



AEGIS LABS INC.



Limited Modular Approval
Test Report
And Application for Grant of Equipment Authorization

Pertaining To:

EUT	FCC ID:
WiBox Serial to Wireless Server, Model: WBX2100E	R68WIBOX

Configuration
802.11b Serial to Wireless Server with a Network Connection using a Wanshih Antenna

MEASUREMENTS PERFORMED IN ACCORDANCE WITH

Regulatory Standard(s)
47 CFR Part 15, Subpart C Section 15.247
<p>Test Method: ANSI C63.4: 1992 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz</p>



Certificate Number: 1111.01

APPLICANT:

Lantronix, Inc.
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Irvine, California 92618

Contact(s): Mr. Van Quach

PREPARED BY:

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	REPORT BODY	APPENDICES		TOTAL PAGES
		<i>A</i>	<i>B</i>	
PAGES	17	31	2	50

Test Report #: LANTR-040324F
Test Report Revision: None

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1.0 CERTIFICATION OF TEST DATA

Aegis Labs, Inc. operates as both a Nevada and California Corporation with no organizational or financial relationship with any company, institution, or private individual.

Testing and engineering functions provided by Aegis Labs are furnished through the use of part-time, full-time or consulting engineers with the appropriate qualifications to carry out their duties. The intended purpose of this test report is to describe the measurement procedure and to determine whether the equipment under test "EUT" complies with both the conducted and radiated limits. Limits for emissions testing are described under Subpart C of Part 15 of the FCC rules.

The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the Equipment Under Test (EUT) under the requirements specified in the emissions standard as described below. The test results contained in this report are only representative of the test sample tested as described in Section 3.0 of this report. Certification of the EUT is required as a prerequisite to marketing as defined in Part 2 of the FCC Rules.

Prepared By:

07/12/04

Rick Candelas
Staff Engineer
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Date:

Report Approved By:

07/12/04

Steve J. Kuiper
Quality Assurance Manager
Aegis Labs, Inc.

Date:

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2.0 SUMMARY OF TEST RESULTS

The test results provided within this report, indicate that the EUT has been found to be in **COMPLIANCE** with the test specifications based upon the following RF compliance standards:

Pass/Fail determination is based upon the nominal values of the test data.

802.11b Mode (2400-2483.5 MHz)

EMISSIONS STANDARD			
FCC Part 15 Section	Description	Results	Comments
15.247(a)(2)	The minimum 6dB bandwidth shall be at least 500 kHz.	PASSED	2412 MHz = 12.17 MHz 2437 MHz = 12.08 MHz 2462 MHz = 12.17 MHz
15.247(b)(1)	The maximum peak output power of the intentional radiator shall not exceed 1 watt.	PASSED	2412 MHz = 16.44 dBm = 44.06 mW 2437 MHz = 16.23 dBm = 41.88 mW 2462 MHz = 16.27 dBm = 42.36 mW
15.247(b)(4)	The intentional radiator shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the FCC guidelines per Section 1.1307(b)(1).	PASSED	Refer to MPE Calculations Exhibit
15.247(c)	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.	PASSED	See Data Sheets
15.247(c)	Radiated emissions, which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a). All others must be < -20dBc.	PASSED	See Data Sheets
15.247(d)	The peak 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.	PASSED	2412 MHz = -12.50 dB 2437 MHz = -13.17 dB 2462 MHz = -12.67 dB
15.207	AC Conducted Emissions	PASSED	See Data Sheets
15.209	Radiated Emissions (30-1000 MHz)	PASSED	See Data Sheets



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3.0 ADMINISTRATIVE DATA AND TEST DESCRIPTION

DEVICE TESTED:	ITE Type: WiBox Serial to Wireless Server Model Number(s): WBX2100E Serial Number: None FCC ID: R68WIBOX
TEST DATE(S):	May 18-June 10, 2004
DATE EUT RECEIVED:	May 18, 2004
ORIGIN OF TEST SAMPLE(S):	Pre-Production Unit
RESPONSIBLE PARTY:	Lantronix, Inc. 15353 Barranca Parkway Irvine, California 92618
CLIENT CONTACT:	Mr. Van Quach
MANUFACTURER:	Lantronix, Inc.
TEST LOCATION:	Aegis Labs, Inc. 32231 Trabuco Creek Road Trabuco Canyon, CA 92678 Conducted Site #1 Radiated Site #1
A2LA CERTIFICATE:	1111.01, Valid through February 28, 2006
PURPOSE OF TEST:	To demonstrate compliance with the relevant standards described in Section 2.0 of this report.
TEST(S) PERFORMED:	Refer to Table in Section 2.0 of this report.

All calibration vendors were responsible for certifying Aegis Labs, Inc. test equipment as per the manufacturer's specifications and that the equipment is calibrated using instruments and standards where the accuracy is traceable to the National Institute of Standards and Technology (NIST). Calibration of all test equipment conforms to ANSI/NCSL Z540-1 and ISO 10012-1 and/or ISO/IEC Guide 17025 compliance (Additionally, other pertinent test equipment will carry MIL-STD-45662A). All calibration documents are on file with Aegis Labs, Inc., with copies provided upon request.

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4.0 DESCRIPTION OF EUT

4.1 EUT Description

Equipment Under Test (EUT)	
Trade Name:	WiBox Serial to Wireless Server
Model Number:	WBX2100E
Frequency Range:	802.11b = 2400 – 2483.5 MHz
Type of Transmission:	Direct Sequence Spread Spectrum
Transfer Rate:	1/5.5/11 Mbps for 802.11b mode
Number of Channels:	802.11b mode (2400-2483.5 MHz) = 11
Modulation Type:	DBPSK, DQPSK, CCK, OFDM
Antenna Type:	External Antenna with Reverse SMA connector
Antenna Gain (See Note 2):	2.45 GHz = 2.15 dBi
Transmit Output Power:	16 dBm (Typical) for 802.11b mode Please see Appendix A (Data Sheets) for actual output power.
Power Supply:	9-30VDC (2.5 W max) DC input from external 120VAC Adapter
Number of External Test Ports Exercised:	1 Antenna Port, 2 Serial Ports, 1 Network Port

The WiBox Serial to Wireless Server provides serial-to-wireless network connectivity. The WiBox allows serial devices to connect and communicate over 802.11b wireless networks using IP protocol (TCP for connection-oriented stream applications and UDP for datagram applications).

NOTE 1: For a more detailed description, please refer to the manufacture's specifications or User's Manual.

NOTE 2: The EUT was tested with a set of antennas (Wansih). (Refer to the antenna specifications exhibits).

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4.1.1 Channel Number and Frequencies

802.11b Mode	
Channel	Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462



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4.2 EUT Configuration

The EUT was tested as a standalone device connected to a remotely located Belkin 5-Port Network Switch via its network port. The Belkin 5-Port Network Switch was then connected to an eMachines computer via its network port. The eMachines computer was then connected to a Kogi monitor, an eMachines keyboard and mouse via its video, keyboard and mouse ports respectively. Serial ports 1 & 2 were connected in a loop back configuration. A Wanshih external antenna was connected to the EUT's antenna ports via its reverse SMA antenna connector. Data for the Wanshih antenna can be found in Appendix A (Data Sheets).

The low, middle, and high channels were tested in 802.11b mode. The EUT was placed in either continuous transmit or continuous receive mode by a program provided by the manufacturer (*RTS Ver. 2_3*).

Also, a second model without the network port was tested (WBX2100). It was considered a lesser configuration because of the absence of the network port. During preliminary scans the EUT with the network port (WBX2100E) was found to be worst case therefore full testing was only performed on this model (WBX2100E). Please refer to Appendix A for the data.

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4.3 List of EUT, Sub-Assemblies, and Host Equipment

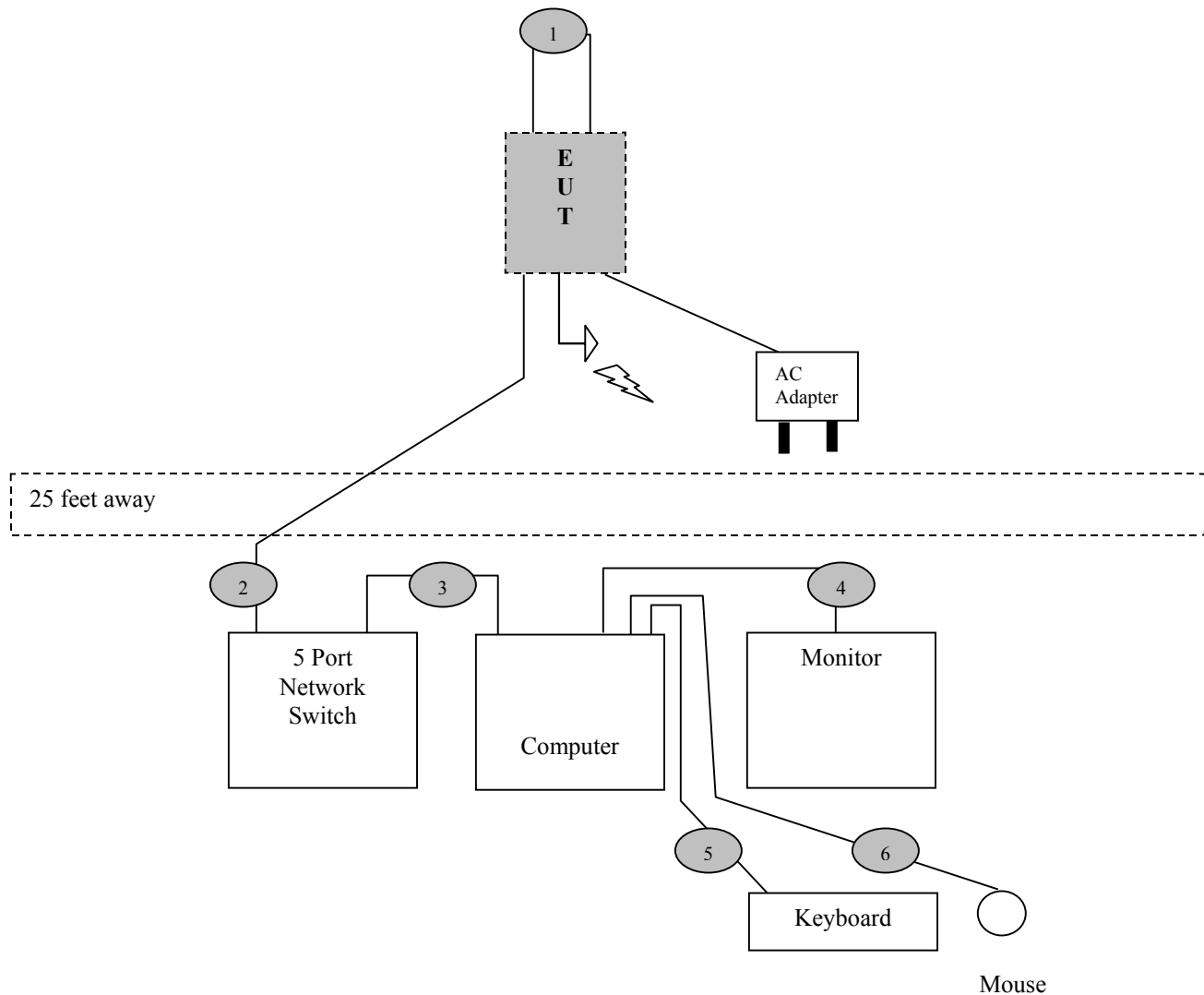
LIST OF EUT AND SUB-ASSEMBLIES			
Equipment Name	Manufacturer	Model Number	Serial Number
WiBox Serial to Wireless Server	Lantronix, Inc.	WBX2100E	None
EUT Sub-Assemblies			
External Antenna	Wanshih	WSS003	N/A
AC Adaptor	Regal Electronics, Inc.	JK-12101-N	401

HOST EQUIPMENT LIST			
Equipment Name	Manufacturer	Model Number	Serial Number
Computer	eMachines	T2842	QIV42B0201284
LCD Monitor	Kogi	L7CH	G7NX33800158
Keyboard	EMachines	KB-9908	1358924A13400720B
Mouse	EMachines	SAGM002	133771SYS1440074
5-Port Network Switch	Belkin	F5D5131-5	None

NOTE: All the power cords of the above support equipment are standard non-shielded, 1.8 meters long.



4.4 I/O Cabling Diagram and Description



Cable 1: This is a 6-foot braid and foil shielded round cable connecting the EUT's serial port 1 and serial port 2 in loop back configuration. It has metallic DB-9 type connector at both ends. The cable is bundled to a length of one meter and the shield of the cable is grounded to the chassis via the connector shells.

Cable 2: This is a 25-foot unshielded twisted pair cable connecting the EUT's Network port to the Belkin 5-Port Network Switch. It has a plastic RJ-45 type connector on both ends.



4.4 I/O Cabling Diagram and Description (Continued)

- Cable 3: This is a 5-foot unshielded twisted pair cable connecting the Belkin 5-Port Network Switch to the eMachines computer. It has a plastic RJ-45 type connector on both ends.
- Cable 4: This is a 6-foot braid and foil shielded round cable connecting the eMachines computer to the Kogi LCD monitor. It has metallic DB-15 type connector at the computer end and is hardwired to the monitor. The cable is bundled to a length of one meter and the shield of the cable is grounded to the chassis of both devices via the connector shells.
- Cable 5: This is a 6-foot braid and foil shielded round cable connecting the eMachines computer to the eMachines keyboard. It has a metallic 6-pin mini din type connector at the computer end and is hardwired to the keyboard. The shield of the cable is grounded to the chassis of the computer via the connector shell.
- Cable 6: This is a 6-foot braid and foil shielded round cable connecting the eMachines computer to the eMachines mouse. It has a metallic 6-pin mini din type connector at the computer end and is hardwired to the mouse. The shield of the cable is grounded to the chassis of the computer via the connector shell.



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5.0 TEST EQUIPMENT AND TEST SETUPS

The test equipment settings and functions are selected using the guidance of ANSI C63.4-1992. All test equipment setups and operations during conducted and radiated emissions testing are in accordance with this reference document.

5.1 AC Power Line Conducted Emissions

During conducted emissions measurements, a spectrum analyzer was used as the measuring instrument along with a preselector and quasi-peak detector. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage. The conducted emissions from the EUT in the frequency range from 150 kHz to 30 MHz were captured for graphical display through the use of automated LABVIEW EMI measurement software. All graphical readings were measured in the “Peak” mode only to reduce testing time. Upon completion of the graphical scan, the test lab personnel performed the conducted measurement scan manually using the spectrum analyzer front panel keys. All peak measurements coming within 3 dB of the limit line were “Averaged” and/or “Quasi-Peaked” and denoted appropriately in the EXCEL spreadsheet.

The Equipment Under Test (EUT) was configured as a system with peripherals connected, so that at least one interface port of each type is connected to one external peripheral when tested for conducted emissions according to ANSI C63.4: 1992. Excess power cord length was wrapped in a bundle 30 to 40 centimeters in length near the center of the cord. The EUT was tested in a tabletop configuration.

The emission readings for Line 1 and Line 2 are highlighted on the data sheets in Appendix A. The graphical scans only reflect peak readings while the tabulated data sheets reflect peak, average, and/or quasi-peak readings which ever applies.



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5.2 Spurious Radiated Emissions

A spectrum analyzer was used as the measuring instrumentation along with a preselector and quasi-peak-detector. The pre-amplifiers were used to increase the sensitivity of the instrument. The spectrum analyzer was used in the peak detector mode with the “max-hold” feature activated and in Positive Peak mode. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The quasi-peak detector was used only for those readings, which are marked accordingly in the data sheet. The effective measurement bandwidth used for the radiated emissions test was 120 kHz for (30 MHz- 1000 MHz). The spectrum analyzer operated such that the modulation of the signal was filtered out to set the analyzer in linear mode. For testing beyond 1000 MHz a spectrum analyzer capable of taking reading above 1000 MHz was connected to the high frequency amplifier, where these measurement readings were taken with the transducer placed at a 3-meter test distance from the EUT.

The Open Area Test Sites (OATS) was used for radiated emission testing. These test sites are designed according to ANSI C63.4: 1992 and ANSI C63.7: 1992 guidelines. The Measurements were conducted in accordance with ANSI C63.4: 1992 and ANSI C63.7: 1992 requirements.

Broadband biconical, log periodic, and horn antennas were used as transducers during the measurement reading phase. The frequency spans were wide (30 MHz-88 MHz, 88 MHz- 216 MHz, 216 MHz- 300 MHz, and 300 MHz- 1000 MHz). After 1000 MHz the horn antenna was used to measure emissions. The emission readings in both horizontal and vertical polarities are highlighted on the data sheets in Appendix A.

5.3 Conducted Emissions at the Antenna Port

A spectrum analyzer or power meter was used as the measuring instrumentation along with an attenuator and/or filter connected to the EUT antenna port. The attenuator and filters are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission. . The instruments recorded the measured readings with the bandwidths (video and resolution) set in accordance with the FCC Rules and regulations.

For the power out measurements in 802.11b and 802.11g modes a peak power meter was used along with a peak power sensor with a wide enough bandwidth to capture the entire fundamental transmission. For 802.11a mode a spectrum analyzer with “Channel Power Measurement” function was used to measure the peak output power.

The measured readings are on the data sheets in Appendix A.

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5.4 Test and Measurement Equipment Used

TEST EQUIPMENT USED					
Equipment Name	Manufacturer	Model Number	Serial Number	Calibration Due Date	Calibration Cycle
EMI Receiver - RF Section	Hewlett Packard	85462A	3325A00137	03/29/05	1 Year
EMI Receiver – RF Filter Section	Hewlett Packard	85460A	3330A00138	03/29/05	1 Year
Transient Limiter	Hewlett Packard	11947A	3107A02734	03/30/05	1 Year
LISN (EUT)	Solar Electronics	9252-50-R-24-BNC	961025	04/01/05	1 Year
LISN (Access)	Solar Electronics	9252-50-R-24-BNC	961024	04/01/05	1 Year
Spectrum Analyzer	Agilent	8564EC	4046A00387	02/06/06	2 Years
1-18 GHz Preamplifier	Hewlett Packard	8449B	3008A01573	12/01/05	2 Years
1-18 GHz Horn Antenna	EMCO	3110	2230	02/06/05	2 Years
2400-2483.5 MHz Notch Filter	Micro-Tronics	BRM50702-02	003	04/21/06	2 Years
Antenna - Biconical	EMCO	3110B	3383	11/04/04	1 Year
Antenna - Log Periodic	Electro-Metrics	LPA-25	1186	11/04/04	1 Year
18-26.5 GHz Preamplified Antenna – Horn	Custom Microwave	H042	001	11/04/04	1 Year
Power Meter	Anritsu	ML2487A	6K00001785	04/05/05	2 Years
Wide Bandwidth Sensor	Anritsu	MA2491A	31193	04/05/05	2 Years
Temperature/Humidity Monitor	Dickson	TH550	7255185	01/18/05	1 Year

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6.0 SAMPLE CALCULATIONS

If a preamplifier is used during the Radiated Emissions Testing, it is required that the amplifier gain be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna, cable and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the Automatic Mode of A.R.M.S. measurements, these considerations are automatically presented as a part of the printout. In the case of manual measurements and for greater efficiency and convenience, usage of the calibration correction factors in the Appendices is necessary to calculate the Corrected Meter Reading. These correlation factors for each meter reading, shall be modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the “Corrected Meter Reading Limit” (CML).

The equation shall be derived in the following manner:

$$\text{Corrected Meter Reading} = \text{Meter Reading} + F + C - G - D$$

Where, F = Antenna Factor

C = Cable Factor

G = Amplifier Gain

D = Distance Factor

Therefore, the equation for determining the Corrected Meter Reading Limit (CML) is:

$$\text{CML} = \text{Specification Limit} - F - C + G + D$$

For the manual mode of measurement, a table of corrected meter reading limits shall be used to permit immediate comparison of the meter reading to determine if the measured emission amplitude exceeded the specification limit at that specific frequency. There shall be two calculation sheets done, one for three meter and one for ten-meter measurement distances, where applicable. The correction factors for the antenna and the amplifier gain are attached in the Appendices.



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6.0 Sample Calculations (Continued)

Peak Transmit Power Output:

A correction factor for the cable must be applied to the Conducted Power before a true power reading can be obtained. This is referred to as the “Corrected Power” (CP).

The equation shall be derived in the following manner:

$$\text{Corrected Power Reading} = \text{Conducted Power Reading} + C$$

Where, C = Cable Factor

The conducted power is taken in units of dBm. To obtain units of mW the following equation is used:

$$\text{mW} = 10^{(\text{dBm}/10)}$$



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7.0 MODIFICATIONS AND RECOMMENDATIONS

No modifications were made to the EUT.

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APPENDIX A

TEST DATA

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AC POWER LINE CONDUCTED EMISSIONS TEST RESULTS

CLIENT:	Lantronix, Inc.	DATE:	05/21/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324-03
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	1
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	12 C
		HUMIDITY:	55% RH
		TIME:	1:00 PM

Standard:	FCC CFR 47, Part 15.207
Description:	AC Power Line Conducted Emissions
Results:	Passes the conducted limits

Conducted Limits		
Frequency (MHz)	Quasi-Peak Limit (dBuV)	Average Limit (dBuV)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

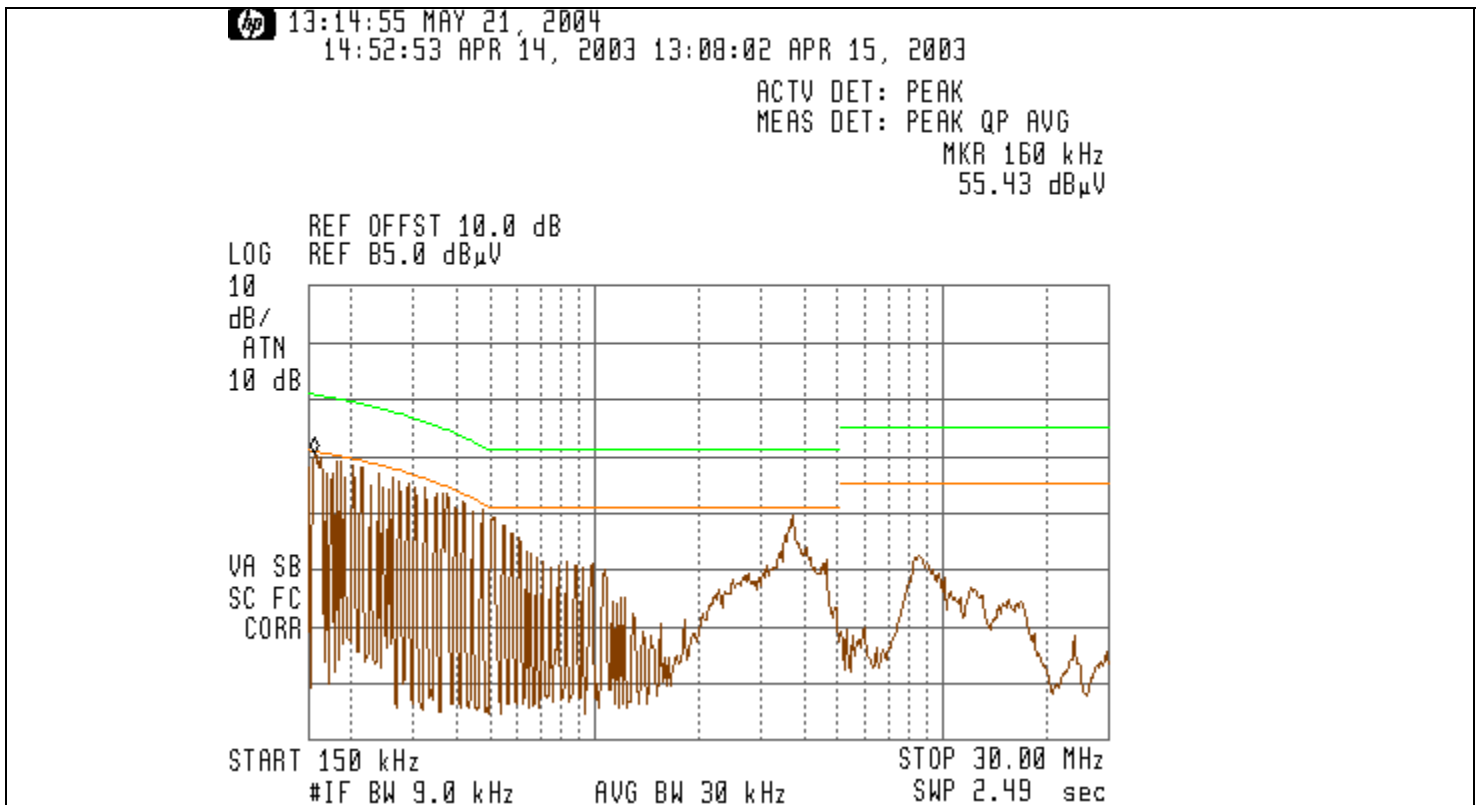
NOTE: During preliminary scans, there wasn't any difference which mode, channel, or data rate was used with the EUT; therefore only 802.11b mode at Channel 1 with a data rate of 1 Mbps was used for final testing. Also, the scan was only done on the WBX2100E model.

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AC Power Line Conducted Emissions Test Results (Continued)

CONDUCTED EMISSIONS – LINE 1						
Freq. (MHz)	Meter Reading (dBuV)	Detector (PK/QP/AV)	Average Limit (dBuV)	Average Delta(dB)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta(dB)
0.1500	18.28	AV	56.00	-37.72	66.00	-47.72
0.1600	18.17	AV	55.71	-37.54	65.71	-47.54
0.1700	18.15	AV	55.43	-37.28	65.43	-47.28
0.1800	16.54	AV	55.14	-38.60	65.14	-48.60
0.2000	17.96	AV	54.57	-36.61	64.57	-46.61
0.2100	17.16	AV	54.29	-37.13	64.29	-47.13

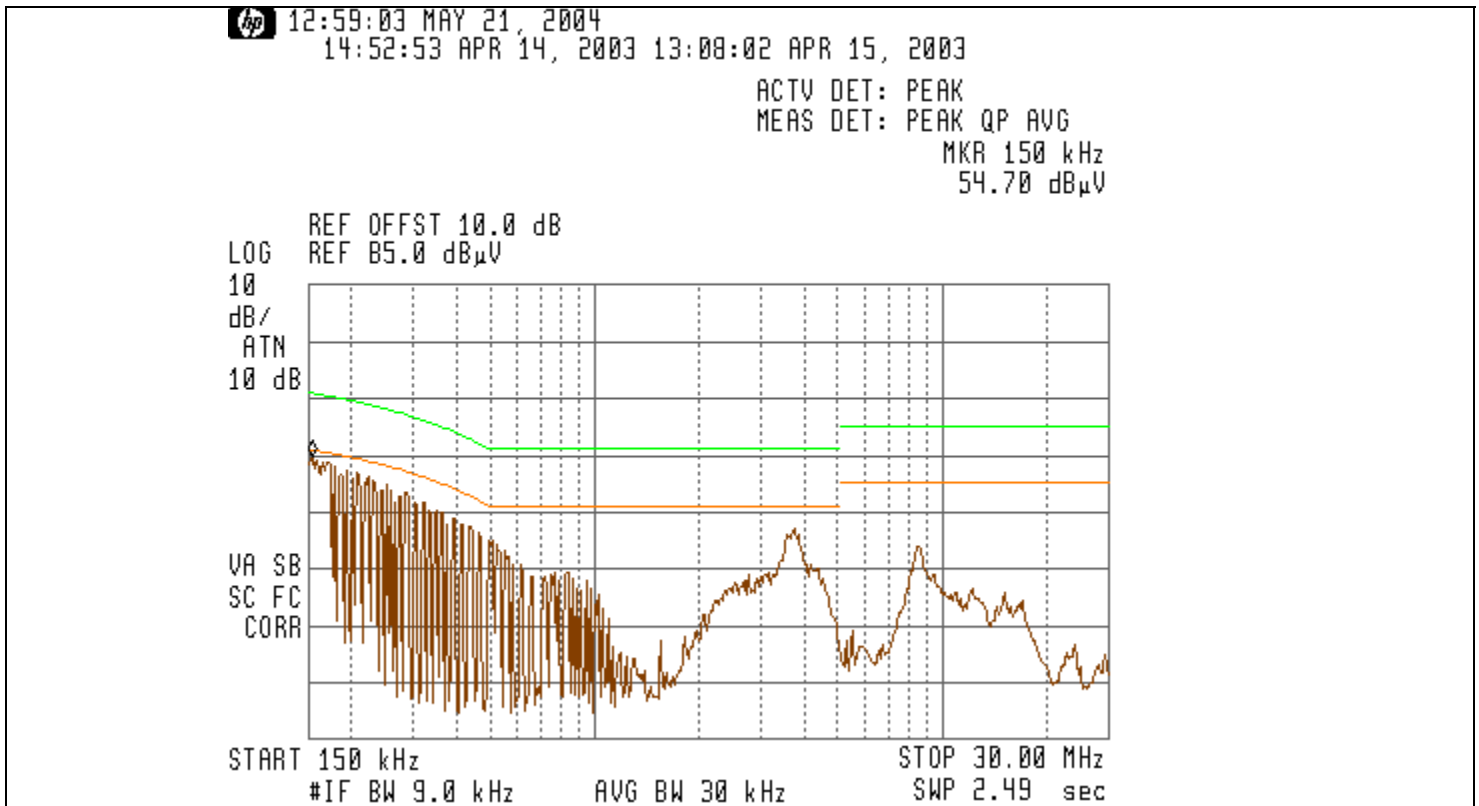




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AC Power Line Conducted Emissions Test Results (Continued)

CONDUCTED EMISSIONS - LINE 2						
Freq. (MHz)	Meter Reading (dBuV)	Detector (PK/QP/AV)	Average Limit (dBuV)	Average Delta(dB)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta(dB)
0.1500	17.00	AV	56.00	-39.00	66.00	-49.00
0.1800	15.73	AV	55.14	-39.41	65.14	-49.41
0.1900	17.35	AV	54.86	-37.51	64.86	-47.51
0.2000	17.71	AV	54.57	-36.86	64.57	-46.86
0.2100	16.36	AV	54.29	-37.93	64.29	-47.93
0.2300	14.80	AV	53.71	-38.91	63.71	-48.91



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SPURIOUS RADIATED EMISSIONS TEST RESULTS

CLIENT:	Lantronix, Inc.	DATE:	05/18/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324-01
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	2
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	12 C
		HUMIDITY:	50% RH
		TIME:	10:00 AM

Standard:	FCC Pt. 15.209
Description:	Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Sec. 15.209.
Results:	Passes the radiated limits

Radiated Limits	
Frequency (MHz)	Quasi-Peak Limit (dBuV)
30-88	40
88-216	43.52
216-960	46.02
960-1000	54

NOTE: During preliminary scans, there wasn't any difference which mode, channel, or data rate was used with the EUT; therefore only 802.11b mode at Channel 1 with a data rate of 1 Mbps was used for final testing. Also, the scan was only done on the WBX2100E model.

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Spurious Radiated Emissions Test Results (Continued)

RADIATED EMISSIONS - Horizontal Antenna Polarization												
Freq. (MHz)	Meter Reading (dBuV)	Antenna Height (cm)	Azimuth (degrees)	Quasi pk or AVG (dBuV)			Cable Factor (dB)	Ant. Factor (dB)	10 Meter Distance Factor (dB)	Corrected Reading (dBuV)	Limits (dBuV)	Diff (dB) +=FAIL
179.97	7.88	400	225				2.30	16.40	10.46	37.04	43.50	-6.46
209.97	9.87	400	180				2.48	17.16	10.46	39.97	43.50	-3.53
250.01	12.22	400	135				2.70	17.70	10.46	43.08	46.00	-2.92
314.56	6.96	400	0				3.09	14.30	10.46	27.85	46.00	-18.15
352.00	11.82	300	270				3.31	15.19	10.46	28.96	46.00	-17.04
374.98	3.96	300	270				3.40	15.05	10.46	32.87	46.00	-13.13
399.96	9.54	250	270				3.50	15.20	10.46	38.70	46.00	-7.30
499.99	7.42	250	270				4.00	18.80	10.46	40.68	46.00	-5.32

NOTE: The measurements were taken at 10 meters and extrapolated to 3 meters.

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Spurious Radiated Emissions Test Results (Continued)

RADIATED EMISSIONS - Vertical Antenna Polarization

Freq. (MHz)	Meter Reading (dBuV)	Antenna Height (cm)	Azimuth (degrees)	Quasi pk or AVG (dBuV)		Cable Factor (dB)	Ant. Factor (dB)	10 Meter Distance Factor (dB)	Corrected Reading (dBuV)	Limits (dBuV)	Diff (dB) +=FAIL
52.61	14.32	100	180			1.13	10.40	10.46	36.31	40.00	-3.69
61.78	21.08	100	0	16.83	Q	1.24	8.34	10.46	36.87	40.00	-3.13
176.00	10.58	100	0			2.28	15.64	10.46	38.96	43.50	-4.54
249.99	13.11	100	0			2.70	19.10	10.46	32.26	46.00	-13.74
314.56	8.68	100	0			3.09	14.88	10.46	28.42	46.00	-17.58
351.99	11.04	100	315			3.31	15.39	10.46	40.20	46.00	-5.80
374.99	10.77	100	90			3.40	15.30	10.46	39.93	46.00	-6.07
499.98	10.30	100	90			4.00	18.70	10.46	43.46	46.00	-2.54
625.01	8.85	100	90			4.55	19.95	10.46	43.81	46.00	-2.19

NOTE: The measurements were taken at 10 meters and extrapolated to 3 meters.

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Report Number: LANTR-040324F
FCC ID: R68WIBOX



AEGIS LABS INC.

Spurious Radiated Emissions Test Results (Continued)

CLIENT:	Lantronix, Inc.	DATE:	06/08/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	2
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	20 C
		HUMIDITY:	54% RH
		TIME:	10:30 AM

Standard:	FCC CFR 47, Part 15.247(c)
Description:	Radiated emissions, which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a). All others must be < -20dBc.
Results:	Passes (See Data Sheets)

Unwanted Spurious Emissions Limits			
Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m) (Emissions in the restricted bands)	Field Strength (dBm/MHz) (Emissions outside the restricted bands)
Above 960	500	54.00 (Average) 74.00 (Peak)	< -20 dBc

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Report Number: LANTR-040324F
FCC ID: R68WIBOX



Spurious Radiated Emissions Test Results (Continued)

*Fundamental Measurements in 802.11b mode (2400-2483.5 MHz)
Channels 1, 6, & 11
Continuous TX at MAIN Antenna port with Wanshih Antennas
Aegis Labs, Inc. File #: LANTR-040324-11*

RADIATED EMISSIONS - Horizontal Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
2412.00	66.17	100	135				2.29	29.22	97.69		
2412.00				62.99	A		2.29	29.22	94.51		
2437.00	65.67	100	135				2.30	29.27	97.25		
2437.00				62.17	A		2.30	29.27	93.75		
2462.00	67.00	100	225				2.31	29.32	98.64		
2462.00				63.86	A		2.31	29.32	95.50		

RADIATED EMISSIONS – Vertical Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
2412.00	71.67	100	180				2.29	29.42	103.39		
2412.00				69.36	A		2.29	29.42	101.08		
2437.00	73.00	100	180				2.30	29.47	104.78		
2437.00				70.10	A		2.30	29.47	101.88		
2462.00	72.50	100	0				2.31	29.52	104.34		
2462.00				69.18	A		2.31	29.52	101.02		



AEGIS LABS INC.

Spurious Radiated Emissions Test Results (Continued)

Band Edge Field Strength Measurements in 802.11b mode (2400-2483.5 MHz)
Channels 1, 6, & 11
Continuous TX at MAIN Antenna port with Wanshih Antennas
Aegis Labs, Inc. File #: LANTR-040324-11

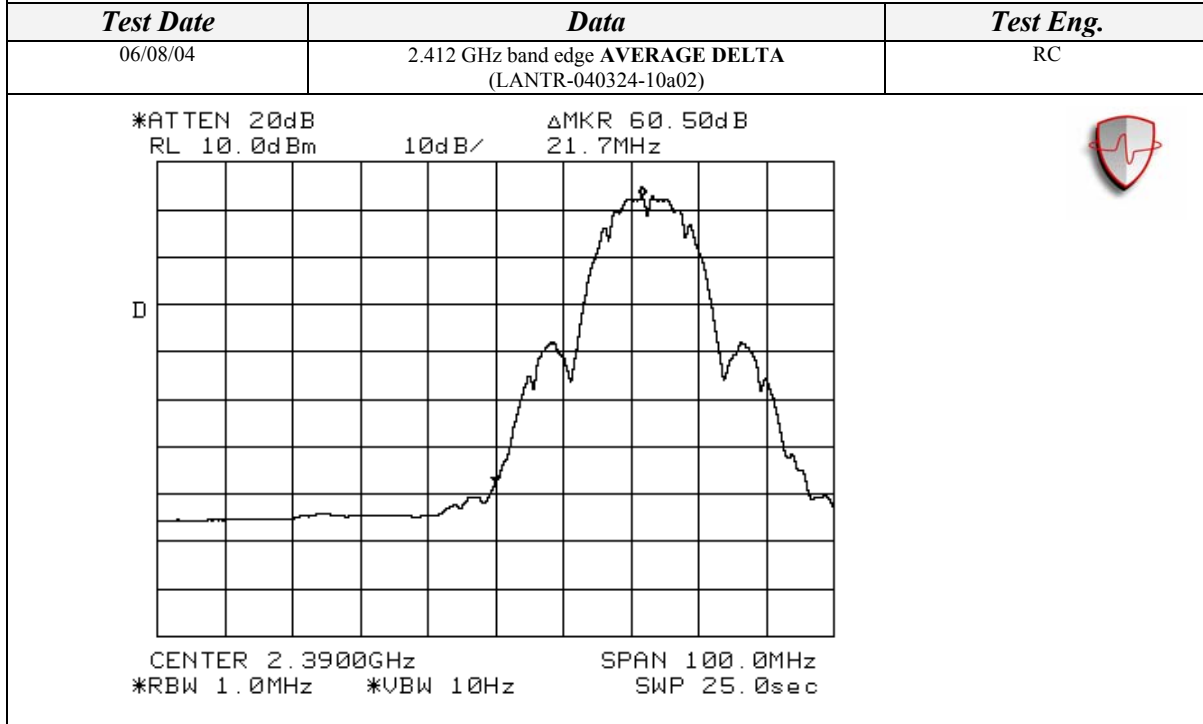
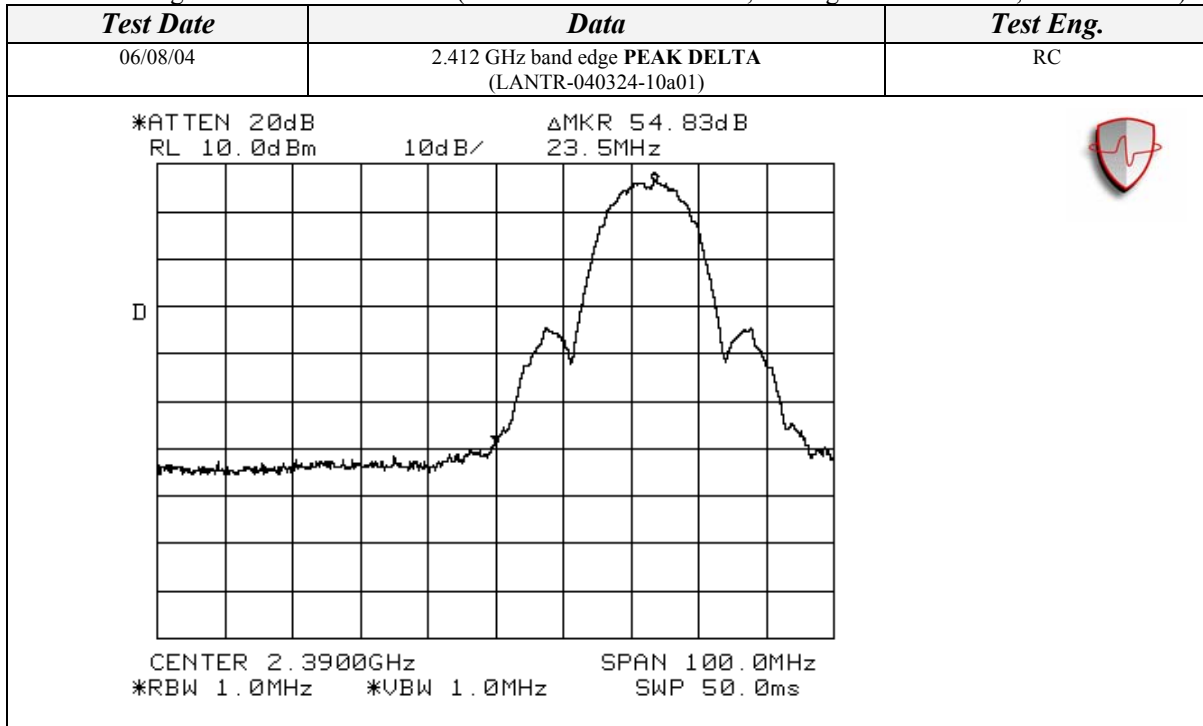
RADIATED EMISSIONS - Horizontal Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
2390.00									42.86	74.00	-31.14
2390.00									34.01	54.00	-19.99
2400.00	38.50	100	135				2.29	29.20	69.99	77.69	-7.70
2483.50									46.31	74.00	-27.69
2483.50									39.50	54.00	-14.50

RADIATED EMISSIONS – Vertical Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
2390.00									48.56	74.00	-25.44
2390.00									40.58	54.00	-13.42
2400.00	43.00	100	180				2.29	29.40	74.69	83.39	-8.70
2483.50									52.01	74.00	-21.99
2483.50									45.02	54.00	-8.98



Spurious Radiated Emissions Test Results (Continued)

Plots Showing Out-Of-Band Emissions (Peak RBW=VBW=1MHz; Average RBW = 1MHz, VBW = 10Hz)

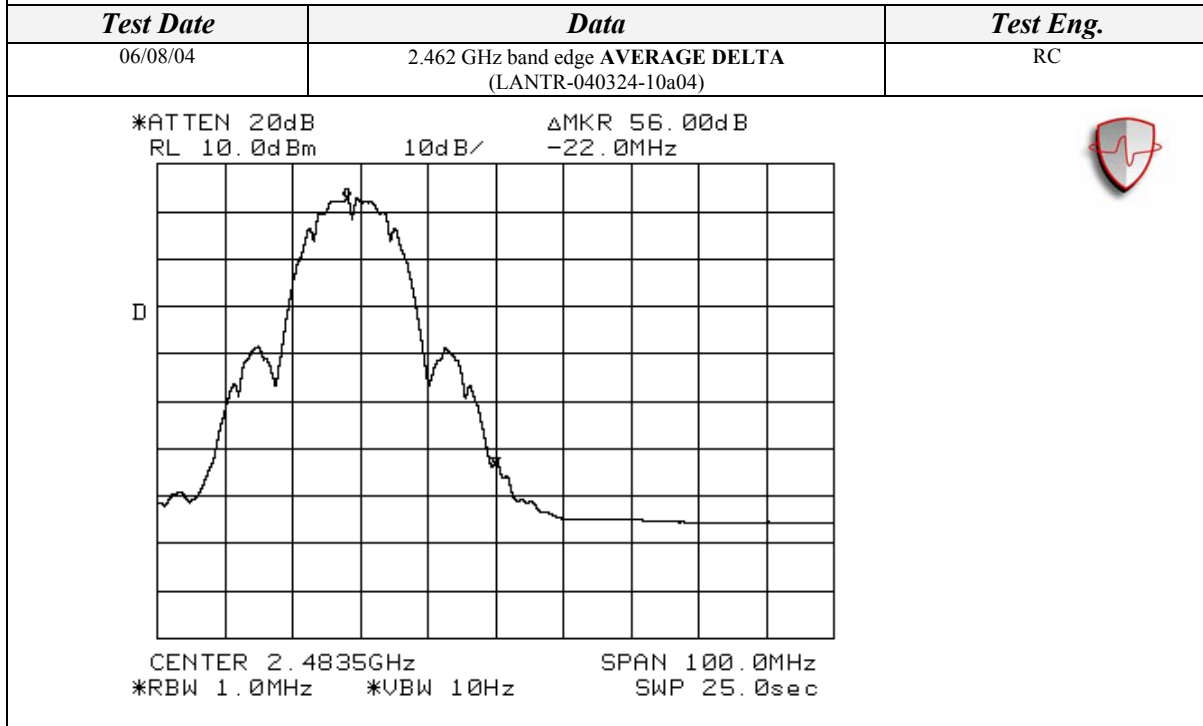
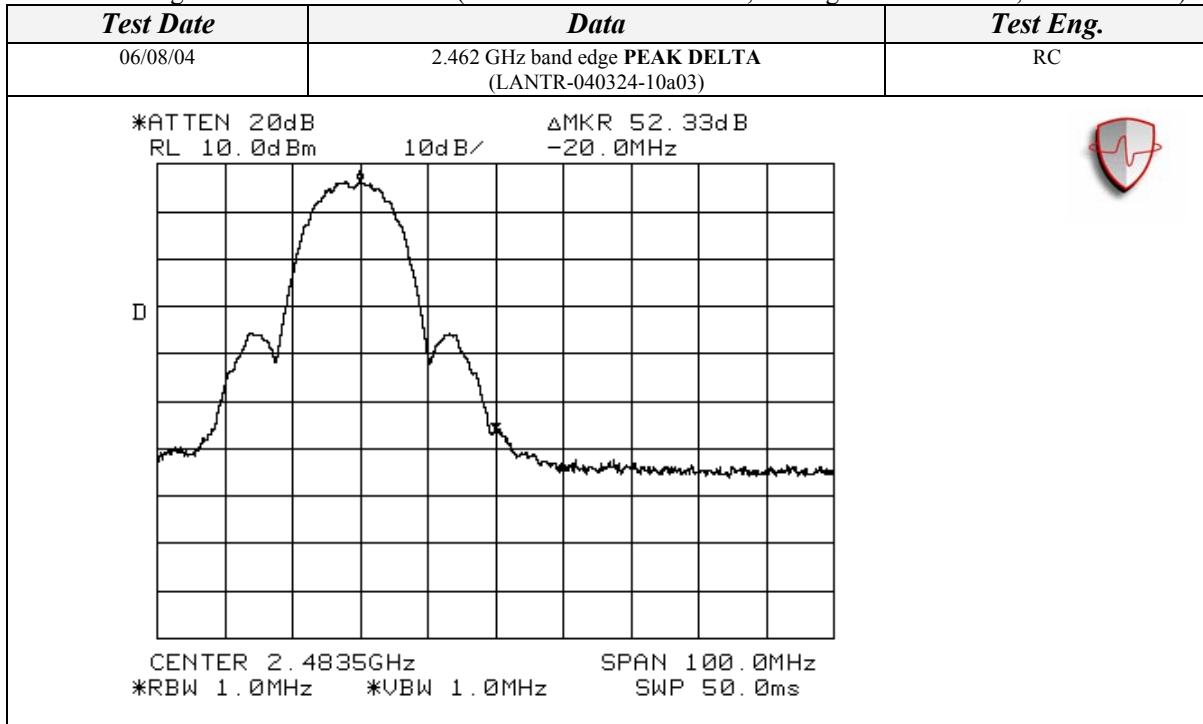


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Report Number: LANTR-040324F
FCC ID: R68WIBOX



Spurious Radiated Emissions Test Results (Continued)

Plots Showing Out-Of-Band Emissions (Peak RBW=VBW=1MHz; Average RBW = 1MHz, VBW = 10Hz)





Spurious Radiated Emissions Test Results (Continued)

*Spurious Emissions Measurements in 802.11b mode (2400-2483.5 MHz)
Channels 1, 6, & 11
Continuous TX at MAIN Antenna port with Wansih Antennas
Aegis Labs, Inc. File #: LANTR-040324-12*

RADIATED EMISSIONS - Horizontal Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
EUT in Continuous Transmit Mode on Channel 1 (2.412 GHz)											
1000.01	50.67	100	135			38.73	1.45	24.90	38.29	74.00	-35.71
1000.01				41.17	A	38.73	1.45	24.90	28.79	54.00	-25.21
1056.09	47.83	100	135			38.53	1.50	25.10	35.90	74.00	-38.10
1056.09				39.67	A	38.53	1.50	25.10	27.74	54.00	-26.26
4824.00	45.00	100	180			36.60	3.30	34.10	45.80	74.00	-28.20
4824.00				32.17	A	36.60	3.30	34.10	32.97	54.00	-21.03
EUT in Continuous Transmit Mode on Channel 6 (2.437 GHz)											
1000.37	50.50	100	225			38.73	1.45	24.90	38.12	74.00	-35.88
1000.37				40.17	A	38.73	1.45	24.90	27.79	54.00	-26.21
1055.97	48.50	100	225			38.53	1.50	25.10	36.57	74.00	-37.43
1055.97				38.50	A	38.53	1.50	25.10	26.57	54.00	-27.43
4873.99	44.67	100	180			36.59	3.32	34.27	45.67	74.00	-28.33
4873.99				31.50	A	36.59	3.32	34.27	32.50	54.00	-21.50
EUT in Continuous Transmit Mode on Channel 11 (2.462 GHz)											
1000.00	52.00	100	135			38.73	1.45	24.90	39.62	74.00	-34.38
1000.00				42.75	A	38.73	1.45	24.90	30.37	54.00	-23.63
1056.20	49.83	100	135			38.53	1.50	25.10	37.90	74.00	-36.10
1056.20				39.29	A	38.53	1.50	25.10	27.36	54.00	-26.64
4924.00	44.33	100	180			36.58	3.34	34.44	45.53	74.00	-28.47
4924.00				32.46	A	36.58	3.34	34.44	33.66	54.00	-20.34



Spurious Radiated Emissions Test Results (Continued)

RADIATED EMISSIONS - Vertical Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
EUT in Continuous Transmit Mode on Channel 1 (2.412 GHz)											
1000.10	51.00	100	180			38.73	1.45	25.00	38.72	74.00	-35.28
1000.10				41.83	A	38.73	1.45	25.00	29.55	54.00	-24.45
1055.97	46.00	100	180			38.53	1.50	25.19	34.16	74.00	-39.84
1055.97				36.67	A	38.53	1.50	25.19	24.83	54.00	-29.17
4823.96	46.83	100	135			36.60	3.30	34.07	47.60	74.00	-26.40
4823.96				36.17	A	36.60	3.30	34.07	36.94	54.00	-17.06
EUT in Continuous Transmit Mode on Channel 6 (2.437 GHz)											
1000.17	49.67	100	180			38.73	1.45	25.00	37.39	74.00	-36.61
1000.17				41.17	A	38.73	1.45	25.00	28.89	54.00	-25.11
1056.02	48.00	100	45			38.53	1.50	25.19	36.16	74.00	-37.84
1056.02				38.17	A	38.53	1.50	25.19	26.33	54.00	-27.67
4874.01	45.67	100	180			36.59	3.32	34.22	46.62	74.00	-27.38
4874.01				33.50	A	36.59	3.32	34.22	34.45	54.00	-19.55
EUT in Continuous Transmit Mode on Channel 11 (2.462 GHz)											
1000.30	50.33	100	180			38.73	1.45	25.00	38.05	74.00	-35.95
1000.30				41.50	A	38.73	1.45	25.00	29.22	54.00	-24.78
1056.10	49.67	100	225			38.53	1.50	25.19	37.83	74.00	-36.17
1056.10				38.67	A	38.53	1.50	25.19	26.83	54.00	-27.17
4924.00	45.50	100	180			36.58	3.34	34.37	46.63	74.00	-27.37
4924.00				33.00	A	36.58	3.34	34.37	34.13	54.00	-19.87



Spurious Radiated Emissions Test Results (Continued)

*Spurious Emissions Measurements in 802.11b mode (2400-2483.5 MHz)
 Channels 1, 6, & 11
 Continuous RX at MAIN Antenna port with Wanshih Antennas
 Aegis Labs, Inc. File #: LANTR-040324-12*

RADIATED EMISSIONS - Horizontal Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
EUT in Continuous Receive Mode on Channel 1 (2.412 GHz)											
1000.65	50.33	100	225			38.73	1.45	24.90	37.96	80.00	-42.04
1000.65				40.50	A	38.73	1.45	24.90	28.13	60.00	-31.87
1056.00	51.00	100	135			38.53	1.50	25.10	39.07	80.00	-40.93
1056.00				38.17	A	38.53	1.50	25.10	26.24	60.00	-33.76
4824.00	44.83	100	135			36.60	3.30	34.10	45.63	80.00	-34.37
4824.00				32.00	A	36.60	3.30	34.10	32.80	60.00	-27.20
EUT in Continuous Receive Mode on Channel 6 (2.437 GHz)											
1000.00	50.67	100	135			38.73	1.45	24.90	38.29	80.00	-41.71
1000.00				40.67	A	38.73	1.45	24.90	28.29	60.00	-31.71
1056.04	48.67	100	225			38.53	1.50	25.10	36.74	80.00	-43.26
1056.04				38.00	A	38.53	1.50	25.10	26.07	60.00	-33.93
4873.79	44.50	100	225			36.59	3.32	34.27	45.50	80.00	-34.50
4873.79				31.67	A	36.59	3.32	34.27	32.67	60.00	-27.33
EUT in Continuous Receive Mode on Channel 11 (2.462 GHz)											
1000.00	50.17	100	135			38.73	1.45	24.90	37.79	80.00	-42.21
1000.00				40.33	A	38.73	1.45	24.90	27.95	60.00	-32.05
1055.96	49.67	100	225			38.53	1.50	25.10	37.74	80.00	-42.26
1055.96				38.17	A	38.53	1.50	25.10	26.24	60.00	-33.76
4924.00	44.67	100	180			36.58	3.34	34.44	45.87	80.00	-34.13
4924.00				31.67	A	36.58	3.34	34.44	32.87	60.00	-27.13



AEGIS LABS INC.

Spurious Radiated Emissions Test Results (Continued)

RADIATED EMISSIONS - Vertical Antenna Polarization											
<i>Freq. (MHz)</i>	<i>Meter Reading (dBuV)</i>	<i>Antenna Height (cm)</i>	<i>Azimuth (degrees)</i>	<i>Quasi pk or AVG (dBuV)</i>		<i>Preamp Factor (dB)</i>	<i>Cable Factor (dB)</i>	<i>Ant. Factor (dB)</i>	<i>Corrected Reading (dBuV)</i>	<i>Limits (dBuV)</i>	<i>Diff (dB) +=FAIL</i>
EUT in Continuous Receive Mode on Channel 1 (2.412 GHz)											
1000.26	50.33	100	180			38.73	1.45	25.00	38.05	80.00	-41.95
1000.26				42.17	A	38.73	1.45	25.00	29.89	60.00	-30.11
1056.04	48.83	100	225			38.53	1.50	25.19	36.99	80.00	-43.01
1056.04				37.17	A	38.53	1.50	25.19	25.33	60.00	-34.67
4824.00	45.50	100	135			36.60	3.30	34.07	46.27	80.00	-33.73
4824.00				33.17	A	36.60	3.30	34.07	33.94	60.00	-26.06
EUT in Continuous Receive Mode on Channel 6 (2.437 GHz)											
1000.22	51.67	100	225			38.73	1.45	25.00	39.39	80.00	-40.61
1000.22				43.17	A	38.73	1.45	25.00	30.89	60.00	-29.11
1056.12	48.67	100	225			38.53	1.50	25.19	36.83	80.00	-43.17
1056.12				37.50	A	38.53	1.50	25.19	25.66	60.00	-34.34
4874.07	44.83	100	180			36.59	3.32	34.22	45.78	80.00	-34.22
4874.07				32.83	A	36.59	3.32	34.22	33.78	60.00	-26.22
EUT in Continuous Receive Mode on Channel 11 (2.462 GHz)											
1000.16	51.50	100	225			38.73	1.45	25.00	39.22	80.00	-40.78
1000.16				43.17	A	38.73	1.45	25.00	30.89	60.00	-29.11
1056.04	49.67	100	225			38.53	1.50	25.19	37.83	80.00	-42.17
1056.04				37.17	A	38.53	1.50	25.19	25.33	60.00	-34.67
4924.00	45.67	100	180			36.58	3.34	34.37	46.80	80.00	-33.20
4924.00				33.33	A	36.58	3.34	34.37	34.46	60.00	-25.54



AEGIS LABS INC.

PEAK TRANSMIT POWER

CLIENT:	Lantronix, Inc.	DATE:	06/08/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324-09
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	2
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	23 C
		HUMIDITY:	48% RH
		TIME:	2:00 PM

Standard:	FCC CFR 47, Part 15.247(b)(1)
Description:	The maximum peak output power of the intentional radiator shall not exceed 1 watt.
Results:	See Data Sheet

Peak Transmit Power Limits	
Frequency (MHz)	Output Power (W)
2412-2462	1

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Report Number: LANTR-040324F
FCC ID: R68WIBOX



Peak Transmit Power (Continued)

Mode	Channel	Frequency (MHz)	Rate (Mbps)	Average Power (dBm)	Average Power (mW)	Peak Power (dBm)	Peak Power (mW)
802.11b	1	2412	1	14.05	25.41	16.44	44.06
802.11b	1	2412	5.5	14.13	25.88	15.98	39.63
802.11b	1	2412	11	14.15	26.00	16.50	44.67
802.11b	6	2437	1	13.76	23.77	16.23	41.98
802.11b	6	2437	5.5	13.83	24.15	15.70	37.15
802.11b	6	2437	11	13.85	24.27	16.25	42.17
802.11b	11	2462	1	13.84	24.21	16.27	42.36
802.11b	11	2462	5.5	13.82	24.10	15.69	37.07
802.11b	11	2462	11	13.83	24.15	16.22	41.88

NOTE: The output power measurement is conducted.



AEGIS LABS INC.

6 dB EMISSIONS BANDWIDTH

CLIENT:	Lantronix, Inc.	DATE:	06/08/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324-10
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	2
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	22 C
		HUMIDITY:	50% RH
		TIME:	2:30 PM

Standard:	FCC CFR 47, Part 15.247(a)(2)
Description:	The minimum 6 dB bandwidth shall be at least 500 kHz.
Results:	See Data Sheets

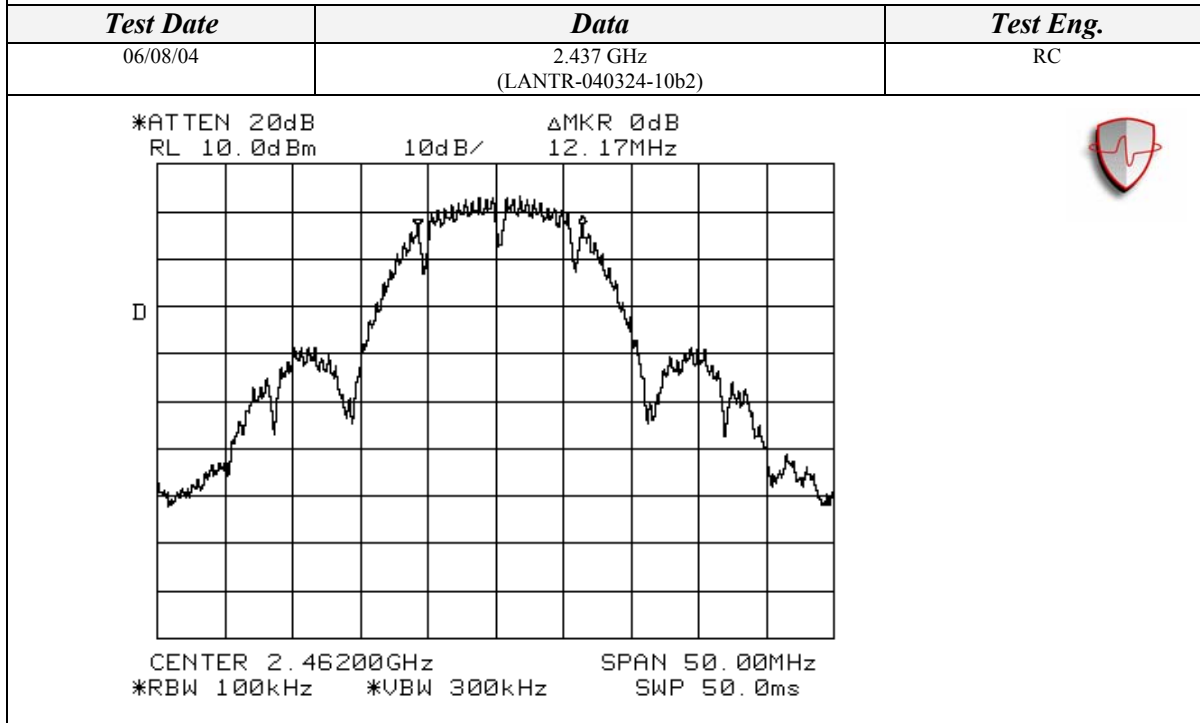
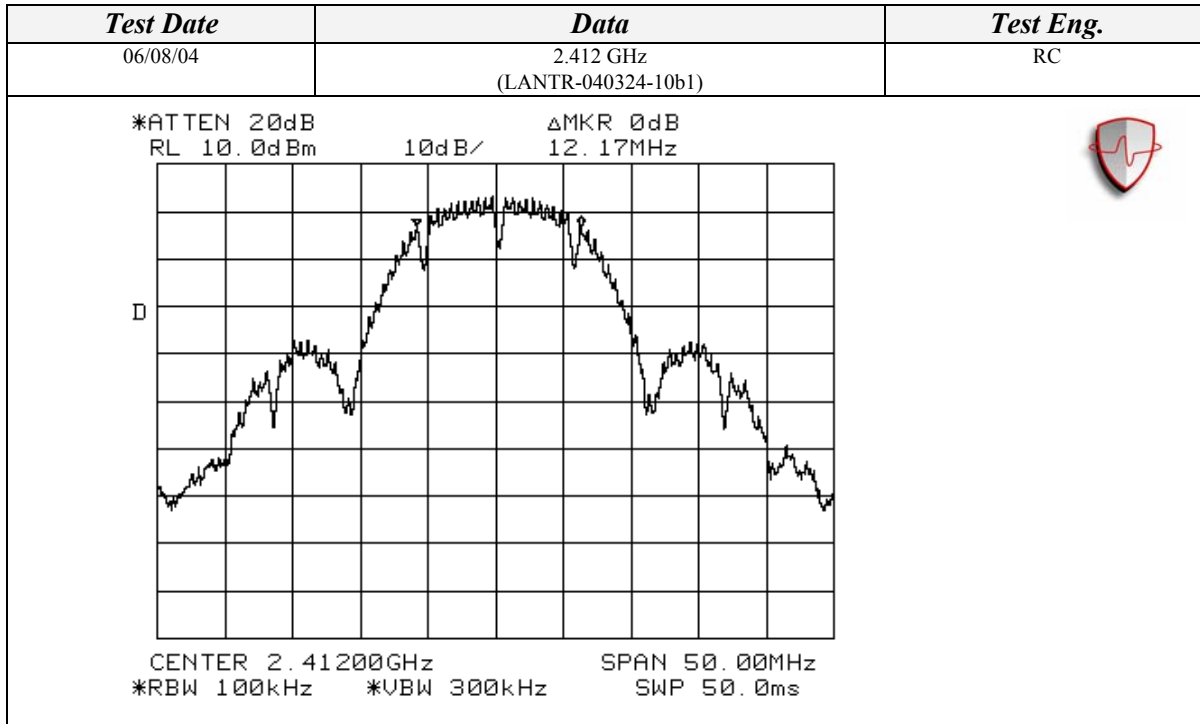
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Report Number: LANTR-040324F
FCC ID: R68WIBOX



AEGIS LABS INC.

6 dB Emissions Bandwidth (Continued)

802.11b Mode

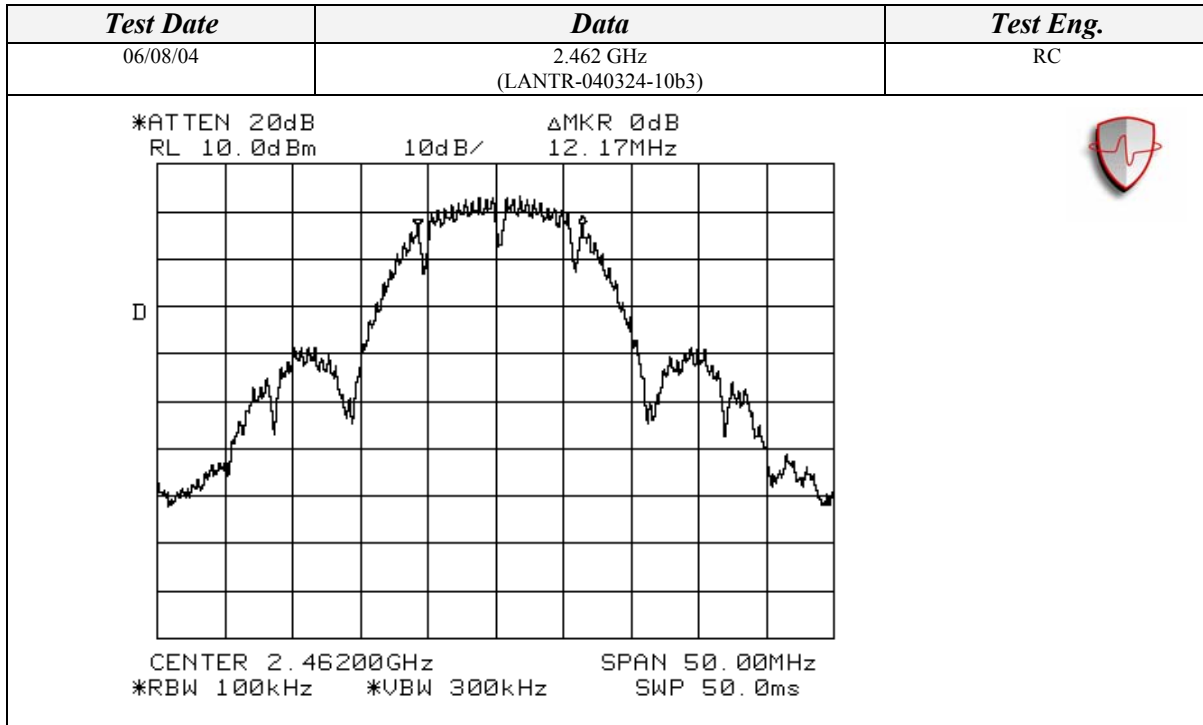




AEGIS LABS INC.

6 dB Emissions Bandwidth (Continued)

802.11b Mode





AEGIS LABS INC.

PEAK POWER SPECTRAL DENSITY

CLIENT:	Lantronix, Inc.	DATE:	06/08/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	2
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	22 C
		HUMIDITY:	50% RH
		TIME:	2:30 PM

Standard:	FCC CFR 47, Part 15.247(d)
Description:	The peak 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.
Results:	See Data Sheets

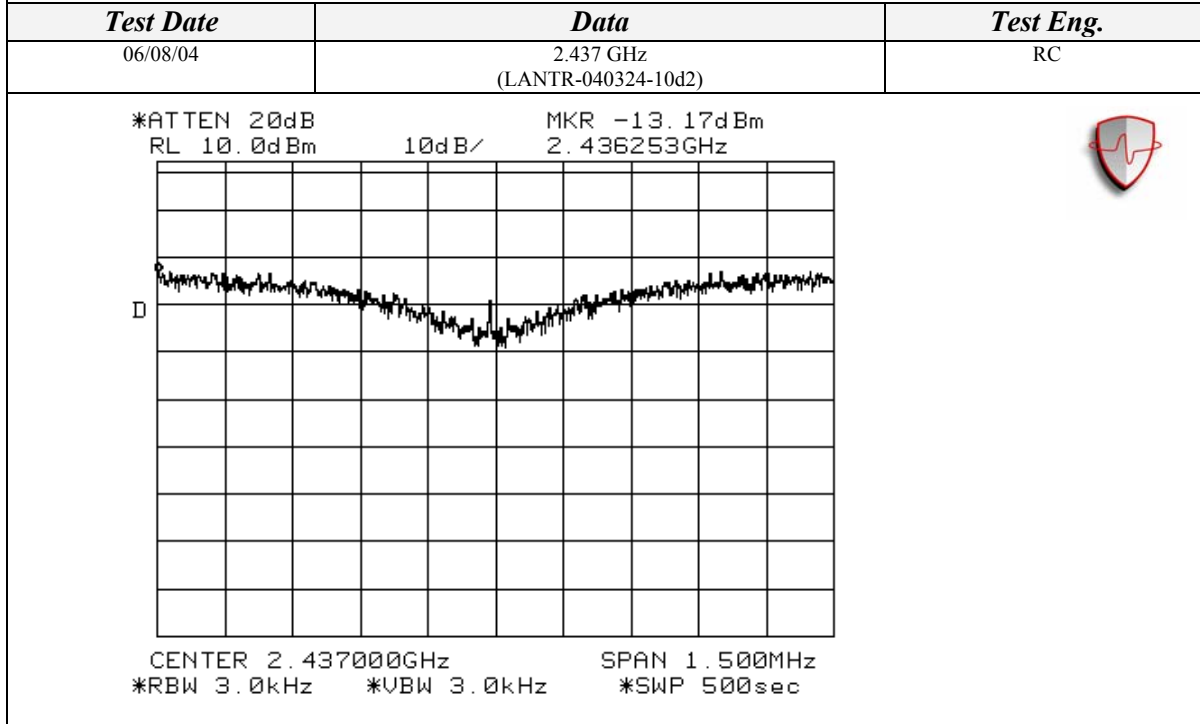
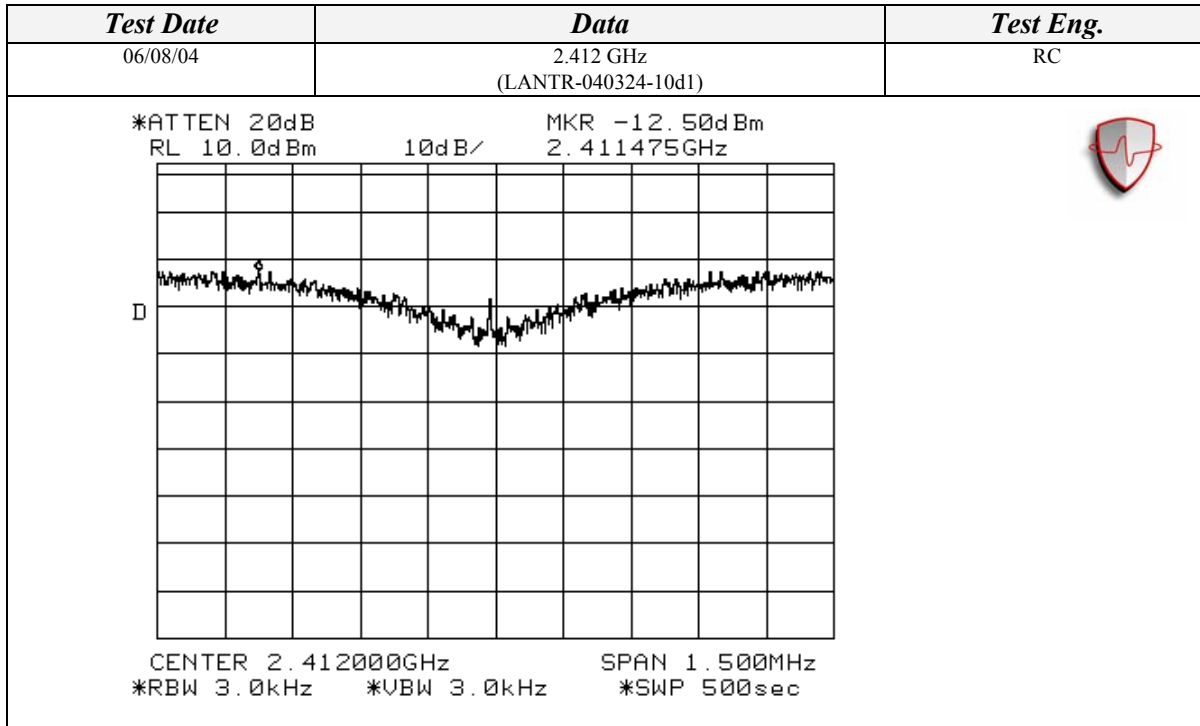
Peak Power Spectral Density Limits	
Frequency (MHz)	Limit (dBm)
2412-2462	8

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Report Number: LANTR-040324F
FCC ID: R68WIBOX



Peak Power Spectral Density (Continued)

802.11b Mode





AEGIS LABS INC.

CONDUCTED OUT OF BAND EMISSIONS

CLIENT:	Lantronix, Inc.	DATE:	06/08/04
EUT:	WiBox Serial to Wireless Server	PROJECT NUMBER:	LANTR-040324
MODEL NUMBER:	WBX2100E	TEST ENGINEER:	RC
SERIAL NUMBER:	None	SITE #:	2
CONFIGURATION:	Tested in wireless mode with the Wanshih Antenna.	TEMPERATURE:	22 C
		HUMIDITY:	50% RH
		TIME:	2:30 PM

Standard:	FCC CFR 47, Part 15.247(c)
Description:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

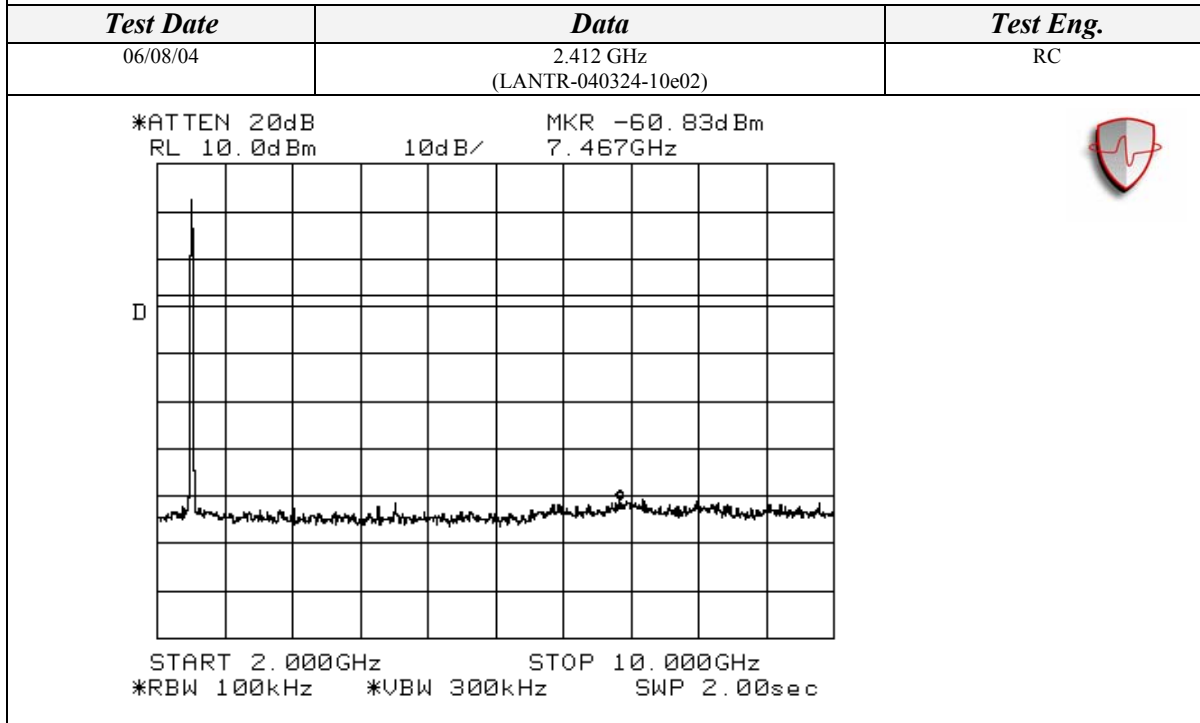
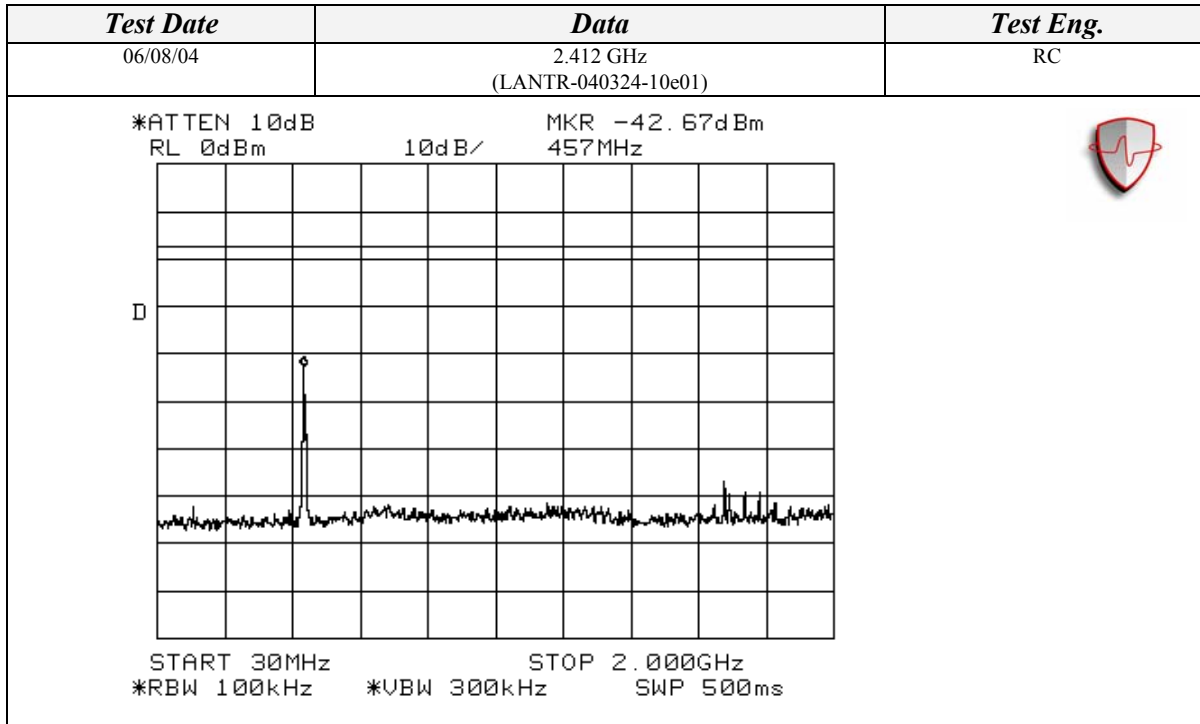
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Conducted Out Of Band Emissions (Continued)

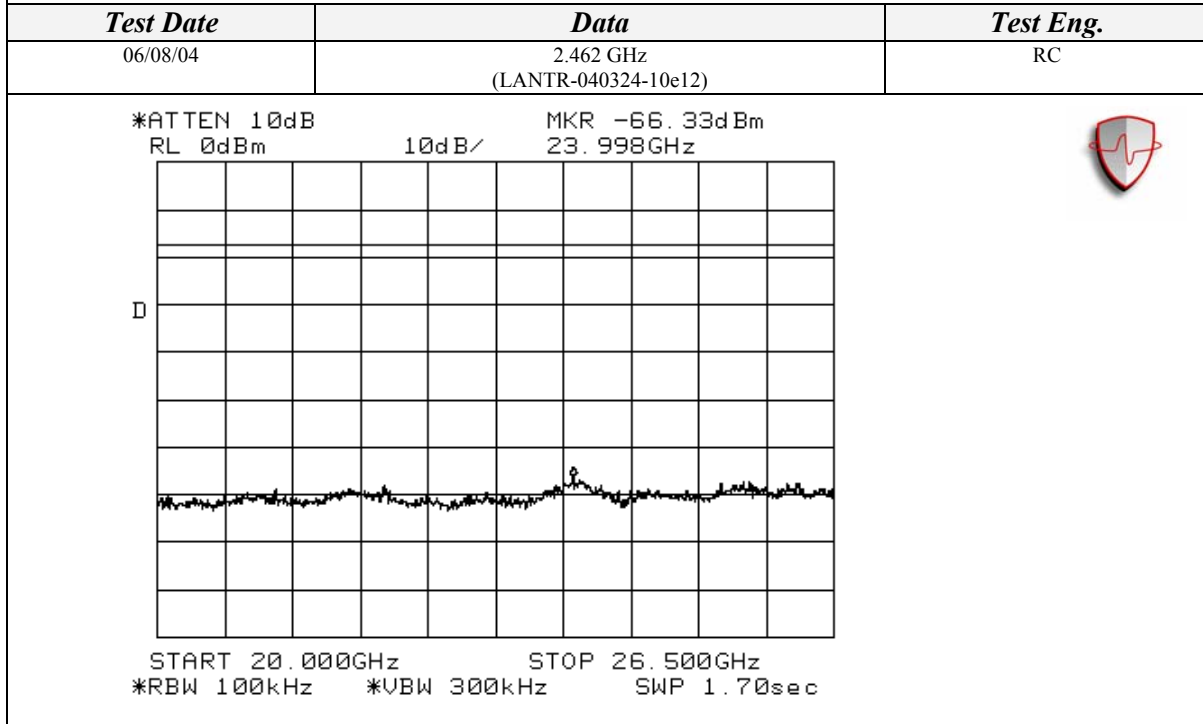
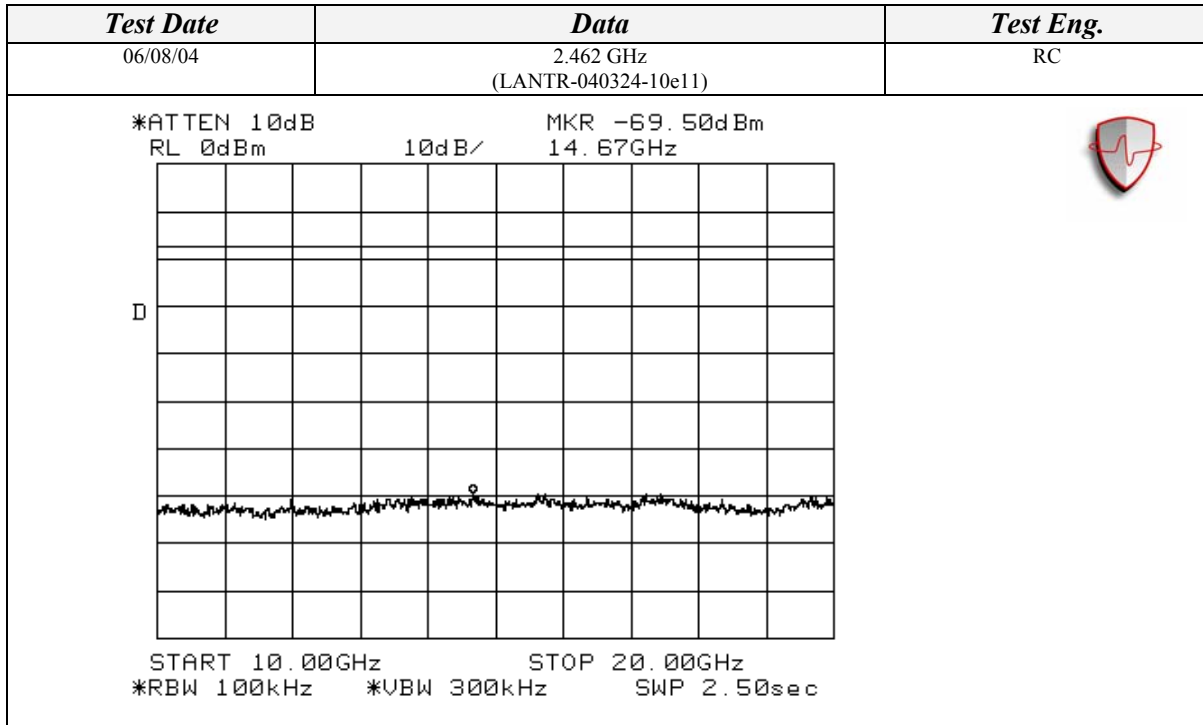
802.11b Mode





Conducted Out Of Band Emissions (Continued)

802.11b Mode





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APPENDIX B

ADDITIONAL MODELS CONSIDERED UNDER SIMILARITIES

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Additional Models Considered Under Similarities

Differences in components for the WBX2100E and WBX2100

WBX2100E (Note 1)	WBX2100 (Note 2)	Components	Ref. Designation	Functionality
Used	Not Used	RJ45 with Magnetic	J1	Ethernet Port
Used	Not Used	Resistor 147 ohm	R3	Ethernet Indicator
Used	Not Used	LED Green	D1	Ethernet Indicator

Note 1: Device tested. Has three more components than the WBX2100. The resistor is 147 ohm, smt, 0805, 1/8W. The LED is smt, 1206.

Note 2: Considered a lesser configuration.