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CERTIFICATION TEST REPORT Class II Permissive Change

Report Number:	2011 015175154 FCC2
Project Number:	1028751
Nex Number:	175154
Applicant:	On-RAMP WIRELESS 10920 VIA FRONTERA San Diego, CA 92127
Equipment Under Test (EUT):	ENODE RF MODULE
Model:	ULPN110
FCCID: IC:	XTE-ULPENODE110 8655A-ULPENODE110
In Accordance With:	FCC Part 15 Subpart C, 15.247 IC RSS-210 Issue 8 December 2010 IC RSS-Gen Issue 3 December 2010
Tested By:	Nemko USA Inc. 11696 Sorrento Valley Road, Suite F San Diego, CA 92121
Authorized By:	ALAN LAUDANI, EMC/RF Test Engineer
Date:	May 27 2011

31

Total Number of Pages:

FCCID: XTE-ULPAP110 IC: 8655A-ULPAP110

Report Number: 2011 015175154 FCC2 Specification: FCC Part 15 Subpart C, 15.247

Section1: Summary of Test Results

1.1 General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15; Subpart C and IC RSS-210. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

Apparatus Assessed: eNode RF Module

Model: ULPN110

Specification: FCC Part 15 Subpart C, 15.247

IC RSS-210 Issue 8 December 2010

Dates Tested in Laboratory: May 16, 2011 to May 27, 2011

Compliance Status: Complies

Exclusions: None

Non-compliances: None

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1.2 Report Release History

Revision	Date	Comments	
-	May 27, 2011	Prepared By:	Alan Laudani
-	May 27, 2011	Initial Release:	Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY:

__Date: May 27, 2011

ALAN LAUDANI, EMC Test Engineer

FCCID: XTE-ULPAP110 IC: 8655A-ULPAP110

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

On-Ramp Wireless ULPN110 eNode RF Module

2.2 Theory of Operation

The ULPN110 is an eNode RF Module. Its function is to transfer digital data. The EUT was exercised by test software.

The EUT's performance during test was evaluated against the performance criterion specified by applicable test standards. Performance results are detailed in the test results section of this report.

2.3 Technical Specifications of the EUT

Manufacturer: On-Ramp Wireless

Operating Frequency: 2402.0 MHz to 2475.63 MHz

in the 2400-2483.5 MHz Band

Number of Operating Frequencies: 40

Rated Power: 72 mW

Modulation: DSSS-DBPSK

Reference Designator: 2M48G1D

Antenna Connector: Type "SMA" (professionally installed)

Power Source: RF Module

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Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0-24.25 GHz bands.

IC RSS-210 Issue 8 December 2010

Low-power Licence-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment. Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

IC RSS-Gen Issue 3 December 2010 General Requirements and Information for the Certification of Radiocommunication Equipment

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range 16-22°C Humidity range 39-45%

Pressure range 102.0 – 102.3 kPa Power supply range 48VDC nominal

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3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
110	Antenna, LPA	Electrometrics	LPA-25	1217	4/1/2011	4/1/2013
115	Antenna, Bicon	EMCO	3104	3020	9/28/2010	9/28/2011
625	Antenna, Dbl Ridge Horn	EMCO	3116	2325	2/1/2010	2/1/2012
684	Transient Limiter	HP	11974A	3107A02636	9/10/2010	9/10/2011
805	LISN	Solar	9348-50-R-24-BNC	992823	2/7/2011	2/7/2012
813	Multimeter	Fluke	111	78130060	9/16/2009	9/16/2011
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	7/12/2010	7/12/2011
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571	688	8/16/2010	8/16/2012
898	EMI Receiver & filter set	HP	8546A	3625A00348	6/22/2010	6/22/2011
899	Filter Section	HP	85460A	3448A00288	6/22/2010	6/22/2011
919	Preamplifier	Spacek Labs MM- Wave Technology	100MHz to 40GHz	3M12 (SLK-35- 3) and 3M13 (SLKa-35-4)	12/14/2010	12/14/2011
E1018	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	835363/0003	2/1/2011	2/1/2012
E1020	Two Line V-Network	Rohde & Schwarz	ENV216	101044	4/4/2011	4/4/2012
NA	Regulating Transformer	TDGC	0-250 Vac	NA	NCR	NCR

Registration of the OATS are on file with the Federal Communications Commission, and are also registered with Industry Canada under Site Numbers 2040B-1 and 2040B-2.

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Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

4.5 Test Deleted

As this was a Class II Permissive Change test evaluation, retesting was not advisable as the change to the circuitry does not warrant retest.

4.6 Additional Observations

There were no additional observations made during this assessment.

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Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: IC RSS-210 Issue 8 December 2010 IC RSS-Gen Issue 3 December 2010

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- No: not applicable / not relevant
- Yes: Mandatory i.e. the apparatus shall conform to these tests.
- N/T Not Tested, mandatory but not assessed. (See section 4.5 Test deleted)
- S Sampled for verification of no change from original test results.

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15C	RSS-210	Test Description	Required	Result
15.207 (a)	RSS-Gen 7.2.4	Conducted Emission Limit	Ν	Pass
15.215(c)	RSS-Gen 4.6.1	20 dB & 99% Bandwidth	N/T	Pass
15.247(a)(2)	RSS-210 A8.2 (a)	Minimum 6dB RF Bandwidth	N/T	Pass
15.247(b)(3)	RSS-210 A8.4 (4)	Peak Output Power	Υ	Pass
15.247(d)	RSS-210 A8.5	Band-edge Compliance of RF Conducted Emissions	Y	Pass
15.247 (d)	RSS-210 A8.5	Spurious RF Conducted Emissions	Y	Pass
15.247 (d)	RSS-210 A8.5	Spurious Radiated Emissions	Y	Pass
15.247(e)	RSS-210 A8.2 (b)	Power Spectral Density for Digitally Modulated Devices	S	Pass
	RSS-Gen 4.10	Receiver Spurious Emissions	Υ	Pass

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Appendix A: Test Results

Power Line Conducted Emissions

15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator 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 μ H/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 boundary between the frequency ranges.

Conducted limit (dBµV)		
Quasi-peak	Average	
66 to 56*	56 to 46*	
56	46	
60	50	
	Quasi-peak 66 to 56* 56	

*Decreases with the logarithm of the frequency.

Test Conditions:

Sample Number:	ULPN110	Temperature:	
Date:		Humidity:	
Modification State:	Low, Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko SR1

Test Results: EUT does not have AC mains input

Additional Observations:

- EUT was tested using the following modes: Low channel, Mid channel, High channel and Receive Test Mode.
- No differences in receive mode emissions due to receive channel selected. Plot shown is worst case.
- Green limit line is Average limit and blue limit line is Quasi-peak limit.
- o represents final quasi peak measurements while x represent final average measurements.
- Instrumentation settings are 9kHz RBW/30kHz VBW for Average measurements and 100 kHz RBW/100kHz VBW for Peak measurements.

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20 dB / 99% Bandwidth

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Conditions:

Sample Number:	ULPN110	Temperature:	
Date:		Humidity:	
Modification State:	Low, Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: Not tested as changes made did not warrant retest.

Minimum 6dB RF Bandwidth

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Conditions:

Sample Number:	ULPN110	Temperature:	
Date:		Humidity:	
Modification State:	Low, Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: Not tested as changes made did not warrant retest.

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Peak Output Power

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Conditions:

Sample Number:	ULPN110	Temperature:	21°C
Date:	May 27, 2011	Humidity:	35%
Modification State:	Low, Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: Complies, output within 1 dB of previous testing.

Additional Observations:

- This is a conducted test. 0.7 dB was offset for the cable used.
- Input voltage to the EUT was varied from 48 VDC+/-15%, however no variation in results observed.
- Power was measured using Option 2, method 2: Sample detector mode, sample set to 100, average.

Original test results:

Channel Range	Peak Power Output (dBm)
Low (2402.00 MHz)	18.03
Mid (2440.00 MHz)	18.60
High (2476.00 MHz)	17.73

Retest:

Channel Range	Peak Power Output (dBm)
Low (2402.00 MHz)	18.16
Mid (2439.80 MHz)	18.45
High (2475.63 MHz)	17.65

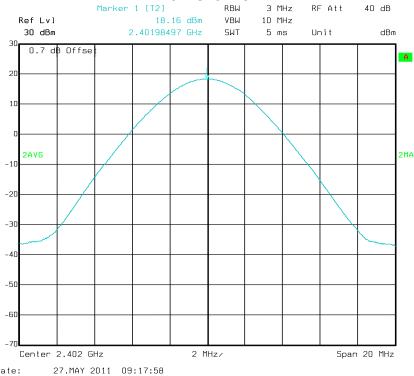
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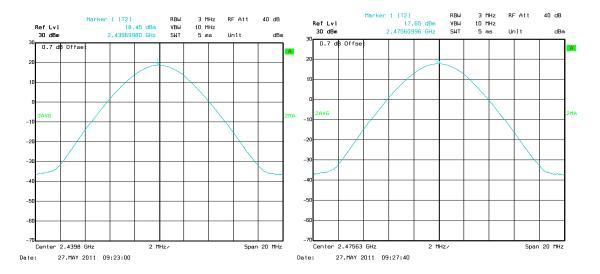
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Mid Channel

High Channel



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Spurious RF Conducted Emissions

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Conditions:

Sample Number:	ULPN110	Temperature:	20°C
Date:	May 17 2011	Humidity:	55%
Modification State:	Low, Mid and High Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: Not tested as changes made did not warrant retest.

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Spurious Radiated Emissions

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Conditions:

Sample Number:	ULPN110	Temperature:	17°C
Date:	May 16, 2011	Humidity:	44%
Modification State:	Receive mode, mid channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: EUT complies.

Emissions were searched from 30 MHz to 25000 MHz, no other emissions within 20 dB of the limits were detected.

Digital emissions presented. No emissions due to the harmonics of the transmit frequencies were within 20 dB of the limits.

Band edge emissions presented.

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Digital emissions.

Cable HF#:

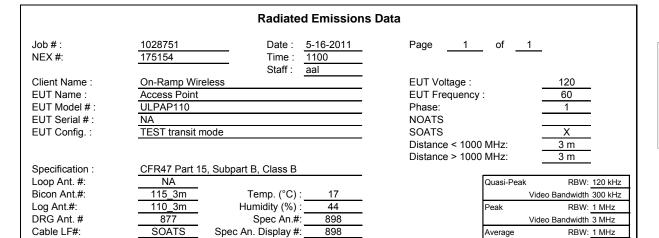
Preamp LF#:

Preamp HF#

40ft

NA

NA



898

899

QP #:

PreSelect#:

Meas.	Meter	Meter	Det.	EUT	Ant.	Max.	Corrected	Spec.	CR/SL	Pass	
Freq.	Reading	Reading		Side	Height	Reading	Reading	limit	Diff.	Fail	
(MHz)	Vertical	Horizontal		F/L/R/B	m	(dBµV)	(dBµV/m)	(dBµV/m)	(dB)		Comment
											Transmit
43.8	19.1	14.6	Q	-	1.0	19.1	30.0	40.0	-10.0	Pass	ambient
47.0	19.1	15.1	Q	-	1.0	19.1	29.8	40.0	-10.2	Pass	ambient
57.8	14.1	7.8	Q	-	1.0	14.1	26.0	40.0	-14.0	Pass	ambient
74.0	14.3	11.3	Q	-	1.0	14.3	23.3	40.0	-16.7	Pass	ambient
221.0	1.2	0.4	Q	-	1.0	1.2	14.6	46.0	-31.4	Pass	
284.0	-0.6	-1.0	Q	-	1.0	-0.6	15.9	46.0	-30.1	Pass	
332.0	0.7	2.4	Q	-	1.0	2.4	20.1	46.0	-26.0	Pass	
375.0	2.0	2.5	Q	-	1.0	2.5	20.5	46.0	-25.5	Pass	
	-										
	-										
						·					

Video Bandwidth 10 Hz

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated

Measurements above 1 GHz are Average values, unless otherwise stated.

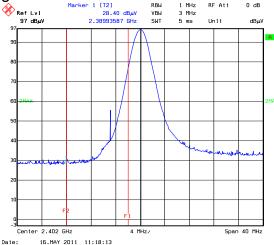
Band Edge Emissions

Band-edge Compliance of RF Conducted /Radiated Emissions

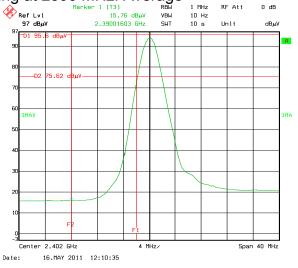
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Compare plots and table below.

restricted band ending at 2390 MHz: Peak



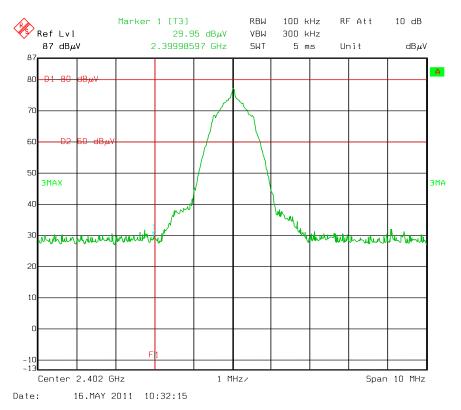
restricted band ending at 2390 MHz: Average



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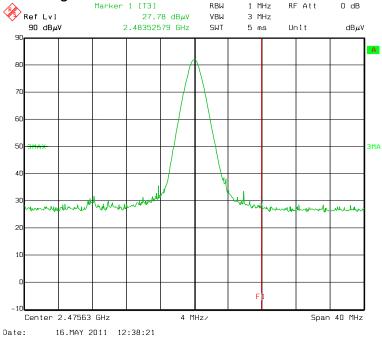
lower band edge. Limit is 20 dBc peak, based on Channel Peak Field Strength.



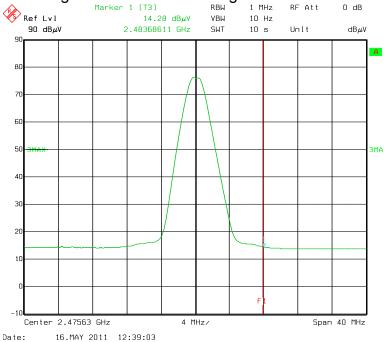
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restricted band starting at 2483.5 MHz: Peak



restricted band starting at 2483.5 MHz: Average



Specification: FCC Part 15 Subpart C, 15.247

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Example:

Corrected reading = max Reading + antenna correction factor and cable loss at frequency 2400 MHz: $65.0 \text{ dB}_{\mu}\text{V/m} = 30.0 \text{ dB}_{\mu}\text{V} + 29.1 \text{ dB/m} + 5.9 \text{ dB}$

Limit at 2400 = Peak -20 dB, from plot, limit = 60 dB μ V/m + 29.1 dB/m + 5.9 dB = 95 dB μ V/m

Radiated Emissions Data

17

44

898

898

898

899

Job#: 1028751 Date: 5-16-2011 1130 NEX#: 175154 Time: Staff: aal Client Name : On-Ramp Wireless

eNode RF Module EUT Name : EUT Model #: ULPN110 EUT Serial #: NA

EUT Config. : TEST transit mode

CFR47 Part 15, Subpart C Specification:

Loop Ant. #: NA Bicon Ant.#: NA Temp. (°C): Humidity (%): Log Ant.#: NA DRG Ant. # 877 Spec An.#: Cable LF#: NA Spec An. Display #: Cable HF#: 40ft QP #: PreSelect#:

Preamp LF#: NA Preamp HF# NA Page 1 of __1

EUT Voltage: 120 EUT Frequency: 60 Phase: 1 **NOATS** SOATS Χ Distance < 1000 MHz: 3 m Distance > 1000 MHz: 3 m

> Quasi-Peak RBW: 120 kHz Video Bandwidth 300 kHz RBW: 1 MHz Peak Video Bandwidth 3 MHz RBW: 1 MHz Average Video Bandwidth 10 Hz

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated. Measurements above 1 GHz are Average values, unless otherwise stated

Meas.	Meter	Meter	Det.	EUT	Ant.	Max.	Corrected	Spec.	CR/SL	Pass	
Freq.	Reading	Reading		Side	Height	Reading	Reading	limit	Diff.	Fail	
(MHz)	Vertical	Horizontal		F/L/R/B	m	(dBµV)	(dBµV/m)	(dBµV/m)	(dB)		Comment
											eNode
2400.0	30.0	20.1	Р	-	1.0	30	65.0	95.0	-30.0	Pass	
2390.0	28.4	28.0	Р	-	1.0	28.4	62.6	74.0	-11.4	Pass	
2390.0	15.8	15.1	Α	-	1.0	15.8	50.0	54.0	-4.0	Pass	
2483.5	27.8	25.3	Р	-	1.0	27.8	62.8	74.0	-11.1	Pass	
2483.5	14.3	13.9	Α	-	1.0	14.3	49.3	54.0	-4.6	Pass	

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Power Spectral Density for Digitally Modulated Devices

(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density. www.nemko.com

Test Conditions:

Sample Number:	ULPN110	Temperature:	21°C
Date:	May 27, 2011	Humidity:	35 %
Modification State:	Mid Channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results: Complies.

Additional Observations:

- This is a conducted test. 0.7 dB was offset for the cable used.
- RBW is 3kHz
- VBW is 10kHz
- Span is set to 0.5 MHz
- Power was measured using *Option 2, method 2: Sample detector mode, sample set to 100, average, sweep: free run.
- Limit is 8 dBm
- **EUT** complies

^{*} FCC guidelines for Measurement of DTS March 23, 2005

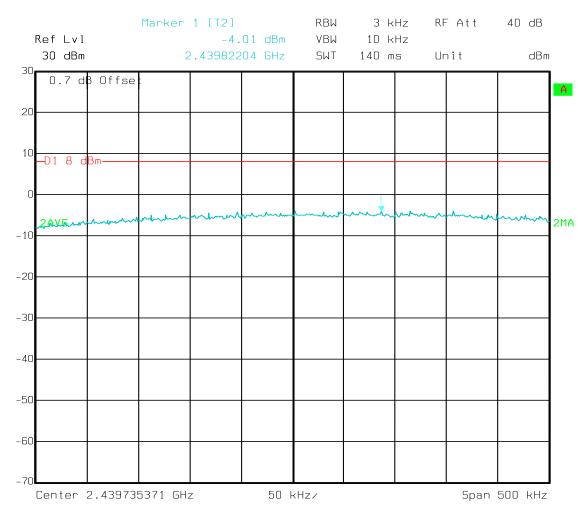
FCCID: XTE-ULPAP110 IC: 8655A-ULPAP110

Report Number: 2011 015175154 FCC2 Specification: FCC Part 15 Subpart C, 15.247



www.nemko.com

Mid Channel -4.01 dBm



Date: 27.MAY 2011 09:26:14

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Receiver Spurious Radiated Emissions

The following receiver spurious emission limits shall be complied with: (a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

Table 1 - Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

Test Conditions:

Sample Number:	ULPN110	Temperature:	17°C
Date:	May 16, 2011	Humidity:	44%
Modification State:	Receive mode, mid channel	Tester:	Alan Laudani
		Laboratory:	Nemko

Test Results:

See attached test result.

Additional Observations:

- The Spectrum was searched from 30 MHz to 12500 MHz.
- EUT operated on "test receive mode".
- Below 1GHz measurements are measured using CISPR quasi-peak detector.
- No other emissions within 20 dB of the limit were detected.

Nemko USA, Inc.

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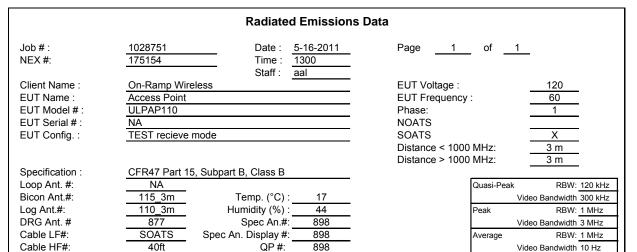
Digital emissions only.

Preamp LF#:

Preamp HF#

NA

NA



899

Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.

Measurements above 1 GHz are Average values, unless otherwise stated.

Meas.	Meter	Meter	Det.	EUT	Ant.	Max.	Corrected	Spec.	CR/SL	Pass	
Freq.	Reading	Reading		Side	Height	Reading	Reading	limit	Diff.	Fail	
(MHz)	Vertical	Horizontal		F/L/R/B	m	(dBµV)	(dBµV/m)	(dBµV/m)	(dB)		Comment
											Transmit
43.8	19.1	14.6	Q	-	1.0	19.1	30.0	40.0	-10.0	Pass	ambient
47.0	19.1	15.1	Q	-	1.0	19.1	29.8	40.0	-10.2	Pass	ambient
57.8	14.1	7.8	Q	-	1.0	14.1	26.0	40.0	-14.0	Pass	ambient
74.0	14.3	11.3	Q	-	1.0	14.3	23.3	40.0	-16.7	Pass	ambient
221.0	1.2	0.4	Q	-	1.0	1.2	14.6	46.0	-31.4	Pass	
284.0	-0.6	-1.0	Q	-	1.0	-0.6	15.9	46.0	-30.1	Pass	
332.0	0.7	2.4	Q	-	1.0	2.4	20.1	46.0	-26.0	Pass	
375.0	2.0	2.5	Q	-	1.0	2.5	20.5	46.0	-25.5	Pass	

PreSelect#: