

Dust Networks

TEST REPORT FOR

**802.15.4 Wireless Mesh Mote
Model: ETERNA1**

Tested To The Following Standards:

ETSI EN 300 328 V1.7.1

Report No.: 93690-14

Date of issue: October 23, 2012



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.

TABLE OF CONTENTS

Administrative Information	3
Test Report Information	3
Report Authorization	3
Test Facility Information	4
Summary of Results	5
Conditions During Testing.....	5
Equipment Under Test.....	6
Peripheral Devices	6
Equipment Details	7
ETSI EN 300 328 V1.7.1.....	8
4.3 Technical Requirements	8
4.3.1 Maximum Transmit Power	8
4.3.2 Maximum E.I.R.P. Spectral Density.....	11
4.3.3 Frequency Range	13
4.3.6 Transmitter Spurious Emissions.....	16
4.3.6 Transmitter Conducted Spurious Emissions	16
4.3.6 Transmitter Radiated Spurious Emissions	18
4.3.7 Receiver Spurious Emissions.....	22
4.3.7 Receiver Conducted Spurious Emissions	22
4.3.7 Receiver Radiated Spurious Emissions	24

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Dust Networks
30695 Huntwood Avenue
Hayward, CA 94544

Representative: Gordon Charles
Customer Reference Number: X9074F

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

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

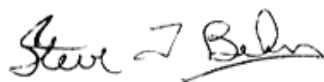
Project Number: 93690

October 8, 2012

October 8-18, 2012

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 written over 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.
110 Olinda Place
Brea, CA 92823

SUMMARY OF RESULTS

Standard / Specification: ETSI EN 300 328 V1.7.1

Description	Test Procedure/Method	Results
Technical Requirements	Sub clause 4.3	
Maximum Transmit Power	Sub clause 4.3.1	Pass
Maximum E.I.R.P. Spectral Density	Sub clause 4.3.2	Pass
Frequency Range	Sub clause 4.3.3	Pass
Frequency Hopping Requirements	Sub clause 4.3.4	NA
Dwell Time	Sub clause 4.3.4.1	NA
Hopping Channel	Sub clause 4.3.4.2	NA
Hopping Sequence	Sub clause 4.3.4.3	NA
Medium Access Protocol	Sub clause 4.3.5	NA
Transmitter Spurious Emissions	Sub clause 4.3.6	Pass
Receiver Spurious Emissions	Sub clause 4.3.7	Pass

NA = Not Applicable

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

EQUIPMENT UNDER TEST

802.15.4 Wireless Mesh Mote

Manuf: Dust Networks

Model: ETERNA1

Serial: 000D67

PERIPHERAL DEVICES

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

Eterna Serial Programmer

Manuf: Dust Networks

Model: NA

Serial: NA

Laptop

Manuf: Lenovo

Model: X61

Serial: 7675CTO

EQUIPMENT DETAILS

Frequencies of Selected Test Channels	
Lowest Channel	(2405) MHz
Middle Channel	(2440) MHz
Highest Channel	(2475) MHz

Equipment specifications for equipment using DSSS

Equipment Installation Type	Stand Alone, Plug-in Radio or Combination
Modulation Type	802.15.4
Operating Frequency Range(s)	2400-2483.5 MHz
List of intended Antennas	Not to exceed 4.8 dBi

ETSI EN 300 328 V1.7.1

4.3 TECHNICAL REQUIREMENTS

4.3.1 Maximum Transmit Power

Ambient Temperature: 21°C

Relative Humidity: 52%

Test Engineer: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02869	Spectrum Analyzer	E4440A	Agilent	2/12/2011	2/12/2013
AN02946	Cable	32022-2-2909K-36TC	Astrolab Inc.	8/8/2011	8/8/2013
AN01878	Temperature Chamber	S 1.2 Mini-Max	Thermotron Corp.	4/1/2011	4/1/2013

Test Data

Rated output power: 8.03 dBm

Antenna assembly gain: Not to exceed 4.8 dBi

Duty cycle of the equipment during the test x=99%

TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		2405MHz	2440MHz	2475MHz
$T_{nom}(25)^{\circ}C$	$V_{nom}(3.0)V$	12.83	12.80	12.79
$T_{min}(-20)^{\circ}C$	$V_{nom}(3.0)V$	13.51	13.53	13.41
$T_{max}(55)^{\circ}C$	$V_{nom}(3.0)V$	12.25	12.33	12.36
Measurement Uncertainty		3.703 dB		

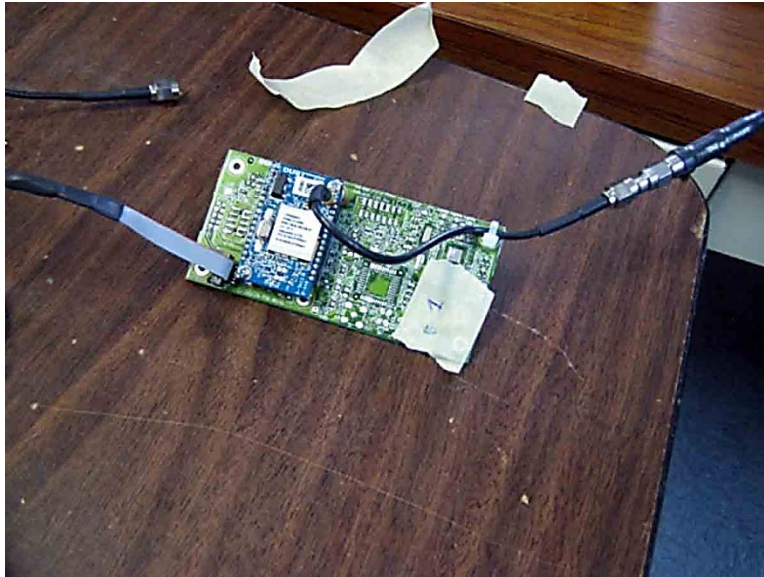
Note: At 99.99% duty cycle, $P_k=Ave$. Reported transmitter power is EIRP, where EIRP= measured conducted power +Antenna gain of 4.8dBi. Extreme voltage condition is not applicable. The equipment under test is designed for operation as part of and powered by another system or piece of equipment.

LIMITS

Under All Test Conditions	= < -10 dBW / 20dBm
---------------------------	---------------------

Test Setup Photos





4.3.2 Maximum E.I.R.P. Spectral Density

Ambient Temperature: 21°C

Relative Humidity: 52%

Test Engineer: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02869	Spectrum Analyzer	E4440A	Agilent	2/12/2011	2/12/2013
AN02946	Cable	32022-2-2909K-36TC	Astrolab Inc.	8/8/2011	8/8/2013

Test Data

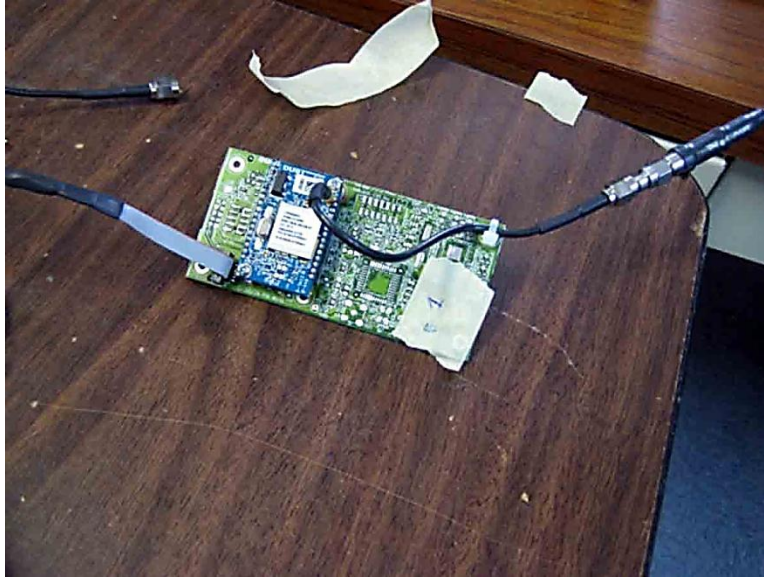
TESTS	Measured Power Density dBm/MHz (EIRP)		
	2405MHz	2440MHz	2475MHz
	9.96	9.89	9.86
Measurement Uncertainty		1×10^{-5} dB	

Note: Antenna assembly gain: Not to exceed 4.8 dBi

LIMITS

Under Normal Test Conditions Only	10mW/MHz, 10dBm/MHz
-----------------------------------	---------------------

Test Setup Photos



4.3.3 Frequency Range

Ambient Temperature: 21°C

Relative Humidity: 52%

Engineer Name: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN01878	Temperature Chamber	S 1.2 Mini-Max	Thermotron Corp.	4/1/2011	4/1/2013
AN02672	Spectrum Analyzer	E4446A	Agilent	9/4/2012	9/4/2013
AN02946	Cable	32022-2-2909K-36TC	Astrolab Inc.	8/8/2011	8/8/2013

Test Data

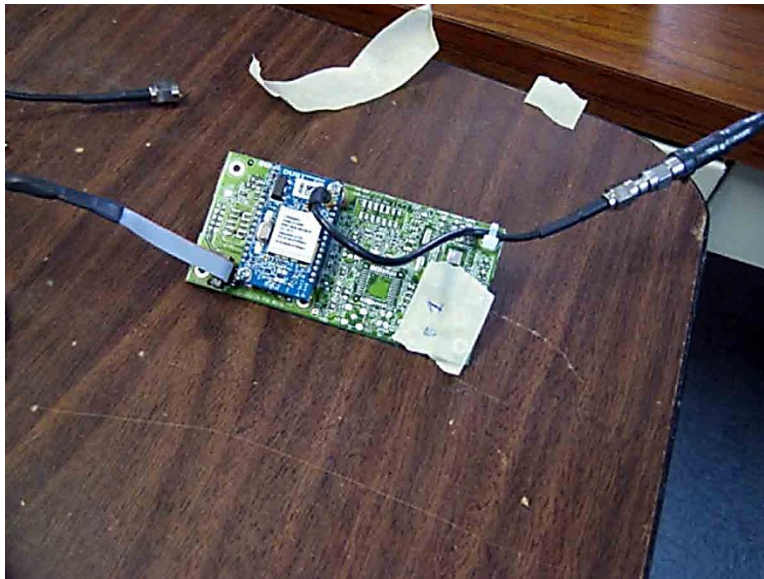
TEST CONDITIONS		FREQUENCY (MHz) at which Power Envelope Crosses -80 dBm/Hz	
		Lowest	Highest
$T_{nom}(25)^{\circ}C$	$V_{nom}(3.0)V$	2400.8930	2478.3650
$T_{min}(-20)^{\circ}C$	$V_{min}(3.0)V$	2400.8913	2478.3650
$T_{max}(55)^{\circ}C$	$V_{min}(3.0)V$	2400.8796	2478.3516
Measured Frequencies (Lowest And Highest)		$f_L = 2400.8796MHz$ $f_H = 2478.3650MHz$	
Measurement Uncertainty		5.774×10^{-10} dB	

Note: Antenna assembly gain: Not to exceed 4.8 dBi

LIMITS

Under All Test Conditions	$f_L > 2400$ MHz $f_H < 2483.5$ MHz
---------------------------	--

Test Setup Photos





4.3.6 Transmitter Spurious Emissions

4.3.6 Transmitter Conducted Spurious Emissions

Ambient Temperature: 21°C

Relative Humidity: 52%

Test Engineer: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02869	Spectrum Analyzer	E4440A	Agilent	2/12/2011	2/12/2013
AN02946	Cable	32022-2-2909K-36TC	Astrolab Inc.	8/8/2011	8/8/2013
AN02744	High Pass Filter	11SH10-3000/T10000-O/O	K & L	6/13/2012	6/13/2014

Test Data

SPURIOUS EMISSIONS LEVEL					
Lowest Channel			Highest Channel		
F (MHz)	Band-width** (kHz)	Level (dBm)	F (MHz)	Band-width** (kHz)	Level (dBm)
4809	100	-66.3	4949.08	100	-39.1
7216.5	100	-37	7426.33	100	-42
9618.17	100	-51.2	9902.08	100	-62.5
12022.92	100	-63.4	12372.5	100	-72.8
Measurement Uncertainty			0.673 dB		

** Bandwidth = the measuring receiver bandwidth

LIMITS

Frequency Range	Limit when Operating
30 MHz to 1 GHz	-36 dBm
above 1 GHz to 12,75 GHz	-30 dBm
1,8 GHz to 1,9 GHz	-47 dBm
5,15 GHz to 5,3 GHz	-47 dBm

Test Setup Photos



4.3.6 Transmitter Radiated Spurious Emissions

Ambient Temperature: 21°C

Relative Humidity: 52%

Test Engineer: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	9/4/2012	9/4/2014
AN00010	Preamp	8447D	HP	3/29/2012	3/29/2014
AN00851	Biconilog Antenna	CBL6111C	Chase	5/16/2012	5/16/2014
ANP04382	Cable	LDF-50	Andrew	8/30/2012	8/30/2014
ANP05555	Cable	RG223/U	Pasternack	6/19/2012	6/19/2014
ANP05569	Cable	RG-214/U	Pasternack	6/19/2012	6/19/2014
AN01646	Horn Antenna	3115	Emco	4/13/2012	4/13/2014
AN02947	Cable	32022-29094K- 29094K-72TC	Astrolab	8/8/2011	8/8/2013
ANP05988	Cable	LDF1-50	Andrew	3/12/2012	3/12/2014
AN00787	Preamp	83017A	HP	4/8/2011	4/8/2013
AN02744	High Pass Filter	11SH10- 3000/T10000-O/O	K & L	6/13/2012	6/13/2014

Test Data

SPURIOUS EMISSIONS LEVEL					
Lowest Channel			Highest Channel		
F (MHz)	Band-width** (kHz)	Level (dBm)	F (MHz)	Band-width** (kHz)	Level (dBm)
4809.981M	100	-68	4951.000M	100	-61
Measurement Uncertainty			0.673 dB		

Note: ** Bandwidth = the measuring receiver bandwidth. Antenna terminated into 50 Ohm Load.

LIMITS

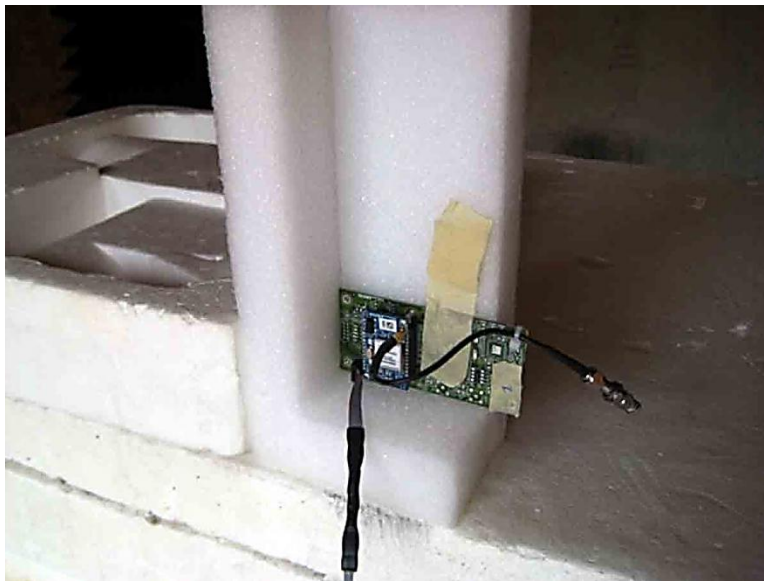
Frequency Range	Limit when Operating
30 MHz to 1 GHz	-36 dBm
above 1 GHz to 12,75 GHz	-30 dBm
1,8 GHz to 1,9 GHz	-47 dBm
5,15 GHz to 5,3 GHz	-47 dBm

Test Setup Photos

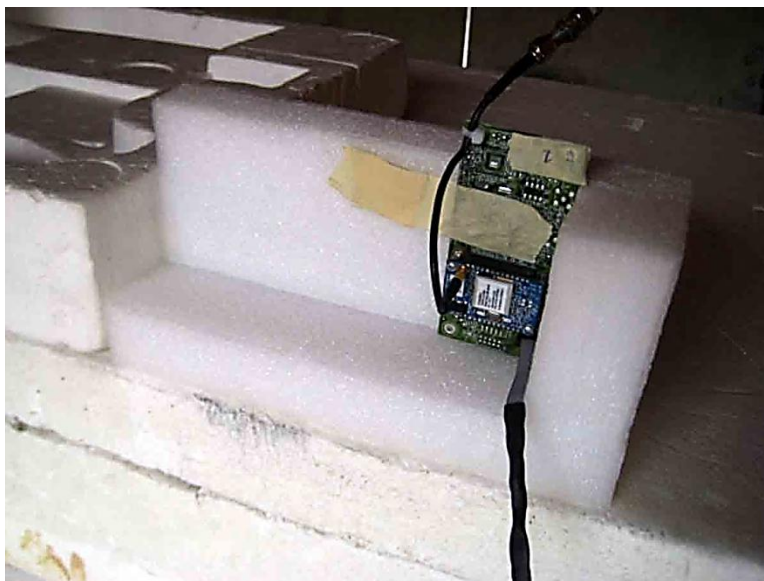




X AXIS



Y AXIS



Z AXIS

4.3.7 Receiver Spurious Emissions

4.3.7 Receiver Conducted Spurious Emissions

Ambient Temperature: 21°C

Relative Humidity: 52 %

Test Engineer: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02869	Spectrum Analyzer	E4440A	Agilent	2/12/2011	2/12/2013
AN02946	Cable	32022-2-2909K-36TC	Astrolab Inc.	8/8/2011	8/8/2013

Test Data

FREQUENCY (MHz)	MEASUREMENT BANDWIDTH (MHz)	SPURIOUS EMISSION LEVEL (dBm)
2402.5	0.1	-59.7
2472.5	0.1	-59.7
Measurement Uncertainty		.673 dB

Note: No Emissions found.

LIMITS

Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
above 1 GHz to 12,75 GHz	-47 dBm

Test Setup Photos



4.3.7 Receiver Radiated Spurious Emissions

Ambient Temperature: 21°C

Relative Humidity: 52%

Test Engineer: E. Wong

Test Equipment					
Asset/Serial #	Description	Model	Manufacturer	Cal Date	Cal Due
AN02672	Spectrum Analyzer	E4446A	Agilent	9/4/2012	9/4/2014
AN00010	Preamplifier	8447D	HP	3/29/2012	3/29/2014
AN00851	Biconilog Antenna	CBL6111C	Chase	5/16/2012	5/16/2014
ANP04382	Cable	LDF-50	Andrew	8/30/2012	8/30/2014
ANP05555	Cable	RG223/U	Pasternack	6/19/2012	6/19/2014
ANP05569	Cable	RG-214/U	Pasternack	6/19/2012	6/19/2014
AN01646	Horn Antenna	3115	Emco	4/13/2012	4/13/2014
AN02947	Cable	32022-29094K- 29094K-72TC	Astrolab	8/8/2011	8/8/2013
ANP05988	Cable	LDF1-50	Andrew	3/12/2012	3/12/2014
AN00787	Preamplifier	83017A	HP	4/8/2011	4/8/2013
AN02744	High Pass Filter	11SH10- 3000/T10000-O/O	K & L	6/13/2012	6/13/2014

Test Data

FREQUENCY (MHz)	MEASUREMENT BANDWIDTH (MHz)	SPURIOUS EMISSION LEVEL (dBm)
NA	NA	NA
Measurement Uncertainty		.673 dB

Note: No emissions found.

LIMITS

Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
above 1 GHz to 12,75 GHz	-47 dBm

Test Setup Photos



