

Dust Networks

TEST REPORT FOR

2.4 GHz Wireless Mote, M2510

Tested To The Following Standards:

FCC Part 15 Subpart B Sections 15.109

Report No.: 91302-17

Date of issue: February 9, 2011



TESTING
CERT #803.01, 803.02,
803.05, 803.06

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Dust Networks
30695 Huntwood Avenue
Hayward, CA 94544

Representative: Gordon Charles

REPORT PREPARED BY:

Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 91302

DATE OF EQUIPMENT RECEIPT:

January 29, 2011

DATE(S) OF TESTING:

January 29, 2011

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink, reading "Steve Behm", is positioned above a horizontal line.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Bothell, WA 98021-4413

Site Registration & Accreditation Information

| Location | CB # | Japan | Canada | FCC |
|----------|--------|--------------------------------|---------|--------|
| Bothell | US0081 | R-2296, C-2506, T-1489 & G-284 | 3082C-1 | 318736 |

SUMMARY OF RESULTS

Standard / Specification: FCC Part 15 Subpart B

| Description | Test Procedure/Method | Results |
|--------------------|--|---------|
| Radiated Emissions | FCC Part 15 Subpart B Section 15.109 Class B / ANSI C63.4 (2003) | Pass |

Conditions During Testing

This list is a summary of the conditions noted for or modifications made to the equipment during testing.

| Summary of Conditions |
|-----------------------|
| None |

EQUIPMENT UNDER TEST (EUT)

The following model has been tested by CKC Laboratories: **M2510**

The manufacturer states that the following additional model is identical electrically to the one which was tested, or any differences between them do not affect their EMC characteristics, and therefore they meet the level of testing equivalent to the tested model: **M2140**

EQUIPMENT UNDER TEST

2.4 GHz Wireless Mote

Manuf: Dust Networks
Model: M2510
Serial: NA
FCC ID: SJC-M2140

2dBi Antenna

Manuf: NA
Model: NA
Serial: NA

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

TTL Converter

Manuf: B&B Electronics
Model: 232LPTTL33
Serial: 0088525046

Laptop

Manuf: Dell
Model: Inspiron 600m
Serial: NA

FCC PART 15 SUBPART B

This report contains EMC emissions test results under United States Federal Communications Commission (FCC) 47 CFR 15B requirements for Unlicensed Radio Frequency Devices, Subpart B - Unintentional Radiators.

15.109 Radiated Emissions

Test Notes: Radiated disturbances emanating from enclosure.

Test Procedure: ANSI C63.4

Test Data Sheets

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Dust Networks**

Specification: **15.109 Radiated Emissions Class B**

Work Order #: **91302**

Test Type: **Radiated Scan**

Equipment: **2.4 GHz Wireless Mote**

Manufacturer: **Dust Networks**

Model: **M2510**

S/N: **NA**

Date: 1/29/2011

Time: 12:19:45 PM

Sequence#: 2

Tested By: Armando del Angel

Test Equipment:

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|----|----------|-------------------|------------------|------------------|--------------|
| T1 | AN01316 | Preamplifier | 8447D | 5/21/2010 | 5/21/2012 |
| T2 | AN01993 | Biconilog Antenna | CBL6111C | 10/9/2009 | 10/9/2011 |
| T3 | AN03121 | Cable | 32026-2-29080-84 | 10/23/2009 | 10/23/2011 |
| T4 | ANP05360 | Cable | RG214 | 11/8/2010 | 11/8/2012 |
| T5 | ANP05366 | Cable | RG-214 | 10/20/2009 | 10/20/2011 |
| | AN02872 | Spectrum Analyzer | E4440A | 8/25/2009 | 8/25/2011 |

Equipment Under Test (* = EUT):

| Function | Manufacturer | Model # | S/N |
|------------------------|---------------|---------|-----|
| 2.4 GHz Wireless Mote* | Dust Networks | M2510 | NA |
| 2dBi Antenna | NA | NA | NA |

Support Devices:

| Function | Manufacturer | Model # | S/N |
|---------------|-----------------|---------------|------------|
| TTL Converter | B&B Electronics | 232LPTTL33 | 0088525046 |
| Laptop | Dell | Inspiron 600m | NA |

Test Conditions / Notes:

Temperature: 21°C

Humidity: 34%

Pressure: 102.1kPa

Freq. Range: 30-1000MHz

RBW: 120kHz

VBW: 360kHz

Sweep: Auto

Mode: RX

EUT is raised 80cm from the ground plane with styrofoam.

EUT is at 3m from the receive antenna.

EUT is connected to the support laptop through a TTL Converter.

The TTL converter is connected to the support laptop through a RS232 (serial) cable.

Antenna port connected to +2 dBi Antenna.

Support laptop is setting the EUT in the proper mode and channels:

MID = 2440MHz

Ext Attn: 0 dB

Measurement Data:

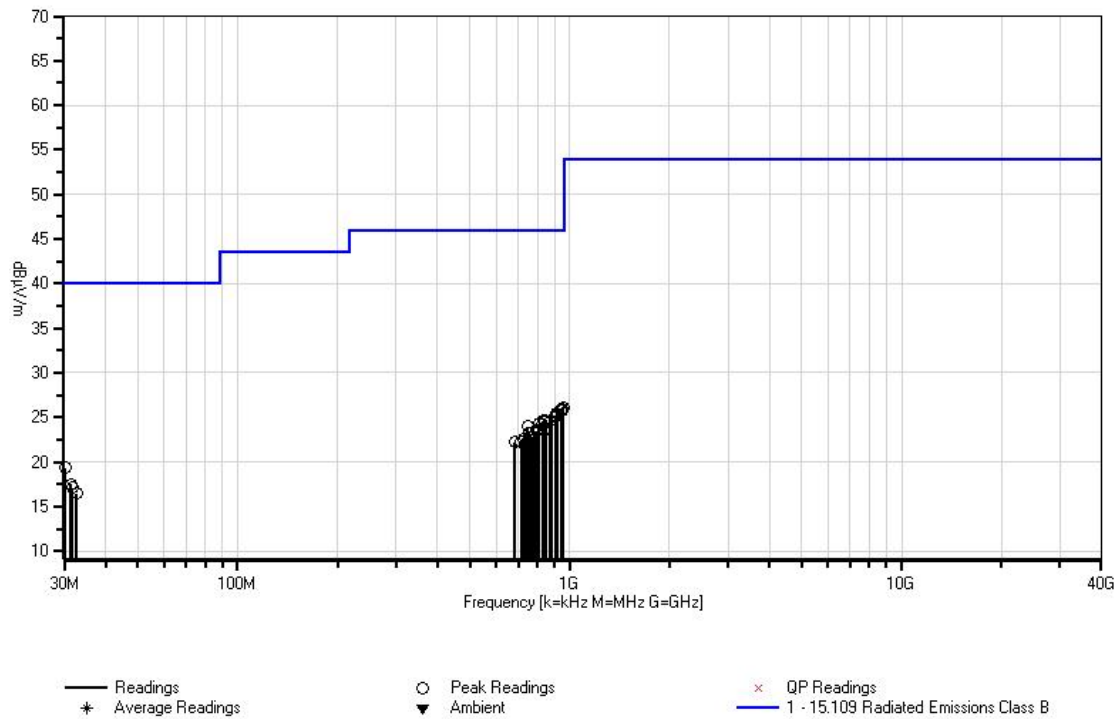
Reading listed by margin.

Test Distance: 3 Meters

| # | Freq MHz | Rdng dBμV | T1 T5 dB | T2 dB | T3 dB | T4 dB | Dist Table | Corr dBμV/m | Spec dBμV/m | Margin dB | Polar Ant |
|----|-------------|--------------|----------------|----------|----------|----------|---------------|----------------|----------------|--------------|--------------|
| 1 | 954.462M | 26.3 | -29.1 +2.3 | +23.8 | +0.8 | +2.0 | +0.0 360 | 26.1 | 46.0 | -19.9 | Horiz 150 |
| 2 | 952.711M | 26.2 | -29.1 +2.3 | +23.8 | +0.8 | +2.0 | +0.0 360 | 26.0 | 46.0 | -20.0 | Horiz 150 |
| 3 | 942.202M | 26.0 | -29.1 +2.3 | +23.7 | +0.8 | +2.0 | +0.0 360 | 25.7 | 46.0 | -20.3 | Horiz 150 |
| 4 | 946.288M | 26.0 | -29.1 +2.3 | +23.7 | +0.8 | +2.0 | +0.0 360 | 25.7 | 46.0 | -20.3 | Horiz 150 |
| 5 | 913.595M | 26.2 | -29.2 +2.3 | +23.3 | +0.8 | +2.0 | +0.0 360 | 25.4 | 46.0 | -20.6 | Horiz 150 |
| 6 | 30.210M | 27.6 | -29.4 +0.4 | +20.4 | +0.1 | +0.2 | +0.0 360 | 19.3 | 40.0 | -20.7 | Horiz 150 |
| 7 | 905.421M | 26.1 | -29.2 +2.3 | +23.2 | +0.8 | +1.9 | +0.0 360 | 25.1 | 46.0 | -20.9 | Horiz 150 |
| 8 | 908.924M | 26.1 | -29.2 +2.3 | +23.2 | +0.8 | +1.9 | +0.0 360 | 25.1 | 46.0 | -20.9 | Horiz 150 |
| 9 | 845.287M | 26.6 | -29.3 +2.2 | +22.6 | +0.7 | +1.9 | +0.0 360 | 24.7 | 46.0 | -21.3 | Horiz 150 |
| 10 | 878.565M | 26.1 | -29.2 +2.2 | +22.9 | +0.8 | +1.9 | +0.0 360 | 24.7 | 46.0 | -21.3 | Horiz 150 |
| 11 | 833.611M | 26.8 | -29.3 +2.1 | +22.4 | +0.7 | +1.9 | +0.0 360 | 24.6 | 46.0 | -21.4 | Horiz 150 |
| 12 | 875.646M | 26.0 | -29.2 +2.2 | +22.9 | +0.8 | +1.9 | +0.0 360 | 24.6 | 46.0 | -21.4 | Horiz 150 |
| 13 | 842.368M | 26.6 | -29.3 +2.1 | +22.5 | +0.7 | +1.9 | +0.0 360 | 24.5 | 46.0 | -21.5 | Horiz 150 |
| 14 | 810.258M | 27.1 | -29.4 +1.9 | +22.2 | +0.7 | +1.8 | +0.0 360 | 24.3 | 46.0 | -21.7 | Horiz 150 |
| 15 | 830.108M | 26.3 | -29.3 +2.1 | +22.4 | +0.7 | +1.9 | +0.0 360 | 24.1 | 46.0 | -21.9 | Horiz 150 |

| | | | | | | | | | | | |
|----|----------|------|---------------|-------|------|------|-------------|------|------|-------|--------------|
| 16 | 747.206M | 27.9 | -29.6 +1.9 | +21.4 | +0.7 | +1.7 | +0.0 360 | 24.0 | 46.0 | -22.0 | Horiz 150 |
| 17 | 837.114M | 25.7 | -29.3 +2.1 | +22.5 | +0.7 | +1.9 | +0.0 360 | 23.6 | 46.0 | -22.4 | Horiz 150 |
| 18 | 31.431M | 27.6 | -29.4 +0.4 | +18.6 | +0.1 | +0.2 | +0.0 360 | 17.5 | 40.0 | -22.5 | Horiz 150 |
| 19 | 790.992M | 26.5 | -29.4 +1.9 | +22.0 | +0.7 | +1.8 | +0.0 360 | 23.5 | 46.0 | -22.5 | Horiz 150 |
| 20 | 799.166M | 26.4 | -29.4 +1.9 | +22.1 | +0.7 | +1.8 | +0.0 360 | 23.5 | 46.0 | -22.5 | Horiz 150 |
| 21 | 758.298M | 27.0 | -29.6 +1.9 | +21.5 | +0.7 | +1.7 | +0.0 360 | 23.2 | 46.0 | -22.8 | Horiz 150 |
| 22 | 31.810M | 27.7 | -29.4 +0.4 | +18.1 | +0.1 | +0.2 | +0.0 360 | 17.1 | 40.0 | -22.9 | Horiz 150 |
| 23 | 754.795M | 26.6 | -29.6 +1.9 | +21.5 | +0.7 | +1.7 | +0.0 360 | 22.8 | 46.0 | -23.2 | Horiz 150 |
| 24 | 768.223M | 26.4 | -29.5 +1.8 | +21.7 | +0.7 | +1.7 | +0.0 360 | 22.8 | 46.0 | -23.2 | Horiz 150 |
| 25 | 774.061M | 26.3 | -29.5 +1.8 | +21.8 | +0.7 | +1.7 | +0.0 360 | 22.8 | 46.0 | -23.2 | Horiz 150 |
| 26 | 32.778M | 28.5 | -29.4 +0.4 | +16.7 | +0.1 | +0.2 | +0.0 360 | 16.5 | 40.0 | -23.5 | Horiz 150 |
| 27 | 725.604M | 26.6 | -29.6 +2.0 | +21.1 | +0.7 | +1.7 | +0.0 360 | 22.5 | 46.0 | -23.5 | Horiz 150 |
| 28 | 682.985M | 27.1 | -29.7 +1.9 | +20.6 | +0.7 | +1.6 | +0.0 360 | 22.2 | 46.0 | -23.8 | Horiz 150 |
| 29 | 715.095M | 26.5 | -29.6 +2.0 | +20.9 | +0.7 | +1.7 | +0.0 360 | 22.2 | 46.0 | -23.8 | Horiz 150 |
| 30 | 740.200M | 26.1 | -29.6 +1.9 | +21.3 | +0.7 | +1.7 | +0.0 360 | 22.1 | 46.0 | -23.9 | Horiz 150 |

CKC Laboratories, Inc. Date: 1/29/2011 Time: 12:19:45 PM Dust Networks WO#: 91302
 15.109 Radiated Emissions Class B Test Distance: 3 Meters Horizontal Sequence#: 2 Ext ATTN: 0 dB



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Dust Networks**
 Specification: **15.109 Radiated Emissions Class B**
 Work Order #: **91302**
 Test Type: **Radiated Scan**
 Equipment: **2.4 GHz Wireless Mote**
 Manufacturer: **Dust Networks**
 Model: **M2510**
 S/N: **NA**

Date: 1/29/2011
 Time: 12:18:00 PM
 Sequence#: 1
 Tested By: Armando del Angel

Test Equipment:

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|----|----------|-------------------|------------------|------------------|--------------|
| T1 | AN02872 | Spectrum Analyzer | E4440A | 8/25/2009 | 8/25/2011 |
| T2 | AN03121 | Cable | 32026-2-29080-84 | 10/23/2009 | 10/23/2011 |
| T3 | AN01993 | Biconilog Antenna | CBL6111C | 10/9/2009 | 10/9/2011 |
| T4 | ANP05360 | Cable | RG214 | 11/8/2010 | 11/8/2012 |
| T5 | ANP05366 | Cable | RG-214 | 10/20/2009 | 10/20/2011 |
| T6 | AN01316 | Preamp | 8447D | 5/21/2010 | 5/21/2012 |

Equipment Under Test (* = EUT):

| Function | Manufacturer | Model # | S/N |
|------------------------|---------------|---------|-----|
| 2.4 GHz Wireless Mote* | Dust Networks | M2510 | NA |
| 2dBi Antenna | NA | NA | NA |

Support Devices:

| Function | Manufacturer | Model # | S/N |
|---------------|-----------------|---------------|------------|
| TTL Converter | B&B Electronics | 232LPTTL33 | 0088525046 |
| Laptop | Dell | Inspiron 600m | NA |

Test Conditions / Notes:

| |
|---|
| Temperature: 21°C Humidity: 34% Pressure: 102.1kPa Freq. Range: 30-1000MHz RBW: 120kHz VBW: 360kHz Sweep: Auto Mode: RX EUT is raised 80cm from the ground plane with styrofoam. EUT is at 3m from the receive antenna. EUT is connected to the support laptop through a TTL Converter. The TTL converter is connected to the support laptop through a RS232 (serial) cable. Antenna port connected to +2 dBi Antenna. Support laptop is setting the EUT in the proper mode and channels: MID = 2440MHz |
|---|

Ext Attn: 0 dB

Measurement Data:

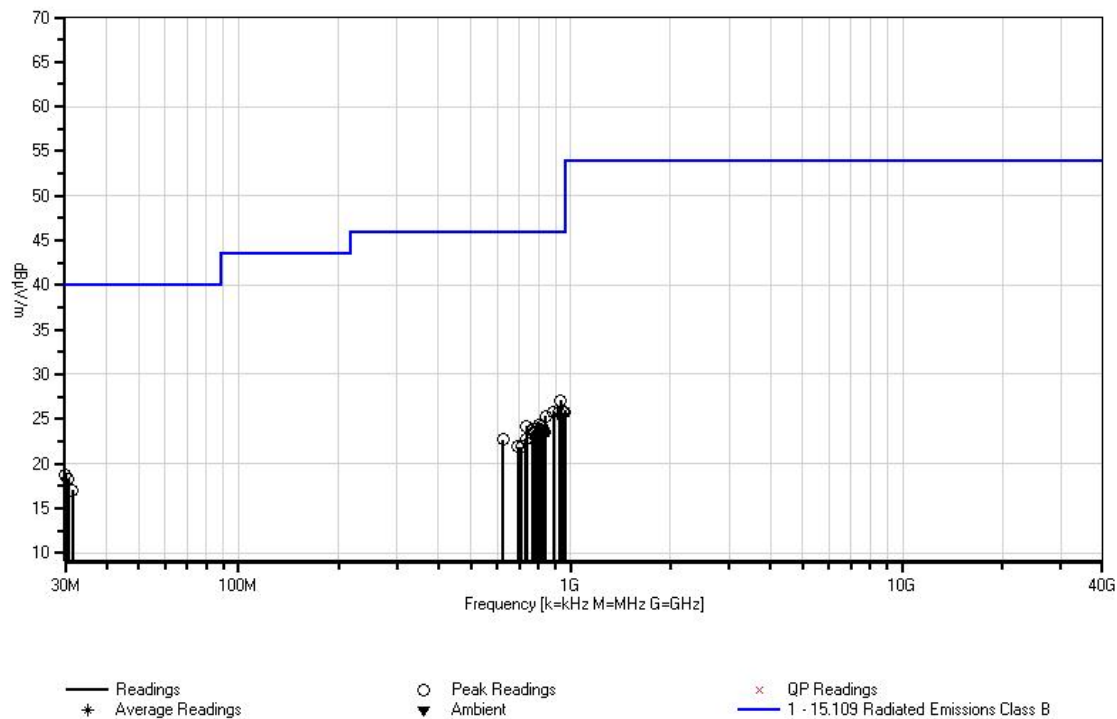
Reading listed by margin.

Test Distance: 3 Meters

| # | Freq MHz | Rdng dB μ V | T1 T5 dB | T2 T6 dB | T3 dB | T4 dB | Dist Table | Corr dB μ V/m | Spec dB μ V/m | Margin dB | Polar Ant |
|----|-------------|--------------------|----------------|----------------|----------|----------|---------------|----------------------|----------------------|--------------|--------------|
| 1 | 935.196M | 27.4 | +0.0 +2.4 | +0.8 -29.1 | +23.6 | +2.0 | +0.0 360 | 27.1 | 46.0 | -18.9 | Verti 130 |
| 2 | 888.490M | 27.1 | +0.0 +2.2 | +0.8 -29.2 | +23.0 | +1.9 | +0.0 360 | 25.8 | 46.0 | -20.2 | Verti 130 |
| 3 | 922.352M | 26.3 | +0.0 +2.4 | +0.8 -29.2 | +23.4 | +2.0 | +0.0 360 | 25.7 | 46.0 | -20.3 | Verti 130 |
| 4 | 945.705M | 26.0 | +0.0 +2.3 | +0.8 -29.1 | +23.7 | +2.0 | +0.0 360 | 25.7 | 46.0 | -20.3 | Verti 130 |
| 5 | 959.133M | 25.8 | +0.0 +2.3 | +0.8 -29.1 | +23.9 | +2.0 | +0.0 360 | 25.7 | 46.0 | -20.3 | Verti 130 |
| 6 | 940.450M | 25.9 | +0.0 +2.3 | +0.8 -29.1 | +23.6 | +2.0 | +0.0 360 | 25.5 | 46.0 | -20.5 | Verti 130 |
| 7 | 842.368M | 27.4 | +0.0 +2.1 | +0.7 -29.3 | +22.5 | +1.9 | +0.0 360 | 25.3 | 46.0 | -20.7 | Verti 130 |
| 8 | 30.042M | 26.9 | +0.0 +0.4 | +0.1 -29.4 | +20.6 | +0.2 | +0.0 360 | 18.8 | 40.0 | -21.2 | Verti 130 |
| 9 | 803.836M | 27.3 | +0.0 +1.9 | +0.7 -29.4 | +22.1 | +1.8 | +0.0 360 | 24.4 | 46.0 | -21.6 | Verti 130 |
| 10 | 30.673M | 27.3 | +0.0 +0.4 | +0.1 -29.4 | +19.7 | +0.2 | +0.0 360 | 18.3 | 40.0 | -21.7 | Verti 130 |
| 11 | 736.697M | 28.2 | +0.0 +2.0 | +0.7 -29.6 | +21.2 | +1.7 | +0.0 360 | 24.2 | 46.0 | -21.8 | Verti 130 |
| 12 | 820.183M | 26.8 | +0.0 +2.0 | +0.7 -29.4 | +22.3 | +1.8 | +0.0 360 | 24.2 | 46.0 | -21.8 | Verti 130 |
| 13 | 785.154M | 27.3 | +0.0 +1.8 | +0.7 -29.5 | +21.9 | +1.7 | +0.0 360 | 23.9 | 46.0 | -22.1 | Verti 130 |
| 14 | 807.339M | 26.7 | +0.0 +1.9 | +0.7 -29.4 | +22.2 | +1.8 | +0.0 360 | 23.9 | 46.0 | -22.1 | Verti 130 |
| 15 | 809.091M | 26.7 | +0.0 +1.9 | +0.7 -29.4 | +22.2 | +1.8 | +0.0 360 | 23.9 | 46.0 | -22.1 | Verti 130 |
| 16 | 771.726M | 27.4 | +0.0 +1.8 | +0.7 -29.5 | +21.7 | +1.7 | +0.0 360 | 23.8 | 46.0 | -22.2 | Verti 130 |
| 17 | 823.102M | 26.3 | +0.0 +2.0 | +0.7 -29.4 | +22.3 | +1.8 | +0.0 360 | 23.7 | 46.0 | -22.3 | Verti 130 |
| 18 | 816.096M | 26.3 | +0.0 +1.9 | +0.7 -29.4 | +22.3 | +1.8 | +0.0 360 | 23.6 | 46.0 | -22.4 | Verti 130 |
| 19 | 830.692M | 25.8 | +0.0 +2.1 | +0.7 -29.3 | +22.4 | +1.9 | +0.0 360 | 23.6 | 46.0 | -22.4 | Verti 130 |
| 20 | 778.148M | 27.0 | +0.0 +1.8 | +0.7 -29.5 | +21.8 | +1.7 | +0.0 360 | 23.5 | 46.0 | -22.5 | Verti 130 |
| 21 | 835.946M | 25.6 | +0.0 +2.1 | +0.7 -29.3 | +22.5 | +1.9 | +0.0 360 | 23.5 | 46.0 | -22.5 | Verti 130 |
| 22 | 766.472M | 26.9 | +0.0 +1.8 | +0.7 -29.5 | +21.7 | +1.7 | +0.0 360 | 23.3 | 46.0 | -22.7 | Verti 130 |
| 23 | 780.483M | 26.8 | +0.0 +1.8 | +0.7 -29.5 | +21.8 | +1.7 | +0.0 360 | 23.3 | 46.0 | -22.7 | Verti 130 |

| | | | | | | | | | | | |
|----|----------|------|--------------|---------------|-------|------|-------------|------|------|-------|--------------|
| 24 | 795.079M | 26.2 | +0.0 +1.9 | +0.7 -29.4 | +22.0 | +1.8 | +0.0 360 | 23.2 | 46.0 | -22.8 | Verti 130 |
| 25 | 31.641M | 27.4 | +0.0 +0.4 | +0.1 -29.4 | +18.3 | +0.2 | +0.0 360 | 17.0 | 40.0 | -23.0 | Verti 130 |
| 26 | 789.824M | 26.0 | +0.0 +1.9 | +0.7 -29.4 | +22.0 | +1.8 | +0.0 360 | 23.0 | 46.0 | -23.0 | Verti 130 |
| 27 | 734.362M | 26.8 | +0.0 +2.0 | +0.7 -29.6 | +21.2 | +1.7 | +0.0 360 | 22.8 | 46.0 | -23.2 | Verti 130 |
| 28 | 625.771M | 28.5 | +0.0 +1.8 | +0.6 -29.8 | +20.1 | +1.5 | +0.0 360 | 22.7 | 46.0 | -23.3 | Verti 130 |
| 29 | 692.910M | 26.7 | +0.0 +1.9 | +0.7 -29.6 | +20.6 | +1.6 | +0.0 360 | 21.9 | 46.0 | -24.1 | Verti 130 |
| 30 | 711.592M | 26.2 | +0.0 +2.0 | +0.7 -29.6 | +20.9 | +1.7 | +0.0 360 | 21.9 | 46.0 | -24.1 | Verti 130 |

CKC Laboratories, Inc. Date: 1/29/2011 Time: 12:18:00 PM Dust Networks WO#: 91302
15.109 Radiated Emissions Class B Test Distance: 3 Meters Vertical Sequence#: 1 Ext ATTN: 0 dB



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Dust Networks**
 Specification: **15.109 Radiated Emissions Class B**
 Work Order #: **91302**
 Test Type: **Radiated Scan**
 Equipment: **2.4 GHz Wireless Mote**
 Manufacturer: **Dust Networks**
 Model: **M2510**
 S/N: **NA**

Date: 1/29/2011
 Time: 1:04:47 PM
 Sequence#: 3
 Tested By: Armando del Angel

Test Equipment:

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|----|----------|--|------------------|------------------|--------------|
| T1 | AN03121 | Cable | 32026-2-29080-84 | 10/23/2009 | 10/23/2011 |
| | AN02872 | Spectrum Analyzer | E4440A | 8/25/2009 | 8/25/2011 |
| | AN01467 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 5/7/2010 | 5/7/2012 |
| | AN03123 | Cable | 32026-2-29801-12 | 10/23/2009 | 10/23/2011 |
| | ANP05542 | Cable | Heliac | 10/23/2009 | 10/23/2011 |
| | AN01271 | Preamplifier | 83017A | 9/17/2009 | 9/17/2011 |

Equipment Under Test (* = EUT):

| Function | Manufacturer | Model # | S/N |
|------------------------|---------------|---------|-----|
| 2.4 GHz Wireless Mote* | Dust Networks | M2510 | NA |
| 2dBi Antenna | NA | NA | NA |

Support Devices:

| Function | Manufacturer | Model # | S/N |
|---------------|-----------------|---------------|------------|
| TTL Converter | B&B Electronics | 232LPTTL33 | 0088525046 |
| Laptop | Dell | Inspiron 600m | NA |

Test Conditions / Notes:

| |
|--|
| Temperature: 21°C Humidity: 34% Pressure: 102.1kPa Freq. Range: 1-13GHz RBW: 1MHz VBW: 3MHz Sweep: Auto Mode: RX EUT is raised 80cm from the ground plane with styrofoam. EUT is at 3m from the receive antenna. EUT is connected to the support laptop through a TTL Converter. The TTL converter is connected to the support laptop through a RS232 (serial) cable. Antenna port connected to +2 dBi Antenna. Support laptop is setting the EUT in the proper mode and channels: MID = 2440MHz |
|--|

Ext Attn: 0 dB

Measurement Data:

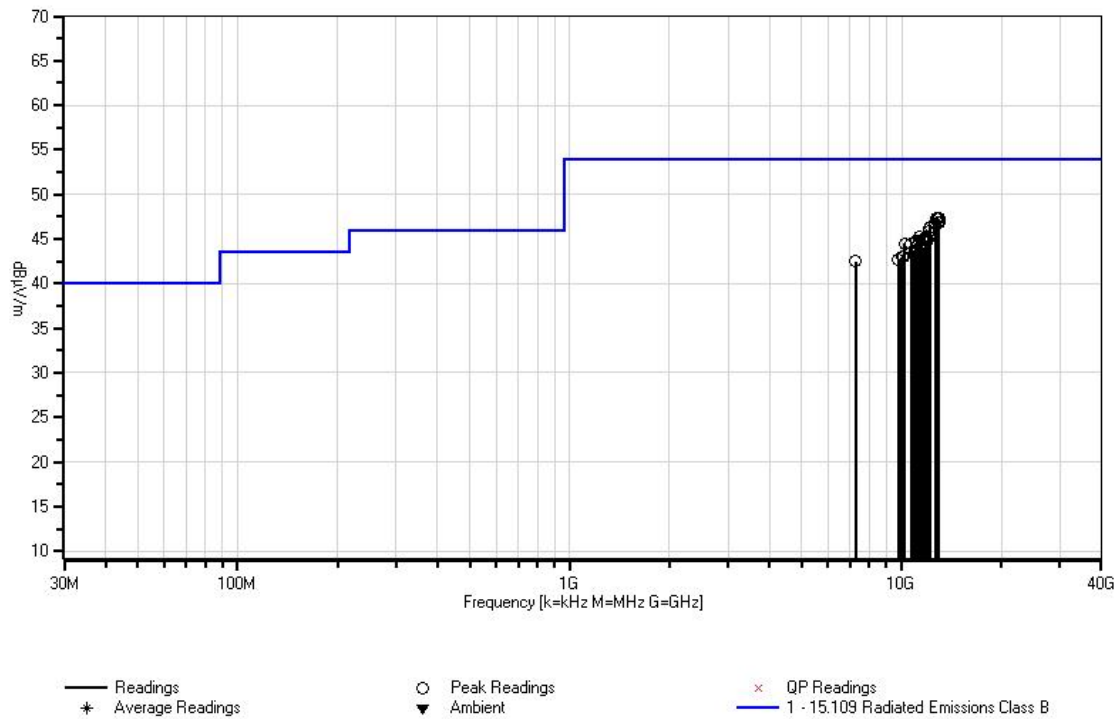
Reading listed by margin.

Test Distance: 3 Meters

| # | Freq MHz | Rdng dB μ V | T1 T5 dB | T2 dB | T3 dB | T4 dB | Dist Table | Corr dB μ V/m | Spec dB μ V/m | Margin dB | Polar Ant |
|----|----------------|--------------------|----------------|----------|----------|----------|---------------|----------------------|----------------------|--------------|--------------|
| 1 | 12778.468 M | 31.6 | +3.6 +7.0 | +39.5 | -35.0 | +0.7 | +0.0 360 | 47.4 | 54.0 | -6.6 | Horiz 100 |
| 2 | 12870.773 M | 31.3 | +3.6 +7.0 | +39.7 | -35.0 | +0.7 | +0.0 360 | 47.3 | 54.0 | -6.7 | Horiz 100 |
| 3 | 12963.078 M | 31.2 | +3.5 +7.0 | +39.9 | -35.1 | +0.8 | +0.0 360 | 47.3 | 54.0 | -6.7 | Horiz 100 |
| 4 | 12981.539 M | 30.9 | +3.4 +7.0 | +39.9 | -35.1 | +0.8 | +0.0 360 | 46.9 | 54.0 | -7.1 | Horiz 100 |
| 5 | 12889.234 M | 30.9 | +3.6 +7.0 | +39.7 | -35.1 | +0.7 | +0.0 360 | 46.8 | 54.0 | -7.2 | Horiz 100 |
| 6 | 12661.548 M | 31.5 | +3.3 +7.0 | +39.2 | -35.0 | +0.7 | +0.0 360 | 46.7 | 54.0 | -7.3 | Horiz 100 |
| 7 | 12218.483 M | 31.5 | +3.7 +6.8 | +38.8 | -35.0 | +0.6 | +0.0 360 | 46.4 | 54.0 | -7.6 | Horiz 100 |
| 8 | 12169.254 M | 31.4 | +3.6 +6.8 | +38.8 | -35.0 | +0.6 | +0.0 360 | 46.2 | 54.0 | -7.8 | Horiz 100 |
| 9 | 12058.488 M | 31.6 | +3.3 +6.7 | +38.7 | -35.0 | +0.6 | +0.0 360 | 45.9 | 54.0 | -8.1 | Horiz 100 |
| 10 | 11252.356 M | 31.7 | +3.3 +6.6 | +38.4 | -35.1 | +0.4 | +0.0 360 | 45.3 | 54.0 | -8.7 | Horiz 100 |
| 11 | 11492.350 M | 31.1 | +3.4 +6.6 | +38.5 | -35.0 | +0.4 | +0.0 360 | 45.0 | 54.0 | -9.0 | Horiz 100 |
| 12 | 12027.719 M | 30.8 | +3.2 +6.7 | +38.7 | -35.0 | +0.6 | +0.0 360 | 45.0 | 54.0 | -9.0 | Horiz 100 |
| 13 | 11781.572 M | 30.9 | +3.3 +6.6 | +38.6 | -35.0 | +0.5 | +0.0 360 | 44.9 | 54.0 | -9.1 | Horiz 100 |
| 14 | 11910.800 M | 30.7 | +3.2 +6.7 | +38.7 | -35.0 | +0.6 | +0.0 360 | 44.9 | 54.0 | -9.1 | Horiz 100 |
| 15 | 11843.109 M | 30.7 | +3.3 +6.6 | +38.7 | -35.0 | +0.5 | +0.0 360 | 44.8 | 54.0 | -9.2 | Horiz 100 |

| | | | | | | | | | | | |
|----|----------------|------|--------------|-------|-------|------|------|------|------|-------|-------|
| 16 | 11104.668 M | 31.4 | +3.2 +6.5 | +38.3 | -35.1 | +0.4 | +0.0 | 44.7 | 54.0 | -9.3 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 17 | 11326.200 M | 31.1 | +3.3 +6.6 | +38.4 | -35.1 | +0.4 | +0.0 | 44.7 | 54.0 | -9.3 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 18 | 11363.122 M | 31.0 | +3.4 +6.6 | +38.4 | -35.1 | +0.4 | +0.0 | 44.7 | 54.0 | -9.3 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 19 | 11793.880 M | 30.6 | +3.3 +6.6 | +38.6 | -35.0 | +0.5 | +0.0 | 44.6 | 54.0 | -9.4 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 20 | 10230.846 M | 31.7 | +3.1 +5.9 | +37.6 | -34.1 | +0.3 | +0.0 | 44.5 | 54.0 | -9.5 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 21 | 10661.604 M | 31.4 | +3.1 +6.3 | +38.1 | -34.8 | +0.4 | +0.0 | 44.5 | 54.0 | -9.5 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 22 | 11406.198 M | 30.3 | +3.4 +6.6 | +38.5 | -35.0 | +0.4 | +0.0 | 44.2 | 54.0 | -9.8 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 23 | 11049.285 M | 30.8 | +3.2 +6.5 | +38.3 | -35.1 | +0.4 | +0.0 | 44.1 | 54.0 | -9.9 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 24 | 11553.886 M | 29.8 | +3.5 +6.6 | +38.5 | -35.0 | +0.5 | +0.0 | 43.9 | 54.0 | -10.1 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 25 | 10981.595 M | 30.3 | +3.2 +6.5 | +38.3 | -35.1 | +0.4 | +0.0 | 43.6 | 54.0 | -10.4 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 26 | 10926.212 M | 30.2 | +3.2 +6.4 | +38.3 | -35.0 | +0.4 | +0.0 | 43.5 | 54.0 | -10.5 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 27 | 10021.621 M | 30.6 | +2.9 +5.9 | +37.3 | -34.0 | +0.3 | +0.0 | 43.0 | 54.0 | -11.0 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 28 | 10144.695 M | 30.3 | +3.1 +5.9 | +37.5 | -34.1 | +0.3 | +0.0 | 43.0 | 54.0 | -11.0 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 29 | 9763.167M | 31.0 | +2.7 +5.8 | +36.8 | -33.9 | +0.3 | +0.0 | 42.7 | 54.0 | -11.3 | Horiz |
| | | | | | | | 360 | | | | 100 |
| 30 | 7270.929M | 32.9 | +2.4 +5.2 | +36.1 | -34.6 | +0.5 | +0.0 | 42.5 | 54.0 | -11.5 | Horiz |
| | | | | | | | 360 | | | | 100 |

CKC Laboratories, Inc. Date: 1/29/2011 Time: 1:04:47 PM Dust Networks WO#: 91302
15.109 Radiated Emissions Class B Test Distance: 3 Meters Horizontal Sequence#: 3 Ext ATTN: 0 dB



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717

Customer: **Dust Networks**
 Specification: **15.109 Radiated Emissions Class B**
 Work Order #: **91302**
 Test Type: **Radiated Scan**
 Equipment: **2.4 GHz Wireless Mote**
 Manufacturer: **Dust Networks**
 Model: **M2510**
 S/N: **N/A**

Date: 1/29/2011
 Time: 1:09:02 PM
 Sequence#: 4
 Tested By: Armando del Angel

Test Equipment:

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|----|----------|--|------------------|------------------|--------------|
| T1 | AN03121 | Cable | 32026-2-29080-84 | 10/23/2009 | 10/23/2011 |
| | AN02872 | Spectrum Analyzer | E4440A | 8/25/2009 | 8/25/2011 |
| | AN01467 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 5/7/2010 | 5/7/2012 |
| | AN03123 | Cable | 32026-2-29801-12 | 10/23/2009 | 10/23/2011 |
| | ANP05542 | Cable | Helix | 10/23/2009 | 10/23/2011 |
| | AN01271 | Preamplifier | 83017A | 9/17/2009 | 9/17/2011 |

Equipment Under Test (* = EUT):

| Function | Manufacturer | Model # | S/N |
|------------------------|---------------|---------|-----|
| 2.4 GHz Wireless Mote* | Dust Networks | M2510 | NA |
| 2dBi Antenna | NA | NA | NA |

Support Devices:

| Function | Manufacturer | Model # | S/N |
|---------------|-----------------|---------------|------------|
| TTL Converter | B&B Electronics | 232LPTTL33 | 0088525046 |
| Laptop | Dell | Inspiron 600m | N/A |

Test Conditions / Notes:

| |
|--|
| Temperature: 21°C Humidity: 34% Pressure: 102.1kPa Freq. Range: 1-13GHz RBW: 1MHz VBW: 3MHz Sweep: Auto Mode: RX EUT is raised 80cm from the ground plane with styrofoam. EUT is at 3m from the receive antenna. EUT is connected to the support laptop through a TTL Converter. The TTL converter is connected to the support laptop through a RS232 (serial) cable. Antenna port connected to +2 dBi Antenna. Support laptop is setting the EUT in the proper mode and channels: MID = 2440MHz |
|--|

Ext Attn: 0 dB

Measurement Data:

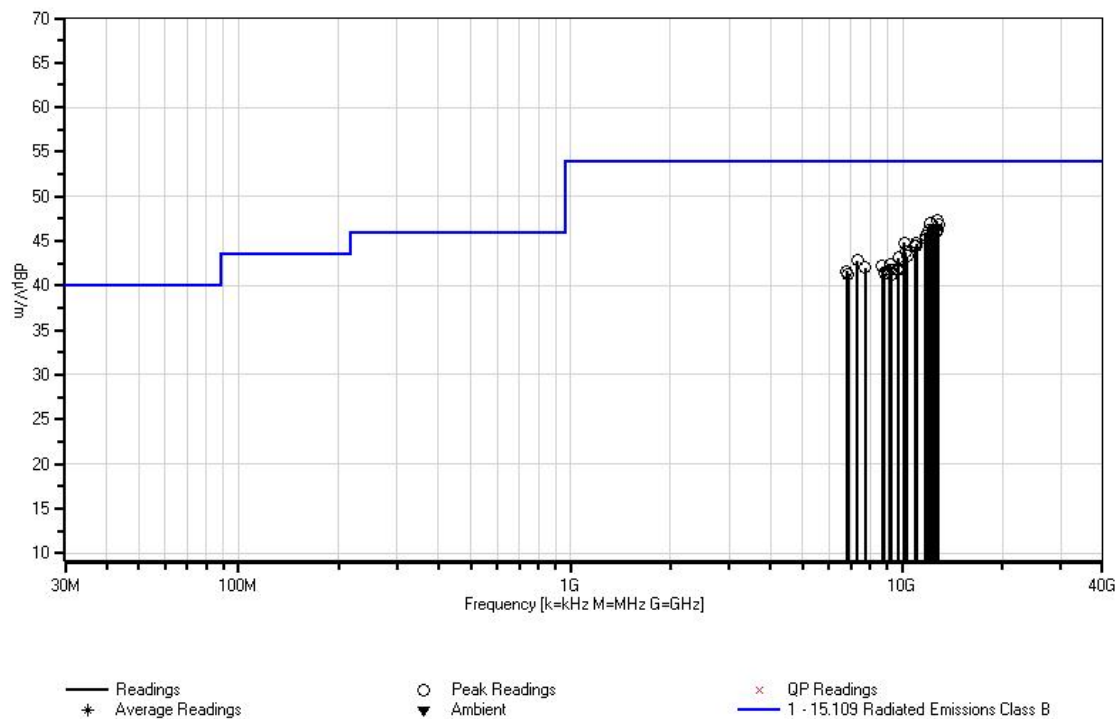
Reading listed by margin.

Test Distance: 3 Meters

| # | Freq MHz | Rdng dB μ V | T1 T5 dB | T2 dB | T3 dB | T4 dB | Dist Table | Corr dB μ V/m | Spec dB μ V/m | Margin dB | Polar Ant |
|----|----------------|--------------------|----------------|----------|----------|----------|---------------|----------------------|----------------------|--------------|--------------|
| 1 | 12710.777 M | 31.9 | +3.4 +7.0 | +39.3 | -35.0 | +0.7 | +0.0 360 | 47.3 | 54.0 | -6.7 | Verti 100 |
| 2 | 12156.947 M | 32.2 | +3.6 +6.8 | +38.8 | -35.0 | +0.6 | +0.0 360 | 47.0 | 54.0 | -7.0 | Verti 100 |
| 3 | 12852.312 M | 31.0 | +3.6 +7.0 | +39.6 | -35.0 | +0.7 | +0.0 360 | 46.9 | 54.0 | -7.1 | Verti 100 |
| 4 | 11966.183 M | 32.1 | +3.1 +6.7 | +38.7 | -35.0 | +0.6 | +0.0 360 | 46.2 | 54.0 | -7.8 | Verti 100 |
| 5 | 12403.094 M | 31.6 | +3.3 +6.9 | +38.8 | -35.0 | +0.6 | +0.0 360 | 46.2 | 54.0 | -7.8 | Verti 100 |
| 6 | 12772.314 M | 30.4 | +3.6 +7.0 | +39.5 | -35.0 | +0.7 | +0.0 360 | 46.2 | 54.0 | -7.8 | Verti 100 |
| 7 | 12655.394 M | 30.9 | +3.3 +7.0 | +39.2 | -35.0 | +0.7 | +0.0 360 | 46.1 | 54.0 | -7.9 | Verti 100 |
| 8 | 12378.479 M | 31.1 | +3.3 +6.9 | +38.8 | -35.0 | +0.6 | +0.0 360 | 45.7 | 54.0 | -8.3 | Verti 100 |
| 9 | 11744.650 M | 31.5 | +3.4 +6.6 | +38.6 | -35.0 | +0.5 | +0.0 360 | 45.6 | 54.0 | -8.4 | Verti 100 |
| 10 | 12224.637 M | 30.7 | +3.7 +6.8 | +38.8 | -35.0 | +0.6 | +0.0 360 | 45.6 | 54.0 | -8.4 | Verti 100 |
| 11 | 11793.880 M | 31.2 | +3.3 +6.6 | +38.6 | -35.0 | +0.5 | +0.0 360 | 45.2 | 54.0 | -8.8 | Verti 100 |
| 12 | 10095.465 M | 32.2 | +3.0 +5.9 | +37.4 | -34.0 | +0.3 | +0.0 360 | 44.8 | 54.0 | -9.2 | Verti 100 |
| 13 | 11000.056 M | 31.4 | +3.2 +6.5 | +38.3 | -35.1 | +0.4 | +0.0 360 | 44.7 | 54.0 | -9.3 | Verti 100 |
| 14 | 10981.595 M | 31.2 | +3.2 +6.5 | +38.3 | -35.1 | +0.4 | +0.0 360 | 44.5 | 54.0 | -9.5 | Verti 100 |
| 15 | 10944.673 M | 31.1 | +3.2 +6.5 | +38.3 | -35.1 | +0.4 | +0.0 360 | 44.4 | 54.0 | -9.6 | Verti 100 |

| | | | | | | | | | | | |
|----|----------------|------|--------------|-------|-------|------|------|------|------|-------|--------------|
| 16 | 10876.982 M | 31.1 | +3.3 +6.4 | +38.2 | -35.0 | +0.4 | +0.0 | 44.4 | 54.0 | -9.6 | Verti 100 |
| 17 | 10237.000 M | 31.0 | +3.1 +5.9 | +37.6 | -34.1 | +0.3 | +0.0 | 43.8 | 54.0 | -10.2 | Verti 100 |
| 18 | 10298.537 M | 30.5 | +3.0 +6.0 | +37.7 | -34.2 | +0.3 | +0.0 | 43.3 | 54.0 | -10.7 | Verti 100 |
| 19 | 9732.399M | 31.4 | +2.8 +5.8 | +36.7 | -33.9 | +0.3 | +0.0 | 43.1 | 54.0 | -10.9 | Verti 100 |
| 20 | 7314.004M | 33.2 | +2.4 +5.2 | +36.1 | -34.6 | +0.5 | +0.0 | 42.8 | 54.0 | -11.2 | Verti 100 |
| 21 | 9178.568M | 31.3 | +2.7 +5.7 | +36.5 | -34.2 | +0.3 | +0.0 | 42.3 | 54.0 | -11.7 | Verti 100 |
| 22 | 8667.813M | 31.8 | +2.8 +5.6 | +36.1 | -34.5 | +0.4 | +0.0 | 42.2 | 54.0 | -11.8 | Verti 100 |
| 23 | 7732.454M | 32.0 | +2.5 +5.4 | +36.2 | -34.6 | +0.5 | +0.0 | 42.0 | 54.0 | -12.0 | Verti 100 |
| 24 | 9670.862M | 30.4 | +2.8 +5.8 | +36.6 | -34.0 | +0.3 | +0.0 | 41.9 | 54.0 | -12.1 | Verti 100 |
| 25 | 9701.630M | 30.2 | +2.8 +5.8 | +36.6 | -33.9 | +0.3 | +0.0 | 41.8 | 54.0 | -12.2 | Verti 100 |
| 26 | 9203.183M | 30.8 | +2.7 +5.7 | +36.4 | -34.2 | +0.3 | +0.0 | 41.7 | 54.0 | -12.3 | Verti 100 |
| 27 | 6778.269M | 32.7 | +2.4 +5.1 | +35.5 | -34.5 | +0.4 | +0.0 | 41.6 | 54.0 | -12.4 | Verti 100 |
| 28 | 8797.040M | 30.8 | +2.9 +5.6 | +36.3 | -34.6 | +0.4 | +0.0 | 41.4 | 54.0 | -12.6 | Verti 100 |
| 29 | 6852.479M | 32.2 | +2.4 +5.1 | +35.6 | -34.4 | +0.4 | +0.0 | 41.3 | 54.0 | -12.7 | Verti 100 |
| 30 | 9270.873M | 30.2 | +2.8 +5.7 | +36.4 | -34.2 | +0.3 | +0.0 | 41.2 | 54.0 | -12.8 | Verti 100 |

CKC Laboratories, Inc. Date: 1/29/2011 Time: 1:09:02 PM Dust Networks WO#: 91302
 15.109 Radiated Emissions Class B Test Distance: 3 Meters Vertical Sequence#: 4 Ext ATTN: 0 dB



Test Setup Photos



SUPPLEMENTAL INFORMATION

Measurement Uncertainty

| Uncertainty Value | Parameter |
|-------------------|---------------------------|
| 4.73 dB | Radiated Emissions |
| 3.34 dB | Mains Conducted Emissions |
| 3.30 dB | Disturbance Power |

The reported measurement uncertainties are calculated based on the worst case of all laboratory environments from CKC Laboratories, Inc. test sites. Only those parameters which require estimation of measurement uncertainty are reported. The reported worst case measurement uncertainty is less than the maximum values derived in CISPR 16-4-2. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k=2$. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dB μ V/m, the spectrum analyzer reading in dB μ V was corrected by using the following formula. This reading was then compared to the applicable specification limit.

| SAMPLE CALCULATIONS | | |
|---------------------|---------------------|----------------|
| | Meter reading | (dB μ V) |
| + | Antenna Factor | (dB) |
| + | Cable Loss | (dB) |
| - | Distance Correction | (dB) |
| - | Preamplifier Gain | (dB) |
| = | Corrected Reading | (dB μ V/m) |

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. The following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE | | | |
|--|---------------------|------------------|-------------------|
| TEST | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| RADIATED EMISSIONS | 30 MHz | 1000 MHz | 120 kHz |
| RADIATED EMISSIONS | 1000 MHz | >1 GHz | 1 MHz |

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the highest readings, this is indicated as a "QP" or an "Ave" on the appropriate rows of the data sheets. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer/receiver readings recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the measuring device called "peak hold," the measuring device had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the quasi-peak detector.

Average

For certain frequencies, average measurements may be made using the spectrum analyzer/receiver. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.