Dust Networks

ADDENDUM TEST REPORT TO 91587-5

2.4GHz Wireless Mote, M2140

Tested To The Following Standards:

FCC Part 15 Subpart C Sections 15.247

Report No.: 91587-5A

Date of issue: April 22, 2011

ACCREDITED

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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Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Dust Networks
30695 Huntwood Avenue
Hayward, CA 94544

Representative: Gordon Charles
Customer Reference Number: 4938

REPORT PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 91587

DATE OF EQUIPMENT RECEIPT: January 20, 2011
DATE(S) OF TESTING: January 20-25, 2011

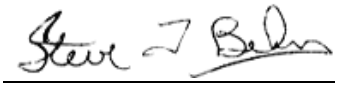
Revision History

Original: Testing of the 2.4GHz Wireless Mote, M2140 to FCC Part 15 Subpart C Sections 15.247.
Addendum A: The following changes were made in the radiated emissions section:

- Added previously erased peak measurements associated with the average measurements.
- Corrected wrong frequency ranges on the RBW and VBW section.
- Added peak measurements VBW for >1GHz.
- Exchanged the plots for low and high radiated emissions with bandedge plots.

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.



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 C

Description	Test Procedure/Method	Results
RF Power Output	FCC Part 15 Subpart C Section 15.247(b)(3) / KDP 558074	Pass
Radiated Spurious Emissions	FCC Part 15 Subpart C Section 15.247(d) / KDP 558074	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)

EQUIPMENT UNDER TEST

The following model has been tested by CKC Laboratories: **2.4 GHz Wireless Mote, M2140**

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 it meets the level of testing equivalent to the tested model. **M2510**

2.4 GHz Wireless Mote
Manuf: Dust Networks
Model: M2140
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):

Laptop
Manuf: Dell
Model: Inspiron 600m
Serial: NA

TTL Converter
Manuf: B&B Electronics
Model: 232LPTTL33
Serial: 0068217044

FCC PART 15 SUBPART C

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

15.247(b)(3)RF Power Output

Test Setup

Temp: 21°C
Humidity: 34%
Pressure: 102.4kPa
Frequency Range: 2405-2475MHz
RBW: 3MHz
VBW: 8MHz
Sweep: Auto

EUT's antenna port is connected to the Spectrum analyzer through a cable and a 20dB attenuator.
EUT is connected to the support laptop through a TTL RS232 adaptor.
Test is being performed with a fresh battery to satisfy FCC15.31 (e) voltage variations on power.
Support laptop is setting the EUT in the proper mode (TX) and channels:
LOW: 2405MHz
MID: 2440MHz
HIGH: 2475MHz

Engineer Name: A. del Angel

Test Equipment					
Asset/Serial #	**Description**	**Model**	**Manufacturer**	**Cal Date**	**Cal Due**
02872	Spectrum Analyzer	E4440A	Agilent	8/25/2009	8/25/2011
P05747	Attenuator	PE7004-20	Pasternack	3/18/2010	3/18/2012
03121	Cable	32026-2-29080-84	Astrolab	10/23/2009	10/23/2011

Test Data

Frequency (MHz)	RF Output Power (dBm)	15.247(b)(3)Limit	Result
2405	8.0	30dBm	Pass
2440	8.3	30dBm	Pass
2475	8.5	30dBm	Pass

Test Setup Photos

15.247(d) Radiated Spurious Emissions

Test Data Sheets

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

Customer: **Dust Networks**
Specification: **15.247(d) Radiated Spurious Emissions**
Work Order #: **91587** Date: 1/30/2011
Test Type: **Radiated Scan** Time: 11:47:45
Equipment: **2.4 GHz Wireless Mote** Sequence#: 1
Manufacturer: Dust Networks Tested By: Armando del Angel
Model: M2140
S/N: N/A

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00052	Loop Antenna	6502	6/8/2010	6/8/2012
T2	AN02872	Spectrum Analyzer	E4440A	8/25/2009	8/25/2011
T3	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	5/7/2010	5/7/2012
T4	AN03121	Cable	32026-2-29080-84	10/23/2009	10/23/2011
T5	AN03123	Cable	32026-2-29801-12	10/23/2009	10/23/2011
T6	ANP05542	Cable	Heliax	10/23/2009	10/23/2011
T7	AN03116	High Pass Filter	11SH10-00313	1/26/2011	1/26/2013
T8	AN01271	Preamp	83017A	9/17/2009	9/17/2011
T9	ANWO91587	Duty Cycle Correction Factor		No Cal Required	No Cal Required
	AN02742	Active Horn Antenna-ANSI C63.5 Antenna Factors (dB)	AMFW-5F-18002650-20-10P	11/10/2010	11/10/2012
	AN02763-69	Waveguide	Multiple	9/2/2010	9/2/2012
	ANP05425	Cable	PE35591-120	12/17/2009	12/17/2011
	ANP05428	Cable	PE35591-60	12/17/2009	12/17/2011
T10	AN01316	Preamp	8447D	5/21/2010	5/21/2012
T11	AN01993	Biconilog Antenna	CBL6111C	10/9/2009	10/9/2011
T12	ANP05360	Cable	RG214	11/8/2010	11/8/2012
T13	ANP05366	Cable	RG-214	10/20/2009	10/20/2011

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
2.4 GHz Wireless Mote*	Dust Networks	M2140	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Dell	Inspiron 600m	N/A
TTL Converter	B&B Electronics	232LPTTL33	0068217044

Test Conditions / Notes:

Temperature: 21°C
Humidity: 34%
Pressure: 102.1kPa
Freq. Range: 9kHz-26GHz
RBW: 9-150kHz = 200Hz
0.150-30MHz = 9kHz
30-1000MHz = 100kHz
1-26GHz = 1MHz
VBW: 9-150kHz = 600Hz
0.150-30MHz = 27kHz
30-1000MHz = 300kHz
1-26GHz = 3MHz (Peak) & 10Hz (AVE)
Sweep: Auto
Mode: TX

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.
Duty Cycle Correction Factor will be applied where the emissions are bove the limit.
DCCF = 20 log (On time/100ms) = -9.3dB
Support laptop is setting the EUT in the proper mode and channels:
LOW = 2405MHz
MID = 2440MHz
HIGH = 2475MHz

Note: Due to runtime limitations on the EUT (Modulated signal runtime <1 min), emission maximization is being performed with CW signals in both vertical & horizontal polarizations. Recorded results are only for the polarization(s) where the highest emissions were found.

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2404.971M	61.0	+0.0	+0.0	+27.9	+1.3	+0.0	99.0	96.2	+2.8	Horiz
	Ambient		+0.3	+2.7	+40.3	-34.5	128		LOW Fundamental		158
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
2	2439.460M	61.4	+0.0	+0.0	+27.9	+1.3	+0.0	96.6	96.2	+0.4	Horiz
	Ambient		+0.3	+2.7	+37.5	-34.5	97		MID Fundamental		101
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

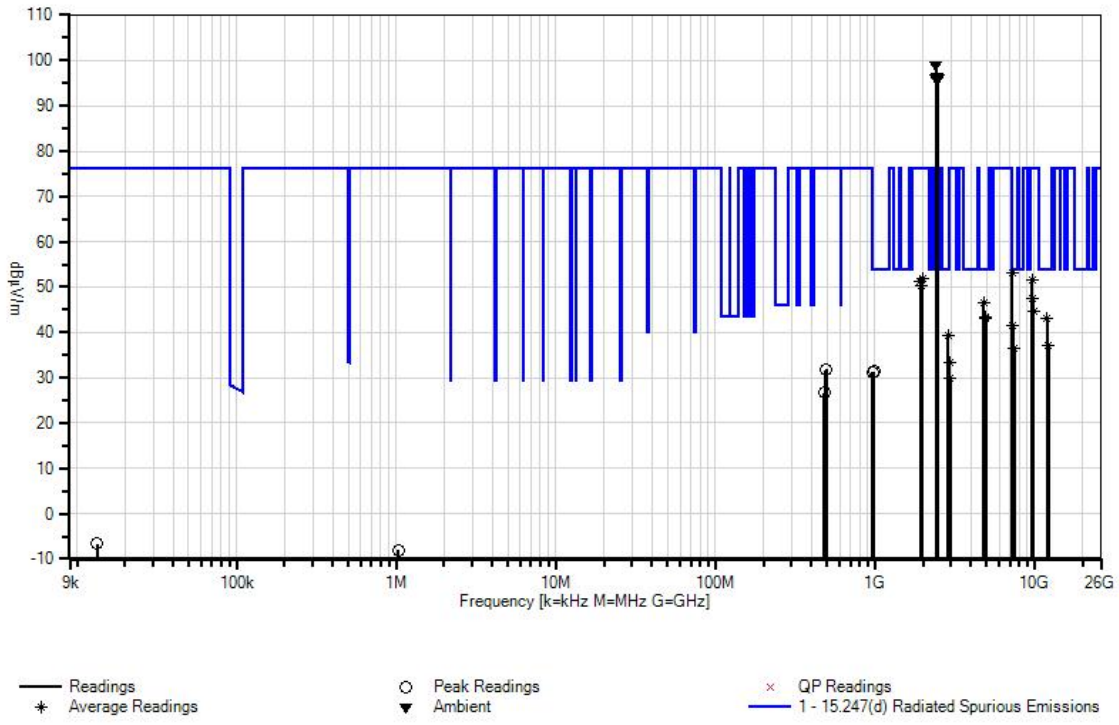
3	2404.972M Ambient	58.3	+0.0 +0.3 +0.0 +0.0	+0.0 +2.7 +0.0	+27.9 +40.3 +0.0	+1.3 -34.5 +0.0	+0.0 256	96.3	96.2 LOW	+0.1 Fundamental	Vert 100
4	2475.504M Ambient	63.7	+0.0 +0.2 +0.0 +0.0	+0.0 +2.8 +0.0	+27.9 +34.7 +0.0	+1.3 -34.4 +0.0	+0.0 360	96.2	96.2 HIGH	+0.0 Fundamental	Horiz 122
5	4808.958M Ave	49.5	+0.0 +0.4 -9.3 +0.0	+0.0 +4.2 +0.0	+32.9 +0.8 +0.0	+2.0 -33.8 +0.0	+0.0 147	46.7	54.0 LOW	-7.3	Horiz 104
^	4808.958M	51.6	+0.0 +0.4 +0.0 +0.0	+0.0 +4.2 +0.0	+32.9 +0.8 +0.0	+2.0 -33.8 +0.0	+0.0 147	58.1	54.0 LOW	+4.1	Horiz 104
7	4878.973M Ave	46.0	+0.0 +0.4 -9.3 +0.0	+0.0 +4.2 +0.0	+33.0 +0.8 +0.0	+2.0 -33.7 +0.0	+0.0 142	43.4	54.0 MID	-10.6	Horiz 118
^	4878.973M	49.1	+0.0 +0.4 +0.0 +0.0	+0.0 +4.2 +0.0	+33.0 +0.8 +0.0	+2.0 -33.7 +0.0	+0.0 142	55.8	54.0 MID	+1.8	Horiz 118
9	4948.830M Ave	45.6	+0.0 +0.4 -9.3 +0.0	+0.0 +4.3 +0.0	+33.1 +0.8 +0.0	+2.0 -33.7 +0.0	+0.0 160	43.2	54.0 HIGH	-10.8	Horiz 115
^	4948.830M	48.0	+0.0 +0.4 +0.0 +0.0	+0.0 +4.3 +0.0	+33.1 +0.8 +0.0	+2.0 -33.7 +0.0	+0.0 160	54.9	54.0 HIGH	+0.9	Horiz 115
11	12022.380 M Ave	28.4	+0.0 +0.6 +0.0 +0.0	+0.0 +6.7 +0.0	+38.7 +0.4 +0.0	+3.2 -35.0 +0.0	+0.0 153	43.0	54.0 LOW	-11.0	Horiz 104
^	12022.380 M	30.1	+0.0 +0.6 +0.0 +0.0	+0.0 +6.7 +0.0	+38.7 +0.4 +0.0	+3.2 -35.0 +0.0	+0.0 153	44.7	54.0 LOW	-9.3	Horiz 104
13	7318.416M Ave	40.4	+0.0 +0.5 -9.3 +0.0	+0.0 +5.2 +0.0	+36.1 +0.9 +0.0	+2.4 -34.6 +0.0	+0.0 246	41.6	54.0 MID	-12.4	Horiz 134
^	7318.416M	42.0	+0.0 +0.5 -9.3 +0.0	+0.0 +5.2 +0.0	+36.1 +0.9 +0.0	+2.4 -34.6 +0.0	+0.0 246	52.5	54.0 MID	-1.5	Horiz 134
15	2885.028M Ave	36.8	+0.0 +0.3 +0.0 +0.0	+0.0 +3.0 +0.0	+28.8 +3.0 +0.0	+1.6 -34.3 +0.0	+0.0 175	39.2	54.0 LOW	-14.8	Horiz 102

^	2885.028M	37.9	+0.0 +0.3 +0.0 +0.0	+0.0 +3.0 +0.0	+28.8 +3.0 +0.0	+1.6 -34.3 +0.0	+0.0 175	40.3	54.0 LOW	-13.7	Horiz 102
17	12202.348 M Ave	21.8	+0.0 +0.6 +0.0 +0.0	+0.0 +6.8 +0.0	+38.8 +0.4 +0.0	+3.7 -35.0 +0.0	+0.0 135	37.1	54.0 MID	-16.9	Horiz 114
^	12202.348 M	23.2	+0.0 +0.6 +0.0 +0.0	+0.0 +6.8 +0.0	+38.8 +0.4 +0.0	+3.7 -35.0 +0.0	+0.0 135	38.5	54.0 MID	-15.5	Horiz 114
19	7426.412M Ave	35.4	+0.0 +0.4 -9.3 +0.0	+0.0 +5.3 +0.0	+36.2 +0.9 +0.0	+2.3 -34.6 +0.0	+0.0 250	36.6	54.0 HIGH	-17.4	Horiz 144
^	7426.412M	38.5	+0.0 +0.4 -9.3 +0.0	+0.0 +5.3 +0.0	+36.2 +0.9 +0.0	+2.3 -34.6 +0.0	+0.0 250	49.0	54.0 HIGH	-5.0	Horiz 144
21	989.021M	30.7	+0.0 +0.0 +0.0 +2.4	+0.0 +0.0 -28.9	+0.0 +0.0 +24.3	+0.8 +0.0 +2.1	+0.0 175	31.4	54.0 HIGH	-22.6	Horiz 119
22	974.781M	31.2	+0.0 +0.0 +0.0 +2.2	+0.0 +0.0 -29.0	+0.0 +0.0 +24.1	+0.8 +0.0 +2.0	+0.0	31.3	54.0 MID	-22.7	Horiz 100
23	961.700M	31.4	+0.0 +0.0 +0.0 +2.2	+0.0 +0.0 -29.1	+0.0 +0.0 +23.9	+0.8 +0.0 +2.0	+0.0 254	31.2	54.0 LOW	-22.8	Horiz 145
24	7213.403M Ave	42.5	+0.0 +0.5 +0.0 +0.0	+0.0 +5.2 +0.0	+36.0 +1.0 +0.0	+2.5 -34.6 +0.0	+0.0 229	53.1	76.2 LOW	-23.1	Horiz 128
^	7213.403M	44.0	+0.0 +0.5 +0.0 +0.0	+0.0 +5.2 +0.0	+36.0 +1.0 +0.0	+2.5 -34.6 +0.0	+0.0 229	54.6	76.2 LOW	-21.6	Horiz 128
26	1979.983M Ave	54.6	+0.0 +0.3 +0.0 +0.0	+0.0 +2.5 +0.0	+28.1 +0.0 +0.0	+1.2 -34.7 +0.0	+0.0 160	52.0	76.2 HIGH	-24.2	Horiz 120
^	1979.983M	57.1	+0.0 +0.3 +0.0 +0.0	+0.0 +2.5 +0.0	+28.1 +0.0 +0.0	+1.2 -34.7 +0.0	+0.0 160	54.5	76.2 HIGH	-21.7	Horiz 120
28	9621.844M Ave	38.5	+0.0 +0.3 +0.0 +0.0	+0.0 +5.8 +0.0	+36.4 +1.6 +0.0	+2.9 -34.0 +0.0	+0.0 256	51.5	76.2 LOW	-24.7	Horiz 105

^	9621.844M	40.2	+0.0 +0.3 +0.0 +0.0	+0.0 +5.8 +0.0	+36.4 +1.6 +0.0	+2.9 -34.0 +0.0	+0.0 256	53.2	76.2 LOW	-23.0	Horiz 105
30	1923.928M Ave	54.4	+0.0 +0.3 +0.0 +0.0	+0.0 +2.5 +0.0	+27.8 +0.0 +0.0	+1.2 -34.9 +0.0	+0.0 160	51.3	76.2 LOW	-24.9	Horiz 120
^	1923.928M	56.1	+0.0 +0.3 +0.0 +0.0	+0.0 +2.5 +0.0	+27.8 +0.0 +0.0	+1.2 -34.9 +0.0	+0.0 160	53.0	76.2 LOW	-23.2	Horiz 120
32	1951.999M Ave	53.1	+0.0 +0.3 +0.0 +0.0	+0.0 +2.5 +0.0	+28.0 +0.0 +0.0	+1.2 -34.8 +0.0	+0.0 160	50.3	76.2 MID	-25.9	Horiz 120
^	1951.999M	54.0	+0.0 +0.3 +0.0 +0.0	+0.0 +2.5 +0.0	+28.0 +0.0 +0.0	+1.2 -34.8 +0.0	+0.0 160	51.2	76.2 MID	-25.0	Horiz 120
34	9757.934M Ave	34.4	+0.0 +0.3 +0.0 +0.0	+0.0 +5.8 +0.0	+36.7 +1.6 +0.0	+2.7 -33.9 +0.0	+0.0 246	47.6	76.2 MID	-28.6	Horiz 119
^	9757.934M	35.9	+0.0 +0.3 +0.0 +0.0	+0.0 +5.8 +0.0	+36.7 +1.6 +0.0	+2.7 -33.9 +0.0	+0.0 246	49.1	76.2 MID	-27.1	Horiz 119
36	9897.995M Ave	31.2	+0.0 +0.3 +0.0 +0.0	+0.0 +5.8 +0.0	+37.1 +1.5 +0.0	+2.8 -34.0 +0.0	+0.0 250	44.7	76.2 HIGH	-31.5	Horiz 117
^	9897.995M	34.1	+0.0 +0.3 +0.0 +0.0	+0.0 +5.8 +0.0	+37.1 +1.5 +0.0	+2.8 -34.0 +0.0	+0.0 250	47.6	76.2 HIGH	-28.6	Horiz 117
38	2926.986M Ave	31.3	+0.0 +0.3 +0.0 +0.0	+0.0 +3.1 +0.0	+28.9 +2.5 +0.0	+1.6 -34.2 +0.0	+0.0 142	33.5	76.2 MID	-42.7	Horiz 153
^	2926.986M	33.2	+0.0 +0.3 +0.0 +0.0	+0.0 +3.1 +0.0	+28.9 +2.5 +0.0	+1.6 -34.2 +0.0	+0.0 142	35.4	76.2 MID	-40.8	Horiz 153
40	495.000M	40.2	+0.0 +0.0 +0.0 +1.5	+0.0 +0.0 -29.6	+0.0 +0.0 +17.9	+0.5 +0.0 +1.3	+0.0 275	31.8	76.2 HIGH	-44.4	Horiz 156
41	487.900M	40.2	+0.0 +0.0 +0.0 +1.5	+0.0 +0.0 -29.6	+0.0 +0.0 +17.8	+0.5 +0.0 +1.3	+0.0 162	31.7	76.2 MID	-44.5	Horiz 100

42	2971.049M Ave	28.0	+0.0 +0.3 +0.0 +0.0	+0.0 +3.1 +0.0	+29.0 +2.2 +0.0	+1.6 -34.2 +0.0	+0.0 165	30.0	76.2 HIGH	-46.2	Horiz 100
^	2971.049M	30.3	+0.0 +0.3 +0.0 +0.0	+0.0 +3.1 +0.0	+29.0 +2.2 +0.0	+1.6 -34.2 +0.0	+0.0 165	32.3	76.2 HIGH	-43.9	Horiz 100
44	480.900M	35.3	+0.0 +0.0 +0.0 +1.5	+0.0 +0.0 -29.6	+0.0 +0.0 +17.7	+0.5 +0.0 +1.3	+0.0 186	26.7	76.2 LOW	-49.5	Horiz 126
45	13.358k	58.3	+15.0 +0.0 +0.0 +0.1	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	-80.0	-6.6	76.2	-82.8	Horiz 100
46	1.029M	62.3	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	-80.0 360	-8.1	76.2	-84.3	Horiz 100

CKC Laboratories, Inc. Date: 1/30/2011 Time: 11:47:45 Dust Networks WO#: 91587
15.247(d) Radiated Spurious Emissions Test Distance: 3 Meters Horizontal 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: **15.247(d) Radiated Spurious Emissions**
Work Order #: **91587** Date: 1/28/2011
Test Type: **Radiated Scan** Time: 10:26:10
Equipment: **2.4 GHz Wireless Mote** Sequence#: 2
Manufacturer: Dust Networks Tested By: Armando del Angel
Model: M2140
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	8/25/2009	8/25/2011
T1	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	5/7/2010	5/7/2012
T2	AN03121	Cable	32026-2-29080-84	10/23/2009	10/23/2011
T3	AN03123	Cable	32026-2-29801-12	10/23/2009	10/23/2011
T4	ANP05542	Cable	Heliax	10/23/2009	10/23/2011
T5	AN01271	Preamp	83017A	9/17/2009	9/17/2011

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
2.4 GHz Wireless Mote*	Dust Networks	M2140	NA
2dBi Antenna	NA	NA	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Dell	Inspiron 600m	NA
TTL Converter	B&B Electronics	232LPTTL33	0068217044

Test Conditions / Notes:

Temperature: 21°C
Humidity: 34%
Pressure: 102.1kPa
Freq. Range: 2378-2405MHz
RBW: 1MHz
VBW: 10Hz
Sweep: Auto
Mode: TX

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:
LOW = 2405MHz

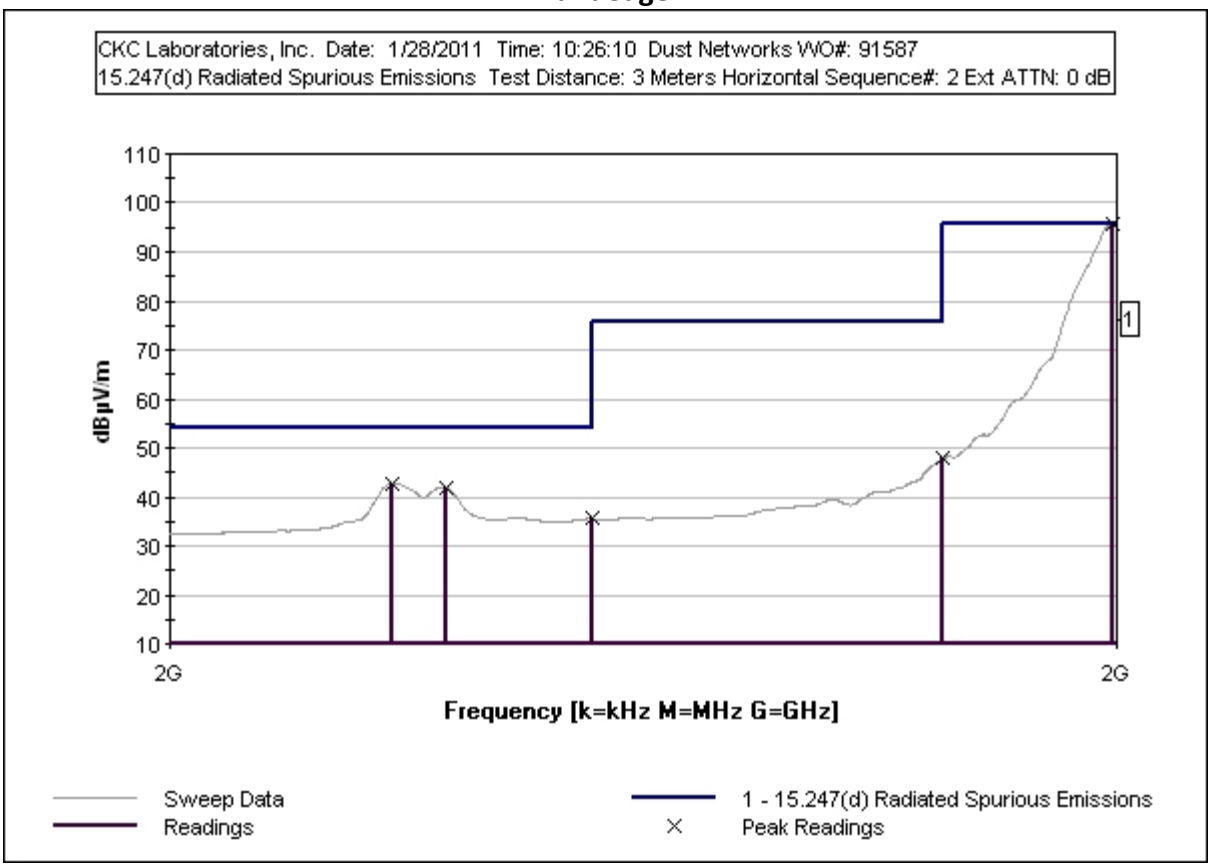
Note: Due to runtime limitations on the EUT (Modulated signal runtime <1 min), emission maximization is being performed with CW signals in both vertical & horizontal polarizations. Recorded results are only for the polarization(s) where the highest emissions were found.

Ext Attn: 0 dB

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2404.865M	98.2	+27.9 -34.5	+1.3	+0.3	+2.7	+0.0 128	95.9	95.9	+0.0	Horiz 158
2	2384.291M	45.0	+28.0 -34.5	+1.3	+0.3	+2.7	+0.0 128	42.8	54.0	-11.2	Horiz 158
3	2385.830M	44.0	+28.0 -34.5	+1.3	+0.3	+2.7	+0.0 128	41.8	54.0	-12.2	Horiz 158
4	2390.000M	37.8	+28.0 -34.5	+1.3	+0.3	+2.7	+0.0 128	35.6	54.0	-18.4	Horiz 158
5	2400.000M	50.1	+27.9 -34.5	+1.3	+0.3	+2.7	+0.0 128	47.8	75.9	-28.1	Horiz 158

Bandedge



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

Customer: **Dust Networks**
Specification: **15.247(d) Radiated Spurious Emissions**
Work Order #: **91587** Date: 1/28/2011
Test Type: **Radiated Scan** Time: 10:37:05
Equipment: **2.4 GHz Wireless Mote** Sequence#: 3
Manufacturer: Dust Networks Tested By: Armando del Angel
Model: M2140
S/N: NA

***Test Equipment*:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	8/25/2009	8/25/2011
T1	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	5/7/2010	5/7/2012
T2	AN03121	Cable	32026-2-29080-84	10/23/2009	10/23/2011
T3	AN03123	Cable	32026-2-29801-12	10/23/2009	10/23/2011
T4	ANP05542	Cable	Heliax	10/23/2009	10/23/2011
T5	AN01271	Preamp	83017A	9/17/2009	9/17/2011

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
2.4 GHz Wireless Mote*	Dust Networks	M2140	NA
2dBi Antenna	NA	NA	NA

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop	Dell	Inspiron 600m	NA
TTL Converter	B&B Electronics	232LPTTL33	0068217044

Test Conditions / Notes:

Temperature: 21°C
Humidity: 34%
Pressure: 102.1kPa
Freq. Range: 2475-2500MHz
RBW: 1MHz
VBW: 10Hz
Sweep: Auto
Mode: TX

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:
HIGH = 2475MHz

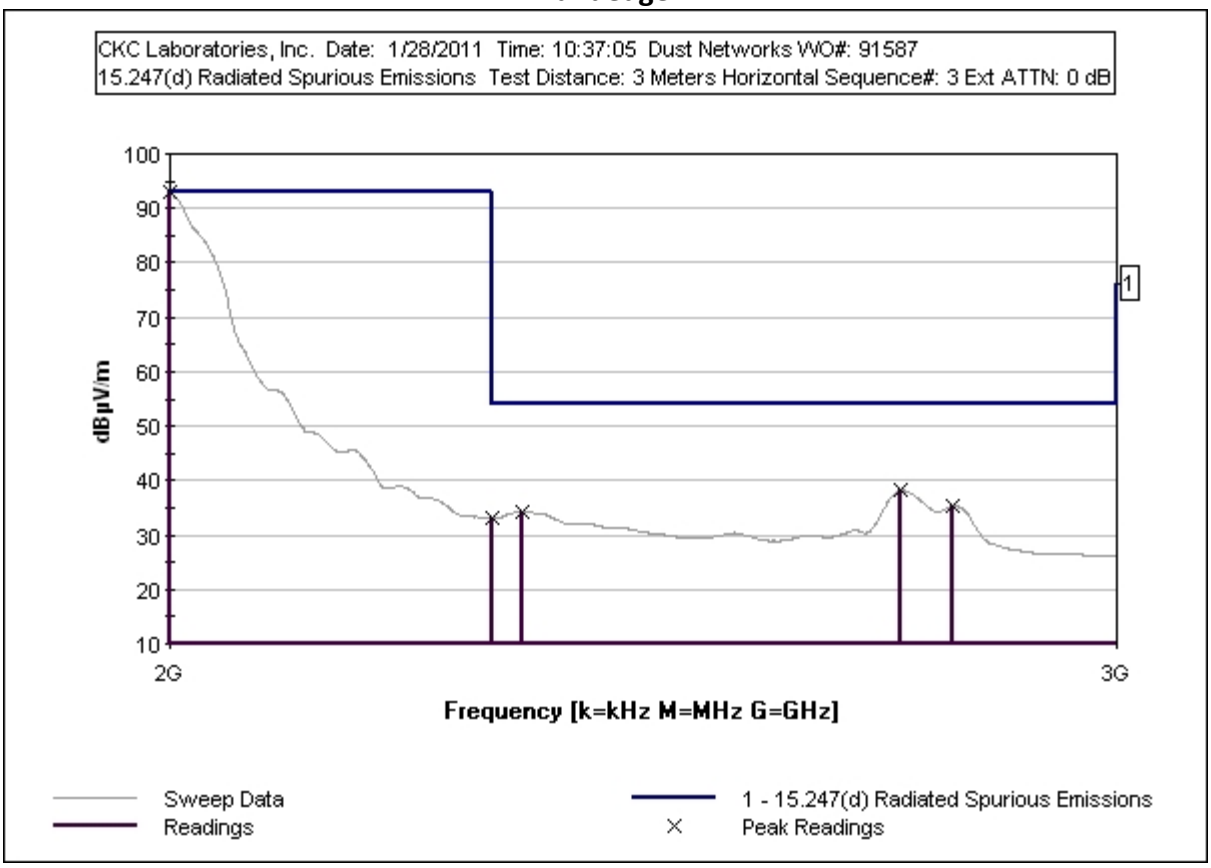
Note: Due to runtime limitations on the EUT (Modulated signal runtime <1 min), emission maximization is being performed with CW signals in both vertical & horizontal polarizations. Recorded results are only for the polarization(s) where the highest emissions were found.

Ext Attn: 0 dB

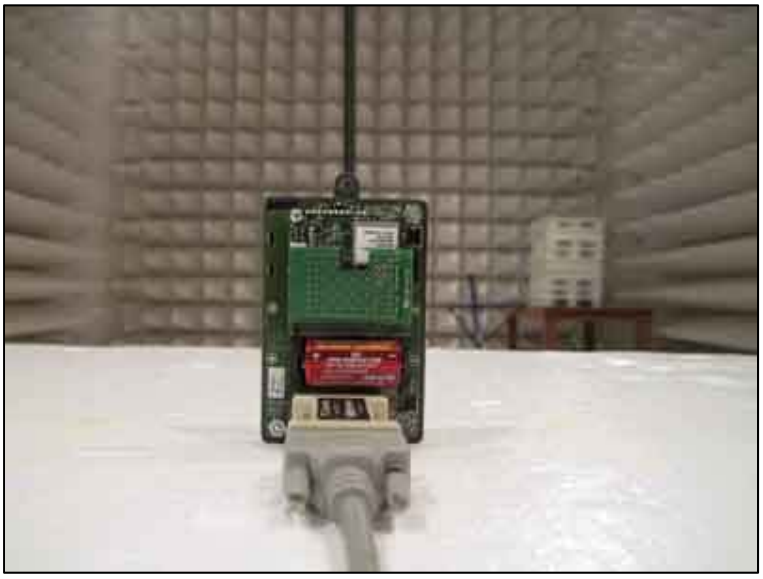
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

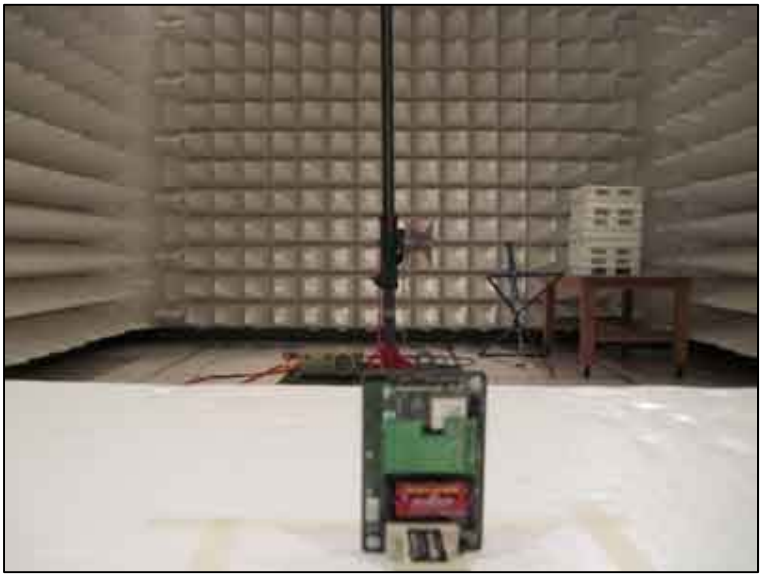
#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2475.000M	95.2	+27.9 -34.4	+1.3	+0.2	+2.8	+0.0 360	93.0	93.0	+0.0	Horiz 122
2	2494.275M	40.4	+27.9 -34.4	+1.3	+0.2	+2.8	+0.0 360	38.2	54.0	-15.8	Horiz 122
3	2495.650M	37.4	+27.9 -34.4	+1.3	+0.2	+2.8	+0.0 360	35.2	54.0	-18.8	Horiz 122
4	2484.250M	36.6	+27.9 -34.4	+1.3	+0.2	+2.8	+0.0 360	34.4	54.0	-19.6	Horiz 122
5	2483.500M	35.2	+27.9 -34.4	+1.3	+0.2	+2.8	+0.0 360	33.0	54.0	-21.0	Horiz 122

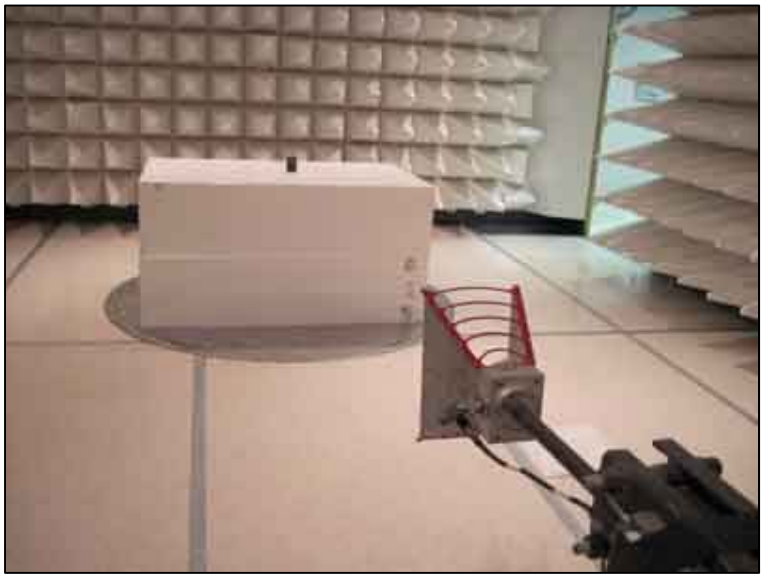
Bandedge



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 dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/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.