

Nemko Test Report: 5L0114RUS4Rev1

Applicant:

Motion Computing, Inc. 8601 RR 2222 Bldg 2 Austin, Texas 78730

LS800 TS01 with Atheros card

Equipment Under Test: (E.U.T.)

FCC ID.:

Q3QWMIA123AG

In Accordance With:

FCC Part 15, Subpart E UNII Band Transceiver

Tested By:

Nemko Dallas Inc. 802 N. Kealy Lewisville, Texas 75057-3136

70- Till

Tom Tidwell, Frontline Group Manager

Authorized By:

Date:

1 December, 2005

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Section 1. Summary of Test Results

Manufacturer: Motion Computing, Inc.

Model No.: TS01 w/ Atheros card

Name: LS800

Serial No.: Proto 8

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 Part 15, Subpart E for UNII devices. 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.

\boxtimes	New Submission		Production Unit
	Class II Permissive Change	\square	Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. NONE See "Summary of Test Data".

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NVLAP LAB CODE: 100426-0

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	Complies
26 dB Bandwidth	15.407(a)	Complies
Maximum Peak Power Output	15.407(a)	Complies
Peak Excursion	15.407(b)	Comlies
Spurious Emissions (Antenna Conducted)	15.407(a)	Complies
Spurious Emissions (Restricted Bands)	15.407(a)	Complies
Peak Power Spectral Density	15.407(a)	Complies

Footnotes:

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Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band:

ع 🖂	5170 –	5240	MHz
25	5260 –	5320	MHz

Channel Spacing:

5 MHz

User Frequency Adjustment:

Software controlled

EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1

Description of EUT

The LS800 TS01 is a portable computer platform based on ultra-portable tablet PC technology utilizing Microsoft's Tablet version of Windows XP. The PC is compatible with 802.11a, b and g technologies.

The PC also has Bluetooth capability.

System Diagram



Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Brian Boyea	DATE: 4/19/05

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

The worst case PEAK emission was 51 dB μ V at 150 kHz on the neutral line. This is 5 dB below the AVERAGE spec limit of 56 dB μ V.

Test Data – Powerline Conducted Emissions

Neutral



Hot



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Photos – Powerline Conducted Emissions

Front



Side



Section 4. 26 dB Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.407(a)
TESTED BY: David Light	DATE: 03 May 2005

Test Results: Complies.

EQUIPMENT: TS01 w/ Atheros card

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Data Plot					Occu	pied Ba	ndwidth					
Page 1 of	<u>9</u>					-			С	omplete	Х	
Job No.:	5L0114			D	ate: 5	/11/2005			Prelin	ninary:		
Specification:	15.407(a)	1	Femperature(°C):	23						
Tested By:	David L	ight	Relat	ive Humidity	/(%)	45						
E.U.T.:	Tablet F	C w/Athero	s 802.11 a/b/g	radio	· · ·							
Configuration:	Tx											
Sample Number:	1											
Location:	Lab	1				RBW: 30	0 kHz					
Detector Type:	Peal	ĸ				VBW: 3	00 kHz					
Test Equipme	ent Use	<u>d</u>										
Antenna:					Direction	al Coupler:						
Pre-Amp:						Cable #1:	1973					
Filter:						Cable #2:						
Receiver:	146	4				Cable #3:						
Attenuator #1	147	2				Cable #4:						
Attenuator #2:						Mixer:						
Additional equip	ment used	1:										
Measurement Un	certainty:	+/-1	7 dB									
	F	ΑΤΤΕΙ RL −: Γ	Ч 10с 23.6с	IB ∃Bm	1	Ød B∕	2	MKR 3.33 1	–.50 MHz I	dB		
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	米ト	KBM (зоокн	1Z	QΒ	M 30	⊿KHZ		SMP	50.U	ms	
Notes:												

EQUIPMENT: TS01 w/ Atheros card

TEST REPORT NO.: 5L0114RUS4Rev1

Data Plot	t				<u>Occup</u>	oied Bar	ndwidth					
Page <u>2</u> o Job No.: Specification: Tested By: E.U.T.: Configuration:	5L0114 15.4070 David I Tablet Tx	4 (a) Light PC w/Athero	Rela s 802.11 a/b/	l Temperature tive Humidit g radio	Date: 5/11/2 (°C): 23 y(%) 45	005		-				
	f	ATTEN RL -2	۱ 10a 23.6a	∃B ∃Bm	10]dB∕	۵ 2	MKR 3.58	–.50 MHz	dB		
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	R	the state of the s		i and in the second					'"\\\	^{n,q} r∖rd _{ens}	HAN NOT	
				1000	30.00-	-					MU-	
	*F	RBM 3	300kH	lz Iz	VBN	, 1 300)kHz	ər	SWP	50.0	lms	
Notes:												

EQUIPMENT: TS01 w/ Atheros card

TEST REPORT NO.: 5L0114RUS4Rev1

Data Plot					Occup	oied Bar	<u>ldwidth</u>					
Page <u>3</u> o Job No.: Specification: Tested By:	f <u>9</u> 5L0114 15.407(David I	a) Light	Relat	I Femperature	Date: $\frac{5/11/20}{(°C)}$ (°C): $\frac{23}{45}$	005						
E.U.T.: Configuration:	Tablet I Tx	PC w/Atheros	802.11 a/b/ş	g radio				-				
	f	ATTEN RL -2	10a 23.6a	IB ∄Bm	10	∂d B∕	۵ 2	MKR 3.67	.17d MHz	В		
		AWK			بالمزيج بر		,	****				
		. 17	dB	12								
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		Without	~~ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~							mare and	Mathews and a second	
) 米	СЕМТЕ RBW З	IR 5. 800kf	2400 Iz	00GH: VBM	z 1 300)kHz	SP	AN 5 SWP	0.00 50.0	MHz Ims	
Notes:												

TEST REPORT NO.: 5L0114RUS4Rev1

Data Plot	- -				Occup	oied Ban	ldwidth					
Page 4_ o	f 9 51.011/	1			Date: 5/11/2	005						
Specification:	15.407	(a)		Temperature	(°C): 23	005						
Tested By:	David	Light	Rela	ative Humidit	y(%) 45							
E.U.T.:	Tablet	PC w/Athere	os 802.11 a/b/	g radio				_				
Configuration:	Tx							-				
	f	атте	N 100	зB			Δ	MKR	1.34	dB		
	I	RL –	<u>23.6</u>	dBm	10	2d B∕	2	4.00	MHz			
		ΔMK 24.	R ØØ MI	Hz	1	***********************	James me	l L				
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		the second se	-							~ 104		
	1	CENT	ER 5	2600	1 00GH:	z		SP	'AN 5	0.00	MHz	
	*I	₹ВЫ :	300k	Ηz	ΛBh	1 300)kHz		SWP	50.C	lms	
Notes:												

EQUIPMENT: TS01 w/ Atheros card

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Data Plot	-				Occup	oied Ba	ndwidth	1				
Page <u>5</u> o Job No.:	f <u>9</u> 5L0114				Date: 5/11/2	005						
Specification:	15.407	(a)		Temperature	e(°C): 23							
Tested By:	David I	Light	Rela	tive Humidit	ty(%) 45							
E.U.T.:	Tablet	PC w/Atheros	802.11 a/b/	g radio								
Configuration:	Tx							_				
	F	ATTEN	10c	B			Δ	MKR_	ØdB			
	F	RL -2	23.60	1Bm	10]dB∕	2	3.75	MHz			
			•		ja.e.e	***	marked and	w.m.				
		23.1	°5 M⊦	Ιz	_	,						
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	R		and the second						···•4	*******	.	
											"HANNAL	
	(CENTE	IR 5.	2800	30 GH 2			SP	AN 5	0.00	MHz	
	术日	KBM 3	ЮОКН	1Z	0BM	1 300	IKHZ		SWP	50.0	ms	
Notes:												

EQUIPMENT: TS01 w/ Atheros card

TEST REPORT NO.: 5L0114RUS4Rev1

Data Plot					Occup	pied Ba	ndwidth	l				
Page <u>6</u> o Job No.: Specification: Tested By: E.U.T.: Configuration:	5L0114 5L0114 15.4070 David I Tablet Tx	4 (a) Light PC w/Ather	Re os 802.11 a/b	Temperaturo lative Humidi o/g radio	Date: $\frac{5/11/2}{23}$ e(°C): $\frac{23}{45}$	2005		-				
	ŕ	ATTE	N 10 23.6	dB dBm	10	3d B∕	۵ 2	MKR 4.00	84 MHz	dB		
	R	ΔMK 24. 8	R ØØ M 4 d B	H Z	ſ					http://www.		
Notes:	(*F	CENT RBW	ER 5 300k	. 3200 Hz	20GH: VBV	z 1 300)kHz	SF	AN 5 SWP	50.00 50.0	IMHz Ims	

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.407(a)
TESTED BY: David Light	DATE: 03 May 2005

(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

Limit = lesser of 50 mW(17 dBm) or 4 dBm + $10\log(20) = 17$ dBm Limit = 50 mW(+17 dBm)

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

Limit = lesser of 250 mW(24 dBm) or 11 dBm + 10log(20) = +24 dBm Limit = 250 mW(+24 dBm)

(3) For the band 5.725-5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Limit = lesser of 1 W (30 dBm) or 17 dBm + $10\log(20) = +30$ dBm Limit = 1 W(+30 dBm)

Test Results: Complies.

Measurement Data: Refer to attached data

The measurement was repeated at +/- 15% of nominal supply voltage with no variation noted in rf power output.

Maximum Peak Power:

Frequency	Peak Power	Peak Power		
(MHz)	(dBm)	(mW)		
	5150 – 5250 MHz band			
5170	17.3	54		
5240	16.6	46		
	5250 – 5350 MHz band			
5260	17.3	54		
5320	16.7	47		

Test Equipment Used: 1464-1973-1472

Test Conditions: 20^oC 50% RH

The carrier is continuous and method #1 of FCC Public Notice DA 02-2138 was used to make the measurement.

Section 6. Peak Excursion

NAME OF TEST: Peak Excursion

PARA. NO.: 15. 407

TESTED BY: David Light

DATE: 13 May 2005

Test Results: Maximum excursion = 13.9 dB.

Measurement Data: See attached plots

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Section 7. Spurious Emissions (conducted)

NAME OF TEST: Spurious Emissions (conducted)	PARA. NO.: 15.407
TESTED BY: David Light	DATE: 5/12/05

Test Results: Complies.

Measurement Data: Refer to attached plots

Test Equipment: 1036-1081-1472

FCC PART 15, SUBPART E

EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1



Test Data – Spurious Emissions (5170 MHz)

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Test Data – Spurious Emissions (5170 MHz)

FCC PART 15, SUBPART E

EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1



Test Data – Spurious Emissions (5240 MHz)

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Test Data – Spurious Emissions (5240 MHz)

FCC PART 15, SUBPART E

EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1



Test Data – Spurious Emissions (5260 MHz)

TEST REPORT NO.: 5L0114RUS4Rev1



Test Data – Spurious Emissions (5260 MHz)

FCC PART 15, SUBPART E

EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1



Test Data – Spurious Emissions (5320 MHz)

FCC PART 15, SUBPART E

EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1



Section 8. Spurious Emissions (radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.407
TESTED BY: David Light	DATE: 5/12/05
TESTED BY: David Light	DATE: 5/12/05

Test Results:	Complies.
Measurement Data:	Statement: This transmitter was tested in 802.11a mode and at 5170, 5240, 5260, 5320, 5745, and 5805 MHz. There were no emissions detected above the noise floor. The ambient threshold of sensitivity is sufficient to detect signals within 20 dB of the specification limit. A high-pass filter was used to reject the fundamental transmission.
Test Equipment:	1464-1484-1485-1016-1304-760-759-791

Section 9. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.407
TESTED BY: David Light	DATE: 5/11/05

Test Results: Complies.

Measurement Data: See attached data.

EQUIPMENT: TS01 w/ Atheros card

<u>Data Plot</u>				Pe	ak Po	wer Spec	tral Der	<u>isity</u>				
Page <u>1</u> of	<u>9</u>			F		5/11/2005			(D 1'	Complete	X	
Job No.:	5L0114	ł		L	Date:	5/11/2005			Preli	minary:		
Specification:	15.407((a)		Temperature	(°C):	23						
Tested By:	David I	Light	Rela	tive Humidit	y(%)	45						
E.U.T.:	Tablet	PC w/Atheros	s 802.11 a/b/	g radio				-				
Configuration:	Tx							-				
Sample Number:	1											
Location:	Lab	1				RBW: 1	MHz	-				
Detector Type:	Pea	<u>k</u>				VBW: 3	MHz	-				
<u>Test Equipme</u>	ent Use	<u>ed</u>										
Antenna:					Direction	nal Coupler:		-				
Pre-Amp:						Cable #1:	1973	-				
Filter:						Cable #2:		-				
Receiver:	146	4				Cable #3:		-				
Attenuator #1	147	2				Cable #4:		_				
Attenuator #2:						Mixer:		_				
Additional equip	nent use	d:						_				
Measurement Un	certainty	+/-1.	7 dB									
	f I R		1 20d 3. 6d I 6457 97 dI	d B Bm GHz		IG 100	3 M 5	KR - . 164	2.90 57GH	dBm z	× ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	
	(¥F	CENTE RBW 1	ER 5.	. 1700 Hz)ØG⊦ ¥VB	lz ₩ 3.0)MHz	SF	PAN 2 SWP	:0.00 50.0	MHz Ims	
Notes:												
110100.												



EQUIPMENT: TS01 w/ Atheros card TEST REPORT NO.: 5L0114RUS4Rev1



Data Plot Peak Power Spectral Density Page 4_of 9 5L0114 Date: 5/11/2005 Job No.: Specification: 15.407(a) Temperature(°C): 23 Relative Humidity(%) 45 Tested By: David Light Tablet PC w/Atheros 802.11 a/b/g radio E.U.T.: Configuration: Tx VAVG 100 MKR -3.90dBm ATTEN 20dB 5.32092GHz 35 RL 33.6dBm 10d B⁄ MKR 5.32092 GHz D -3.**7**3 d₿m A DESCRIPTION OF THE OWNER OF THE was. R ~~ **۳** CENTER 5.32000GHz SPAN 25.00MHz *RBW 1.0MHz *VBW 3.0MHz SWP 50.0ms Notes:

EQUIPMENT: TS01 w/ Atheros card



Data Plot Peak Power Spectral Density Page 8_ of 9 5L0114 Date: 5/11/2005 Job No.: Specification: 15.407(a) Temperature(°C): 23 Relative Humidity(%) 45 Tested By: David Light Tablet PC w/Atheros 802.11 a/b/g radio E.U.T.: Configuration: Tx ATTEN 20dB VAVG 100 MKR -3.07dBm RL 33.6dBm 10d B/ 5.80825GHz 35 МКR 5.80825 GHz D -3.2/3 d₿m -R CENTER 5.80500GHz SPAN 25.00MHz *RBW 1.0MHz *VBW 3.0MHz SWP 50.0ms Notes:

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Section 10. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due	
1973 CABLE, 1m		KTL 0	N/A	08/02/04	08/02/05	
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A	
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07	
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05	
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05	
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05	
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05	
760	Antenna biconical	Electro Metrics MFC-25	477	06/22/04	06/22/05	
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	07/23/04	07/23/05	
791	PREAMP, 25dB	ICC LNA25	398	11/12/04	11/12/05	
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	08/26/04	08/26/05	
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06	
969	lisn	Schwarzbeck 8120	8120281	09/17/04	09/17/05	
1547	CABLE .6m	KTL RG223	N/A	06/09/04	06/09/05	
1115	CABLE, 4.5m	KTL RG223	N/A	04/27/05	04/27/06	
718	HP SPECTRUM ANALYZER	HEWLETT PACKARD 8591EM	3639A00980	04/06/05	04/06/06	
966	Receiver	Rohde & Schwartz ESH2	880370/029	09/20/04	09/20/05	
1193	LIMITER	FISCHER FCC-450B-1.25N	956	02/24/04	02/24/05	
1555	Filter high pass 5KHz	Solar Electronics 7930-5.0	933125	04/20/05	04/20/06	

FCC PART 15, SUBPART E

EQUIPMENT:	TS01 w/ Atheros card	TEST REPORT NO .:	5L0114RUS4Rev1
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ANNEX A - TEST DIAGRAMS

TEST REPORT NO.: 5L0114RUS4Rev1

Test Site For Radiated Emissions



Conducted Emissions



TEST REPORT NO.: 5L0114RUS4Rev1

Peak Power At Antenna Terminals



Minimum 6 dB Bandwidth Peak Power Spectral Density Spurious Emissions (conducted)

