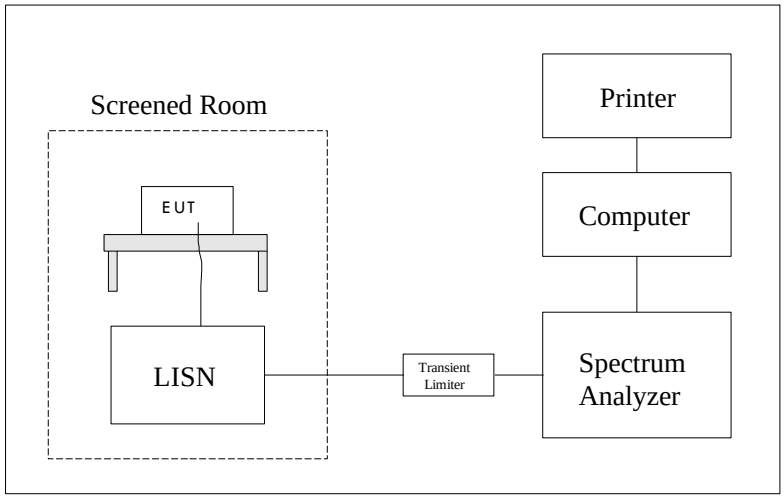
For testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	10/08/2009
Test Software	Nemko-CCL, Inc.	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	11/06/2009

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/06/2009
LISN	EMCO	3825/2	9305-2099	03/08/2010
Conductance Cable Wanship Site #2	Nemko-CCL, Inc.	Cable J	N/A	12/31/2009
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/31/2009

An independent calibration laboratory or Nemko-CCL, Inc. 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



A1.1 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.

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	Nemko-CCL, Inc.	N/A	N/A	10/08/2009
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rohde & Schwarz	1302.6005.40	100064	07/08/2009
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	11/06/2009
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/06/2009
Biconilog Antenna	EMCO	3142	9601-1008	9/26/2008
Active Loop Antenna	EMCO	6502	9111-2675	03/12/2009
20’ High Frequency Cable	Utiflex	UFA210A-1-2400-30050U	1175	03/04/2010

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
3 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable K	N/A	12/31/2009
10 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable L	N/A	12/31/2009
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/24/2009
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2009

An independent calibration laboratory or Nemko-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