

WirelessWERX, Inc.

TrakLITE C4-B

March 29, 2005

Report No. 7LAY0030 Rev 01

Report Prepared By



www.nwemc.com

1-888-EMI-CERT

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EMC Test Report

Certificate of Test
Issue Date: March 29, 2005
WirelessWERX, Inc.
Model: TrakLITE C4-B

		Emissions	
Specification	Test Method	Pass	Fail
FCC 15.247(a) Occupied Bandwidth:2004	ANSI C63.4:2003	☒	☐
FCC 15.247(b) Output Power:2004	ANSI C63.4:2003	☒	☐
FCC 15.247(d) Band Edge Compliance:2004	ANSI C63.4:2003	☒	☐
FCC 15.247(d) Spurious Conducted Emissions:2004	ANSI C63.4:2003	☒	☐
FCC 15.247(d) Spurious Radiated Emissions:2004 (Bluetooth only)	ANSI C63.4:2003	☒	☐
FCC 15.247(d) Spurious Radiated Emissions:2004 (Simultaneous Xmit)	ANSI C63.4:2003	☒	☐
FCC 15.247(e) Power Spectral Density:2004	ANSI C63.4:2003	☒	☐

Modifications made to the product

See the Modifications section of this report

Test Facility

- The measurement facility used to collect the data is located at:
Northwest EMC, Inc.; 41 Tesla, Irvine, CA 92618
Phone: (503) 844-4066 Fax: 844-3826
This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada.

Approved By:



Dean Ghizzone, President

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested, the specific description is noted in each of the individual sections of the test report supporting this certificate of test.

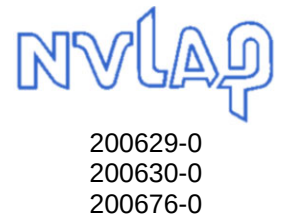
Revision Number	Description	Date	Page Number
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01	Separated and defined Spurious Radiated Emissions Bluetooth Only vs Simultaneous Transmit	6/27/05	52-64 and 65-75
01	Added details regarding Bluetooth Approvals	6/27/05	76
01	Revised Output Power test description	6/27/05	18

FCC: Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.



NVLAP: Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, and National Voluntary Laboratory Accreditation Program for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 89/336/EEC, ANSI C63.4, MIL-STD 461E, DO-160D and SAE J1113. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada.



Industry Canada: Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS 212, Issue 1 (Provisional) and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements.



CAB: Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement.



TÜV Product Service: Included in TÜV Product Service Group's Listing of Recognized Laboratories. It qualifies in connection with the TÜV Certification after Recognition of Agent's Testing Program for the product categories and/or standards shown in TÜV's current Listing of CARAT Laboratories, available from TÜV. A certificate was issued to represent that this laboratory continues to meet TÜV's CARAT Program requirements. Certificate No. USA0401C.



TÜV Rheinland: Authorized to carryout EMC tests by order and under supervision of TÜV Rheinland. This authorization is based on "Conditions for EMC-Subcontractors" of November 1992.



NEMKO: Assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).



Technology International: Assessed in accordance with ISO Guide 25 defining the general international requirements for the competence of calibration and testing laboratories and with ITI assessment criteria LACO196. Based upon that assessment, Interference Technology International, Ltd., has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC and amendments). The scope of the approval was provided on a Schedule of Assessment supplied with the certificate and is available upon request.



Australia/New Zealand: The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body (NVLAP).



VCCI: Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. (*Registration Numbers. - Hillsboro: C-1071 and R-1025, Irvine: C-2094 and R-1943, Newberg: C-1877 and R-1760, Sultan: R-871, C-1784 and R-1761*).



BSMI: Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement. License No.SL2-IN-E-1017.



GOST: Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification



SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/scope.asp>

What is measurement uncertainty?

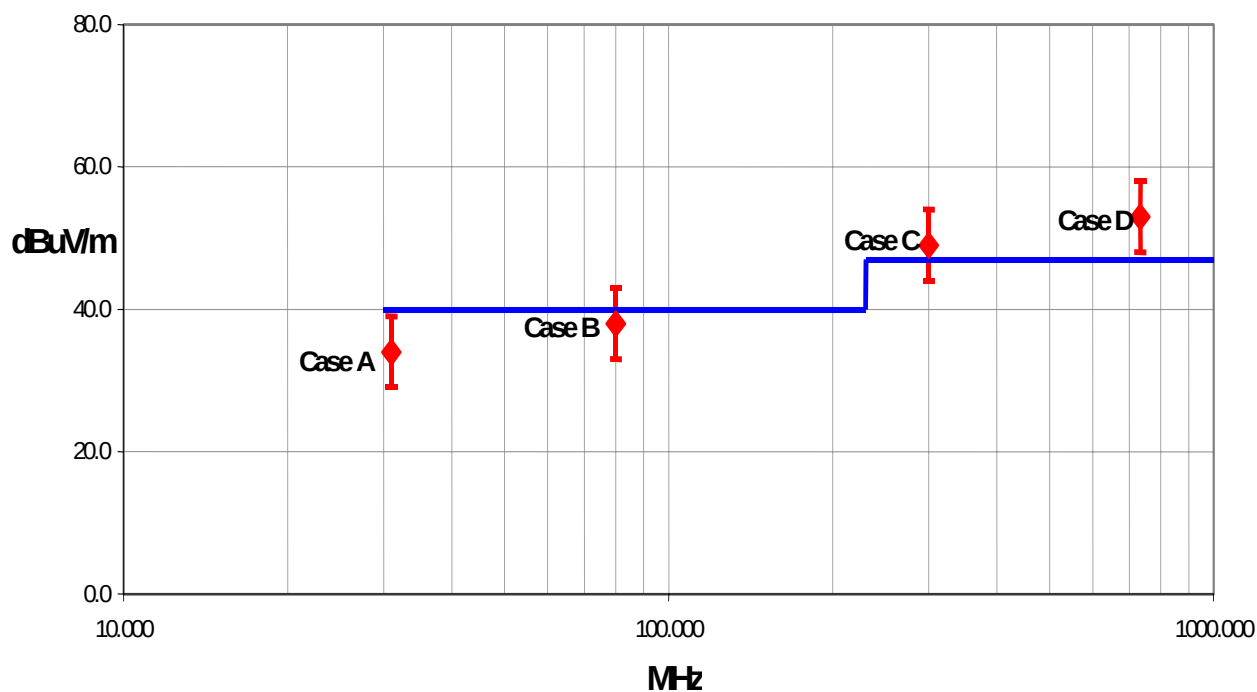
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following statement of measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" value. In the case of transient tests (ESD, EFT, Surge, Voltage Dips and Interruptions), the test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements.

The following documents were the basis for determining the uncertainty levels of our measurements:

- "ISO Guide to the Expression of Uncertainty in Measurements", October 1993
- "NIS81: The Treatment of Uncertainty in EMC Measurements", May 1994
- "IEC CISPR 16-3 A1 f1 Ed.1: Radio-interference measurements and statistical techniques", December 2000

How might measurement uncertainty be applied to test results?

If the diamond marks the measured value for the test and the vertical bars bracket the range of + and – measurement uncertainty, then test results can be interpreted from the diagram below.



Test Result Scenarios:

Case A: Product complies.

Case B: Product conditionally complies. It is not possible to say with 95% confidence that the product complies.

Case C: Product conditionally does not comply. It is not possible to say with 95% confidence that the product does not comply.

Case D: Product does not comply.

Radiated Emissions ≤ 1 GHz

Value (dB)

Test Distance	Probability Distribution	Biconical Antenna		Log Periodic Antenna		Dipole Antenna	
		3m	10m	3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.86 - 1.88	+ 1.82 - 1.87	+ 2.23 - 1.41	+ 1.29 - 1.26	+ 1.31 - 1.27	+ 1.25 - 1.25
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k=2)	+ 3.72 - 3.77	+ 3.64 - 3.73	+ 4.46 - 2.81	+ 2.59 - 2.52	+ 2.61 - 2.55	+ 2.49 - 2.49

Radiated Emissions > 1 GHz

Value (dB)

Test Distance	Probability Distribution	Without High Pass Filter		With High Pass Filter	
		3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.29 - 1.25	+ 1.29 - 1.25	+ 1.38 - 1.35	+ 1.38 - 1.35
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k=2)	+ 2.57 - 2.51	+ 2.57 - 2.51	+ 2.76 - 2.70	+ 2.76 - 2.70

Conducted Emissions

Test Distance	Probability Distribution	Value (+/- dB)
Combined standard uncertainty $u_c(y)$	normal	1.48
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k = 2)	2.97

Radiated Immunity

Test Distance	Probability Distribution	Value (+/- dB)
Combined standard uncertainty $u_c(y)$	normal	1.05
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k = 2)	2.11

Conducted Immunity

Test Distance	Probability Distribution	Value (+/- dB)
Combined standard uncertainty $u_c(y)$	normal	1.05
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k = 2)	2.10

Legend

$u_c(y)$ = square root of the sum of squares of the individual standard uncertainties

U = combined standard uncertainty multiplied by the coverage factor: k . This defines an interval about the measured result that will encompass the true value with a confidence level of approximately 95%. If a higher level of confidence is required, then $k=3$ (CL of 99.7%) can be used. Please note that with a coverage factor of one, $u_c(y)$ yields a confidence level of only 68%.

**California****Orange County Facility****Labs OC01 – OC13**

41 Tesla Ave.
Irvine, CA 92618
(888) 364-2378
FAX (503) 844-3826

**Oregon****Evergreen Facility****Labs EV01 – EV10**

22975 NW Evergreen Pkwy.
Suite 400
Hillsboro, OR 97124
(503) 844-4066
FAX (503) 844-3826

**Oregon****Trails End Facility****Labs TE01 – TE03**

30475 NE Trails End Lane
Newberg, OR 97132
(503) 844-4066
FAX (503) 537-0735

**Washington****Sultan Facility****Labs SU01 – SU07**

14128 339th Ave. SE
Sultan, WA 98294
(888) 364-2378
FAX (360) 793-2536

Party Requesting the Test

Company Name:	WirelessWERX, Inc.
Address:	9361 Irvine Blvd.
City, State, Zip:	Irvine, CA 92618
Test Requested By:	Dave Couchman
Model:	TrakLITE C4-B
First Date of Test:	03-01-2005
Last Date of Test:	03-25-2005
Receipt Date of Samples:	03-25-2005
Equipment Design Stage:	Production
Equipment Condition:	No visual damage.

Information Provided by the Party Requesting the Test

Clocks/Oscillators:	Not provided at the time of the test.
I/O Ports:	Serial, JTAG (factory use only), GSM Modem, GPS, Bluetooth, Vehicle Cable Harness

Functional Description of the EUT (Equipment Under Test):

Vehicle mounted radio with GSM modem, Bluetooth, and GPS capability. The TrakLITE is primarily intended for mounting on a mobile vehicle or cargo, and provides the means for remote positioning and communications on a global scale. The TrakLITE, when requested, can issue commands to a local system or cargo, receive and respond to requests for position and status, issue pre-programmed commands and status messages and log a combination of 4,500 position, velocity, and status records for subsequent download to a Control Center.

Client Justification for EUT Selection:

The product is a representative production sample.

Client Justification for Test Selection:

Tests required to demonstrate FCC Compliance

EUT Photo

Equipment modifications					
Item	Test	Date	Modification	Note	Disposition of EUT
1	Radiated Emissions	02/23/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
2	Spurious Radiated Emissions	02/23/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
3	Spurious Conducted Emissions	03/01/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
4	Occupied Bandwidth	03/01/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
5	Output Power	03/01/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
6	Band Edge Compliance	03/01/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
7	Power Spectral Density	03/01/2005	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

12 VDC.

Software\Firmware Applied During Test

Exercise software	Unknown	Version	Unknown
Description			
The system was tested using special firmware developed to test all functions of the device during the test. The firmware put the radio into a no-hop mode with a modulated carrier. Transmit channels were selectable between the lowest, a middle, and the highest channels in the operating band.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT - TrakLite	WirelessWERX, Inc.	TrakLITE C4-B	100057
10 Amp/13.8VDC Power Supply	RadioShack	CAT. No. 22-506	806977
GPS Antenna	LAIPAC Tech	GLP1	334087
GSM Antenna	Radiall/Larsen	MMC/P3ESMA	N/A

Remote Equipment Outside of Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
Computer	Gateway, Inc.	Micro ATX SAN Professional V800 PC	0023764268
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary.			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.3	No	TrakLITE	RadioShack Power Supply
I/O Leads	No	1.3	No	TrakLITE	Unterminated
Serial DB/9	No	3.0	No	TrakLITE	Gateway PC
SMA	No	0.7	No	TrakLITE	HP8593E Spectrum Analyzer
SMA	No	5.2	No	TrakLITE	GPS Antenna
SMA	No	3.7	No	TrakLITE	GSM Antenna
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/06/2004	13 mo

Test Description

Requirement: Per an FCC Interpretation # 20021209-001, "Bluetooth devices may apply under the rules in 15.247 as either a Digital Transmission System (DTS), a Frequency Hopping System (FHSS), or a Hybrid System whichever provides an advantage to the grantee as long as all the requirements are met... The hopping function (*of a hybrid*) must be a true hopping system, as described in Section 15.247(a)(1)."

As a DTS system, the minimum 6 dB bandwidth is 500 kHz.

As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation (see 47 CFR 15.247(a)(1)). For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz.

As a Hybrid, it must meet the FHSS requirement as described above.

Configuration: The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode.

Completed by:



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01
EUT: TrakLite		Work Order: 7LAY0030		
Serial Number: 100057		Date: 3/11/2005		
Customer: WirelessWERX, Inc.		Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH
Customer Ref. No.:		Power: 12VDC		Job Site: OC11
TEST SPECIFICATIONS				
Specification: 47 CFR 15.247(a)		Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003
SAMPLE CALCULATIONS				
COMMENTS				
Measured with a direct connection between the RF output and a spectrum analyzer.				
EUT OPERATING MODES				
Modulated at maximum data rate				
DEVIATIONS FROM TEST STANDARD				
None				
REQUIREMENTS				
Bluetooth can be authorized as either a Frequency Hopping System (FHSS), a Digital Transmission System (DTS), or a Hybrid System.				
As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation. For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz.				
As a DTS system, the minimum 6 dB bandwidth is 500 kHz. As a Hybrid, it must meet the FHSS requirement as described above.				
RESULTS		BANDWIDTH		
Pass		1.030 MHz		
SIGNATURE				
 Tested By: _____				
DESCRIPTION OF TEST				
20dB Bandwidth - Low Channel				



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite		Work Order: 7LAY0030			
Serial Number: 100057		Date: 3/11/2005			
Customer: WirelessWERX, Inc.		Temperature: 70 °F			
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.:		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(a)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
Measured with a direct connection between the RF output and a spectrum analyzer.					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Bluetooth can be authorized as either a Frequency Hopping System (FHSS), a Digital Transmission System (DTS), or a Hybrid System.					
As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation. For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz.					
As a DTS system, the minimum 6 dB bandwidth is 500 kHz. As a Hybrid, it must meet the FHSS requirement as described above.					
RESULTS		BANDWIDTH			
Pass		1.035 MHz			
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
20dB Bandwidth - Mid Channel					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite		Work Order: 7LAY0030			
Serial Number: 100057		Date: 3/11/2005			
Customer: WirelessWERX, Inc.		Temperature: 70 °F			
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.:		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(a)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
Measured with a direct connection between the RF output and a spectrum analyzer.					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Bluetooth can be authorized as either a Frequency Hopping System (FHSS), a Digital Transmission System (DTS), or a Hybrid System.					
As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation. For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz.					
As a DTS system, the minimum 6 dB bandwidth is 500 kHz. As a Hybrid, it must meet the FHSS requirement as described above.					
RESULTS		BANDWIDTH			
Pass		1.030 MHz			
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
20dB Bandwidth - High Channel					





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low

Mid

High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Power Input Settings Investigated:

12 VDC.

Software\Firmware Applied During Test

Exercise software	Unknown	Version	Unknown
Description			
The system was tested using special firmware developed to test all functions of the device during the test. The firmware put the radio into a no-hop mode with a modulated carrier. Transmit channels were selectable between the lowest, a middle, and the highest channels in the operating band.			

EUT and Peripherals

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GPS Antenna	LAIPAC Tech	GLP1	334087
GSM Antenna	Radiall/Larsen	MMC/P3ESMA	N/A

Remote Equipment Outside of Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
Computer	Gateway, Inc.	Micro ATX SAN Professional V800 PC	0023764268
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary.			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.3	No	TrakLITE	RadioShack Power Supply
I/O Leads	No	1.3	No	TrakLITE	Unterminated
Serial DB/9	No	3.0	No	TrakLITE	Gateway PC
SMA	No	0.7	No	TrakLITE	HP8593E Spectrum Analyzer
SMA	No	5.2	No	TrakLITE	GPS Antenna
SMA	No	3.7	No	TrakLITE	GSM Antenna
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/06/2004	13 mo

Test Description

Requirement: Per 47 CFR 15.247(b)(1), the maximum peak output power must not exceed 1 Watt. The measurement is made using a spectrum analyzer using the following settings:

- Resolution bandwidth set to greater than the 6 dB bandwidth of the modulated carrier, and
- The video bandwidth set to greater than or equal to the resolution bandwidth.

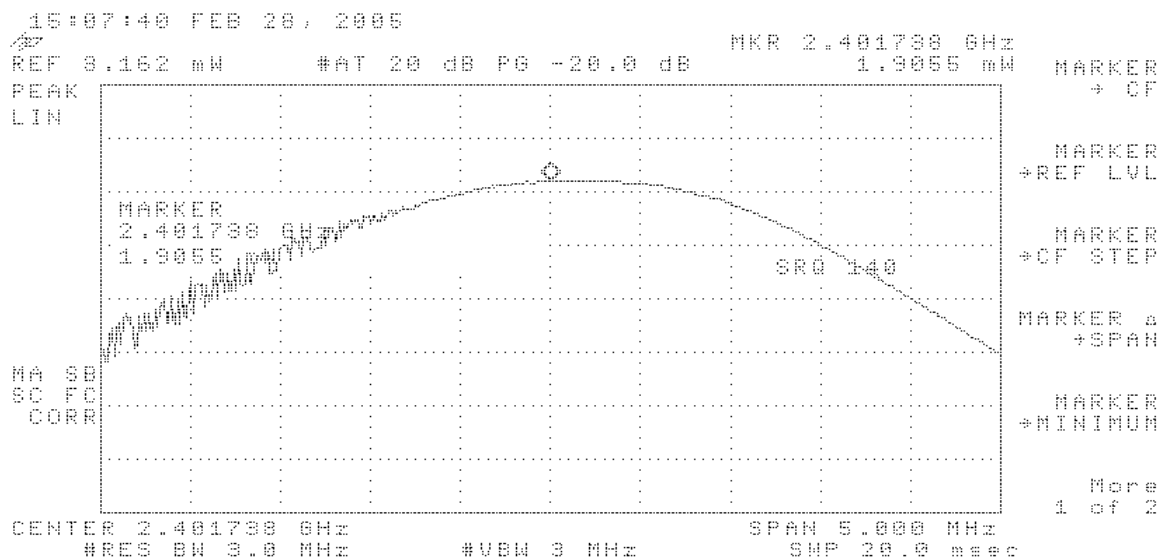
Configuration: The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

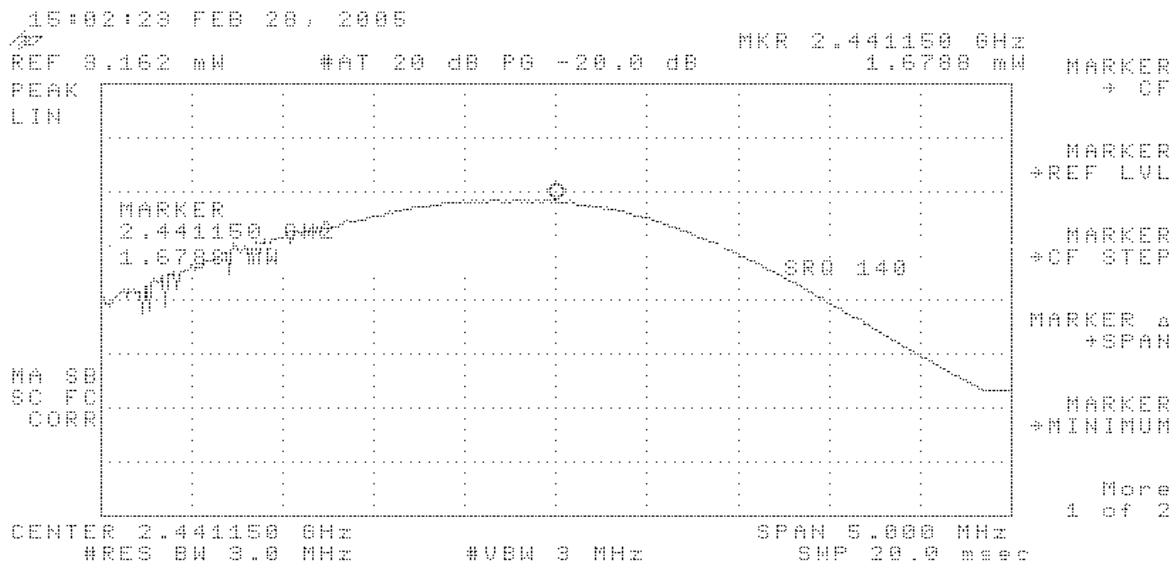
Completed by:



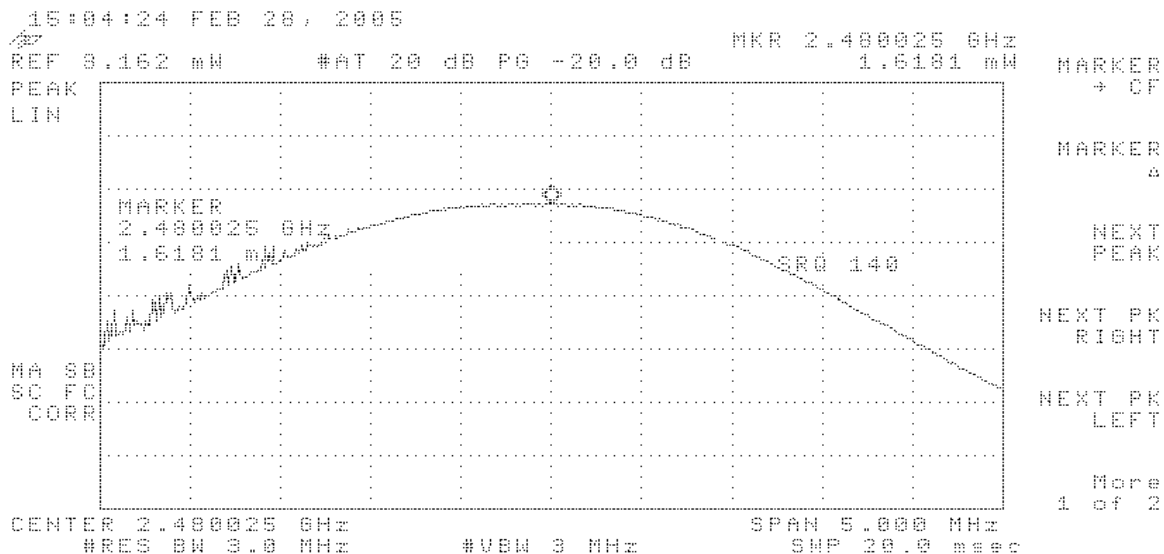
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01
EUT:	TrakLite	Work Order:	7LAY0030	
Serial Number:	100057	Date:	3/1/2005	
Customer:	WirelessWERX, Inc.	Temperature:	70 °F	
Attendees:	None	Tested by:	Jonathan Peng	Humidity:
Customer Ref. No.:	4_WirelessW_0104_GSM	Power:	12VDC	Job Site:
TEST SPECIFICATIONS				
Specification:	47 CFR 15.247(b)	Year:	2004	Method:
		DA 00-705, ANSI C63.4	Year:	2003
SAMPLE CALCULATIONS				
COMMENTS				
Low Channel				
EUT OPERATING MODES				
Modulated at maximum data rate				
DEVIATIONS FROM TEST STANDARD				
None				
REQUIREMENTS				
Maximum peak conducted output power does not exceed 1 Watt				
RESULTS	AMPLITUDE			
Pass	1.9055 mW			
SIGNATURE				
Tested By: 				
DESCRIPTION OF TEST				
Output Power				



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01
EUT:	TrakLite	Work Order:	7LAY0030	
Serial Number:	100057	Date:	3/1/2005	
Customer:	WirelessWERX, Inc.	Temperature:	70 °F	
Attendees:	None	Tested by:	Jonathan Peng	Humidity:
Customer Ref. No.:	4_WirelessW_0104_GSM	Power:	12VDC	Job Site:
TEST SPECIFICATIONS				
Specification:	47 CFR 15.247(b)	Year:	2004	Method:
		DA 00-705, ANSI C63.4	Year:	2003
SAMPLE CALCULATIONS				
COMMENTS				
Middle Channel				
EUT OPERATING MODES				
Modulated at maximum data rate				
DEVIATIONS FROM TEST STANDARD				
None				
REQUIREMENTS				
Maximum peak conducted output power does not exceed 1 Watt				
RESULTS	AMPLITUDE			
Pass	1.6788 mW			
SIGNATURE				
Tested By: 				
DESCRIPTION OF TEST				
Output Power				



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01
EUT:	TrakLite	Work Order:	7LAY0030	
Serial Number:	100057	Date:	3/1/2005	
Customer:	WirelessWERX, Inc.	Temperature:	70 °F	
Attendees:	None	Tested by:	Jonathan Peng	Humidity:
Customer Ref. No.:	4_WirelessW_0104_GSM	Power:	12VDC	Job Site:
TEST SPECIFICATIONS				
Specification:	47 CFR 15.247(b)	Year:	2004	Method:
		DA 00-705, ANSI C63.4	Year:	2003
SAMPLE CALCULATIONS				
COMMENTS				
High Channel				
EUT OPERATING MODES				
Modulated at maximum data rate				
DEVIATIONS FROM TEST STANDARD				
None				
REQUIREMENTS				
Maximum peak conducted output power does not exceed 1 Watt				
RESULTS	AMPLITUDE			
Pass	1.6181 mW			
SIGNATURE				
Tested By: 				
DESCRIPTION OF TEST				
Output Power				





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low

High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

12 VDC.

Software\Firmware Applied During Test

Exercise software	Unknown	Version	Unknown
Description			
The system was tested using special firmware developed to test all functions of the device during the test. The firmware put the radio into a no-hop mode with a modulated carrier. Transmit channels were selectable between the lowest, a middle, and the highest channels in the operating band.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT - TrakLite	WirelessWERX, Inc.	TrakLITE C4-B	100057
10 Amp/13.8VDC Power Supply	RadioShack	CAT. No. 22-506	806977
GPS Antenna	LAIPAC Tech	GLP1	334087
GSM Antenna	Radiall/Larsen	MMC/P3ESMA	N/A

Remote Equipment Outside of Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
Computer	Gateway, Inc.	Micro ATX SAN Professional V800 PC	0023764268
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary.			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.3	No	TrakLITE	RadioShack Power Supply
I/O Leads	No	1.3	No	TrakLITE	Unterminated
Serial DB/9	No	3.0	No	TrakLITE	Gateway PC
SMA	No	0.7	No	TrakLITE	HP8593E Spectrum Analyzer
SMA	No	5.2	No	TrakLITE	GPS Antenna
SMA	No	3.7	No	TrakLITE	GSM Antenna
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/06/2004	13 mo

Test Description

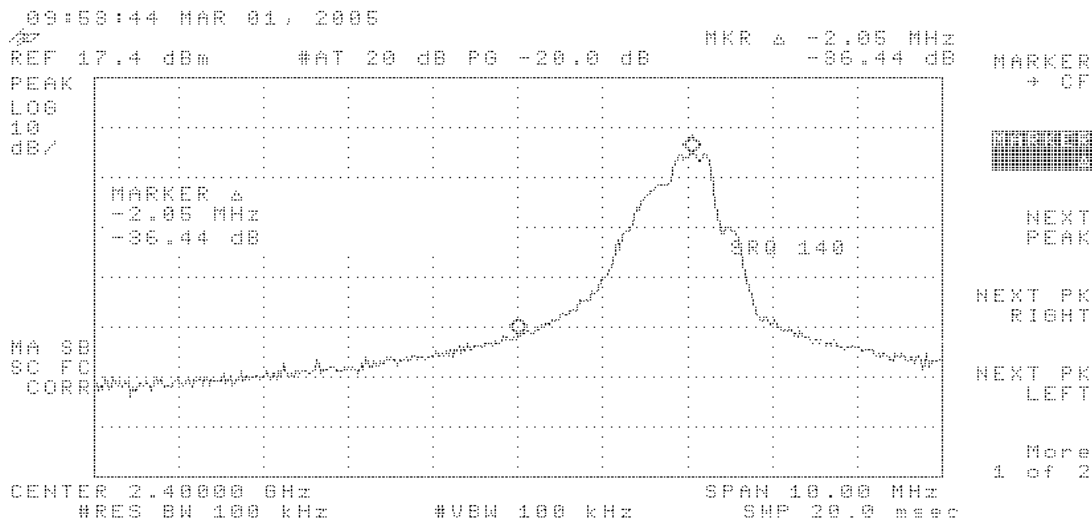
Requirement: Per 47 CFR 15.247(d), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

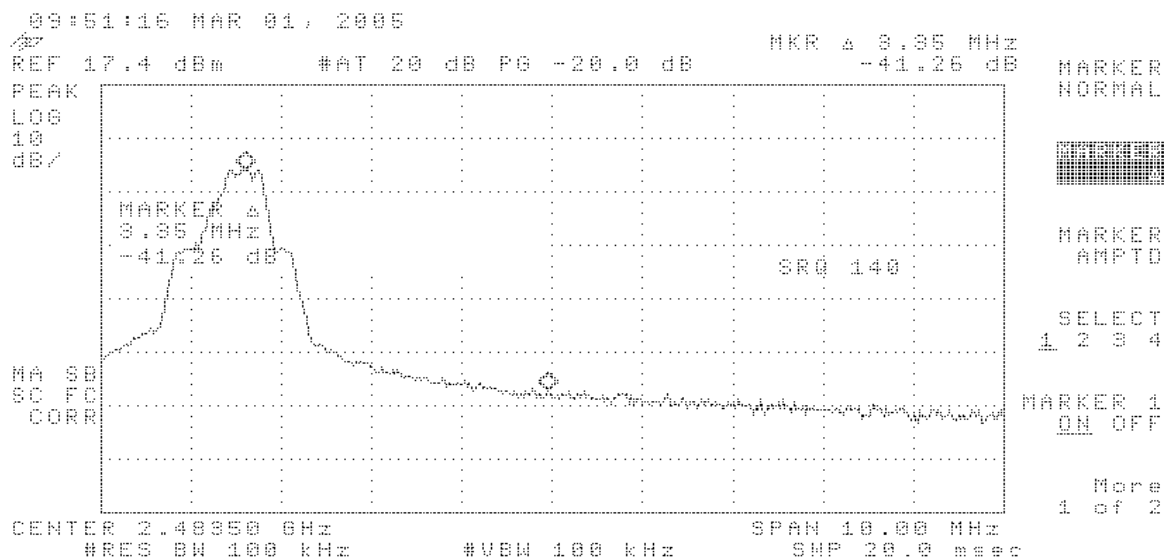
Completed by:



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite		Work Order: 7LAY0030			
Serial Number: 100057		Date: 3/1/2005			
Customer: WirelessWERX, Inc.		Temperature: 70 °F			
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission at the edge of the authorized band is 20 dB down from the fundamental					
RESULTS					
				AMPLITUDE	
Pass				-36.44 dB	
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
Band Edge Compliance - Low Channel					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT:	TrakLite			Work Order:	7LAY0030
Serial Number:	100057			Date:	3/1/2005
Customer:	WirelessWERX, Inc.			Temperature:	70 °F
Attendees:	None	Tested by:	Jonathan Peng	Humidity:	51% RH
Customer Ref. No.:	N/A	Power:	12VDC	Job Site:	OC11
TEST SPECIFICATIONS					
Specification:	47 CFR 15.247(d)	Year:	2004	Method:	DA 00-705, ANSI C63.4
				Year:	2003
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission at the edge of the authorized band is 20 dB down from the fundamental					
RESULTS		AMPLITUDE			
Pass		-41.26 dB			
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
Band Edge Compliance - High Channel					





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low

Mid

High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

12 VDC.

Software\Firmware Applied During Test

Exercise software	Unknown	Version	Unknown
Description			
The system was tested using special firmware developed to test all functions of the device during the test. The firmware put the radio into a no-hop mode with a modulated carrier. Transmit channels were selectable between the lowest, a middle, and the highest channels in the operating band.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT - TrakLite	WirelessWERX, Inc.	TrakLITE C4-B	100057
10 Amp/13.8VDC Power Supply	RadioShack	CAT. No. 22-506	806977
GPS Antenna	LAIPAC Tech	GLP1	334087
GSM Antenna	Radiall/Larsen	MMC/P3ESMA	N/A

Remote Equipment Outside of Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
Computer	Gateway, Inc.	Micro ATX SAN Professional V800 PC	0023764268
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary.			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.3	No	TrakLITE	RadioShack Power Supply
I/O Leads	No	1.3	No	TrakLITE	Unterminated
Serial DB/9	No	3.0	No	TrakLITE	Gateway PC
SMA	No	0.7	No	TrakLITE	HP8593E Spectrum Analyzer
SMA	No	5.2	No	TrakLITE	GPS Antenna
SMA	No	3.7	No	TrakLITE	GSM Antenna
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/06/2004	13 mo

Test Description

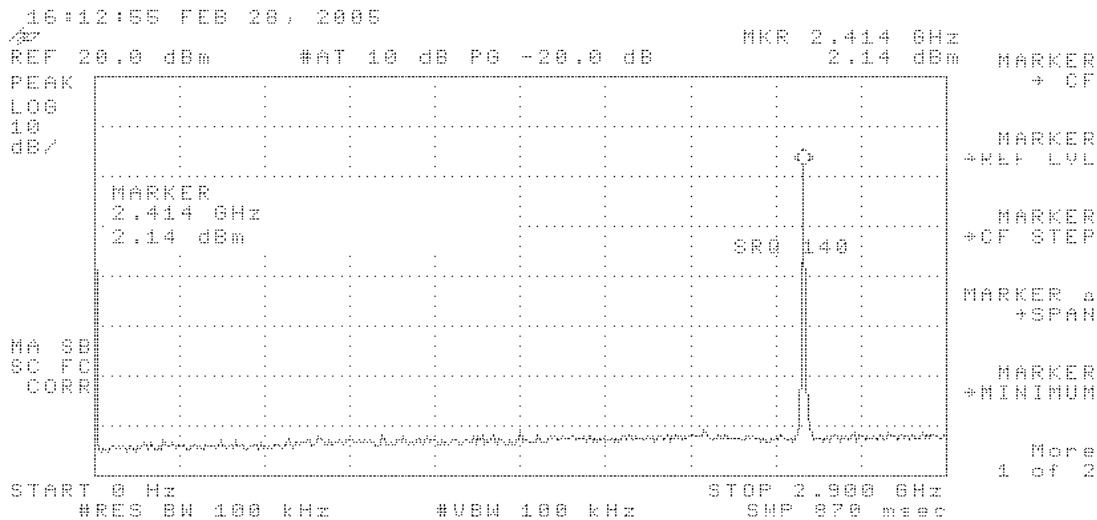
Requirement: Per 47 CFR 15.247(d), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency.

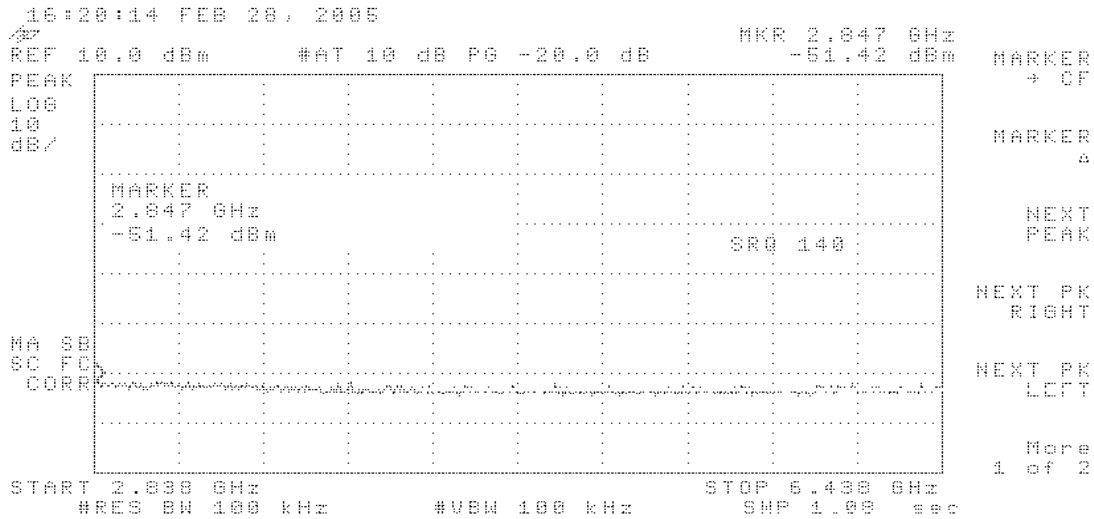
Completed by:



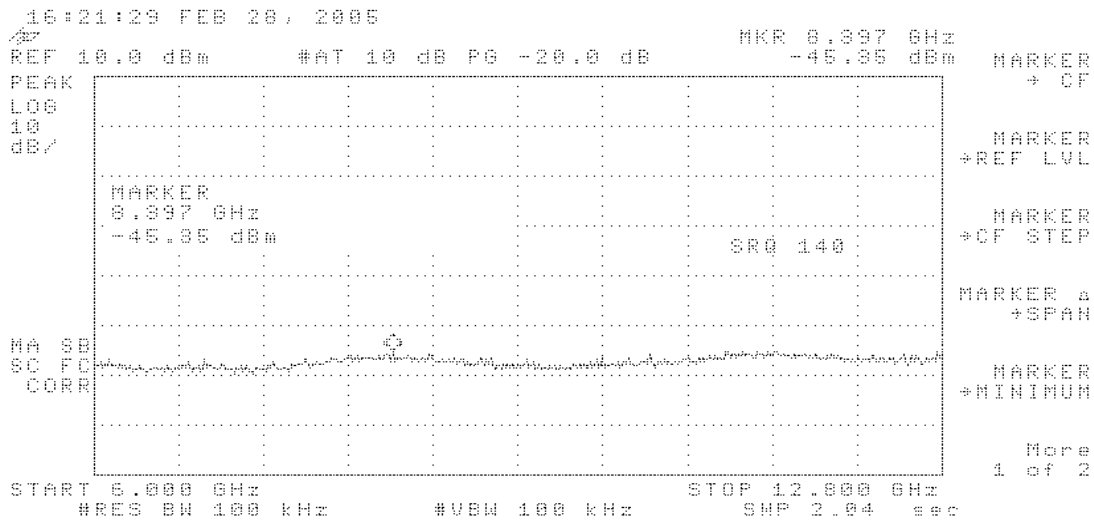
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite		Work Order: 7LAY0030			
Serial Number: 100057		Date: 3/1/2005			
Customer: WirelessWERX, Inc.		Temperature: 70 °F			
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Low Channel 0MHz-2.9GHz					



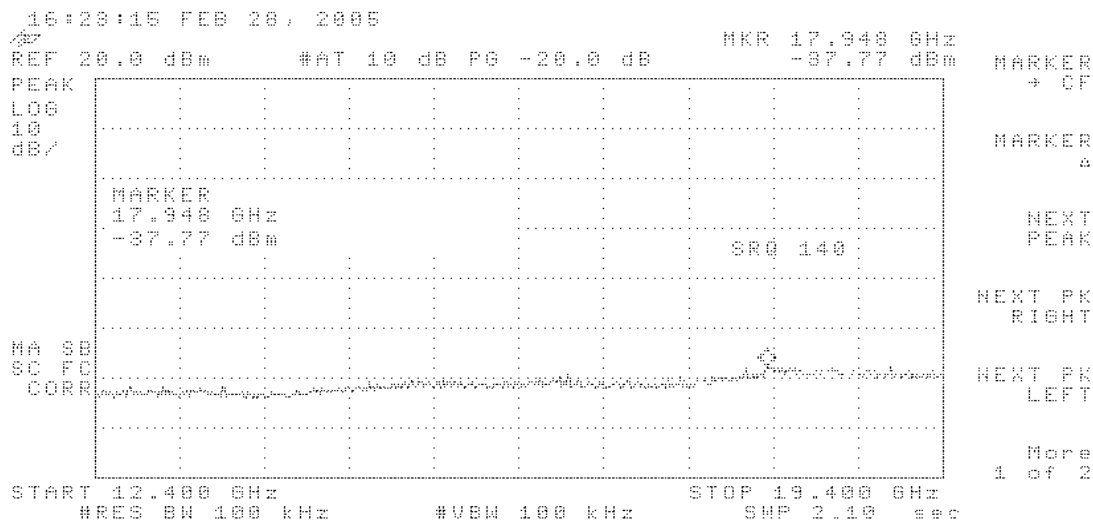
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Low Channel 2.9GHz-6.0GHz					



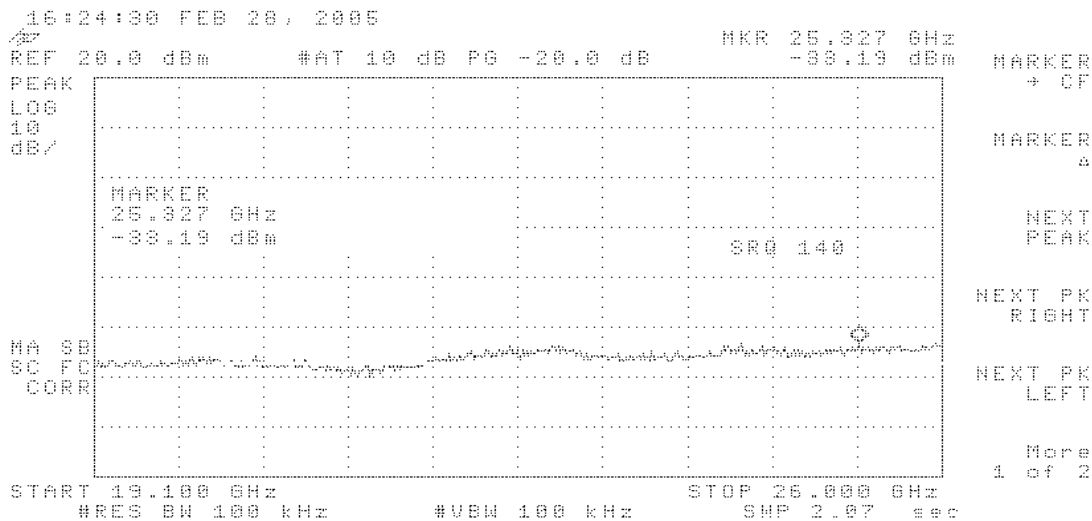
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
Tested By:					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Low Channel 6GHz-12.8GHz					



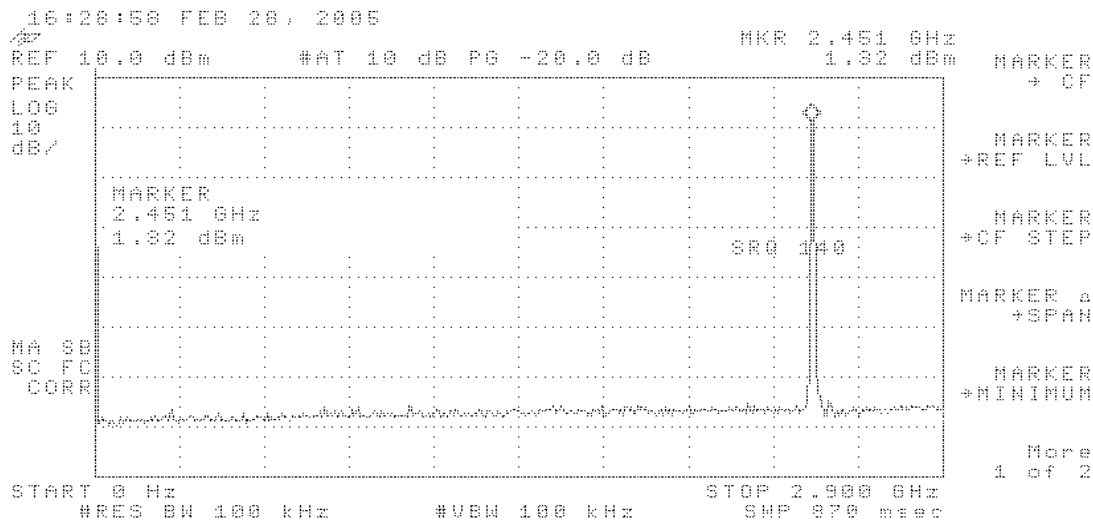
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Low Channel 12.4GHz - 19.4GHz					



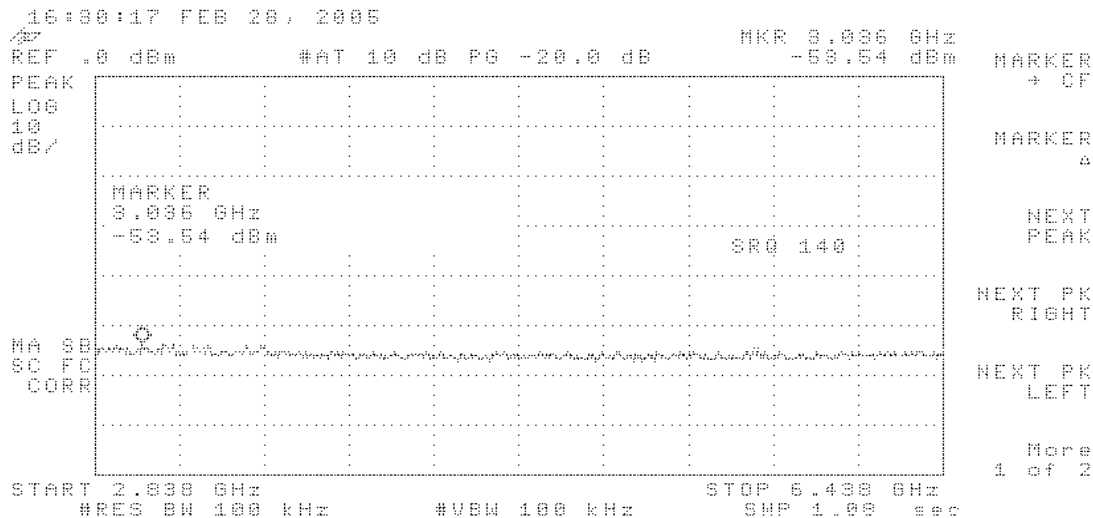
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite		Work Order: 7LAY0030			
Serial Number: 100057		Date: 3/1/2005			
Customer: WirelessWERX, Inc.		Temperature: 70 °F			
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Low Channel 19.1GHz - 26GHz					



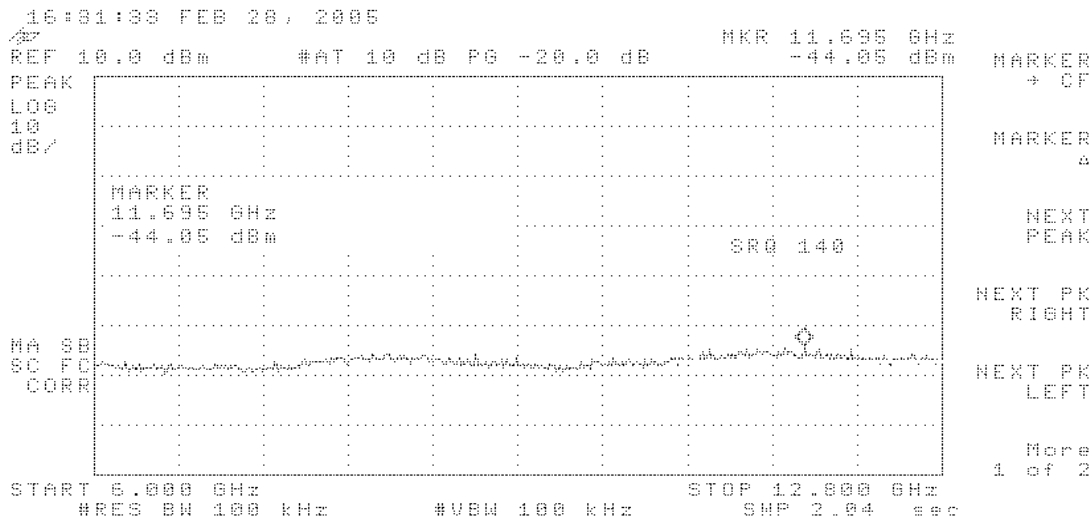
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 0MHz-2.9GHz					



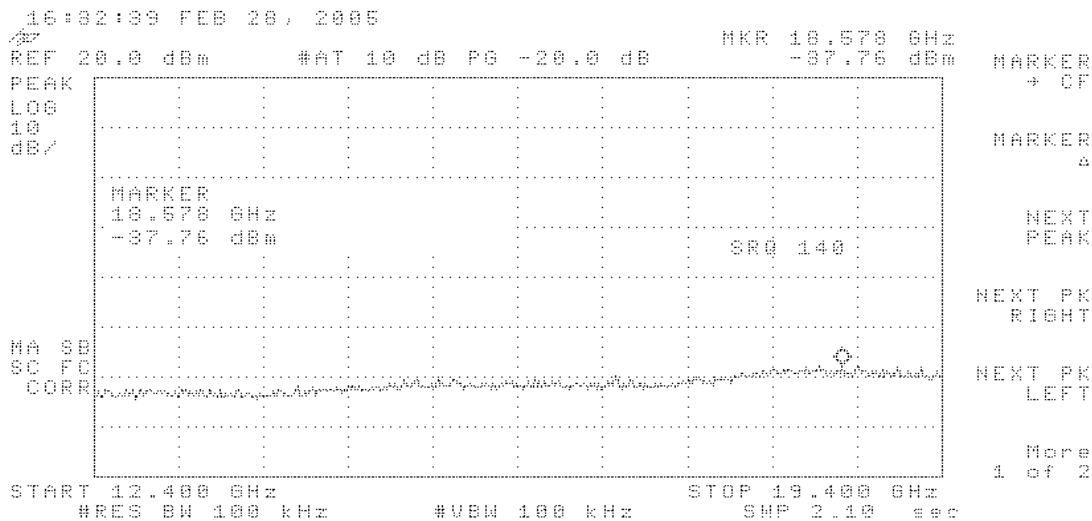
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 2.9GHz-6GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 6GHz-12.8GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 12.4GHz-19.4GHz					



EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT: TrakLite		Work Order: 7LAY0030
Serial Number: 100057		Date: 3/1/2005
Customer: WirelessWERX, Inc.		Temperature: 70 °F
Attendees: None	Tested by: Jonathan Peng	Humidity: 51% RH
Customer Ref. No.: N/A	Power: 12VDC	Job Site: OC11

TEST SPECIFICATIONS

Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003
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SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

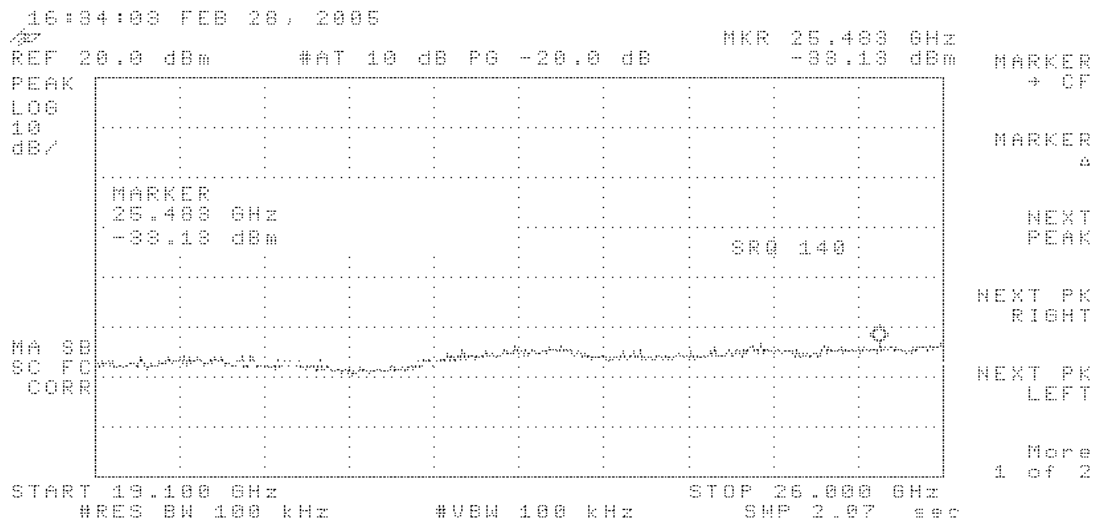
Pass

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Mid Channel 19.1GHz-26GHz



EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT:	TrakLite	Work Order:	7LAY0030
Serial Number:	100057	Date:	3/1/2005
Customer:	WirelessWERX, Inc.	Temperature:	70 °F
Attendees:	None	Tested by:	Jonathan Peng
Customer Ref. No.:	N/A	Power:	12VDC
		Humidity:	51% RH
		Job Site:	OC11

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(d)	Year:	2004	Method:	DA 00-705, ANSI C63.4	Year:	2003
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SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

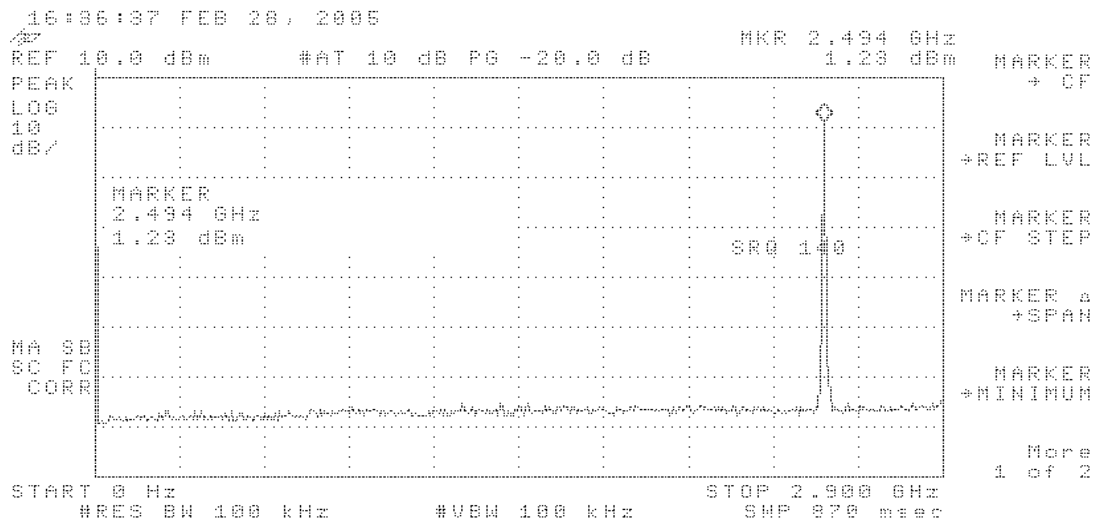
Pass

SIGNATURE

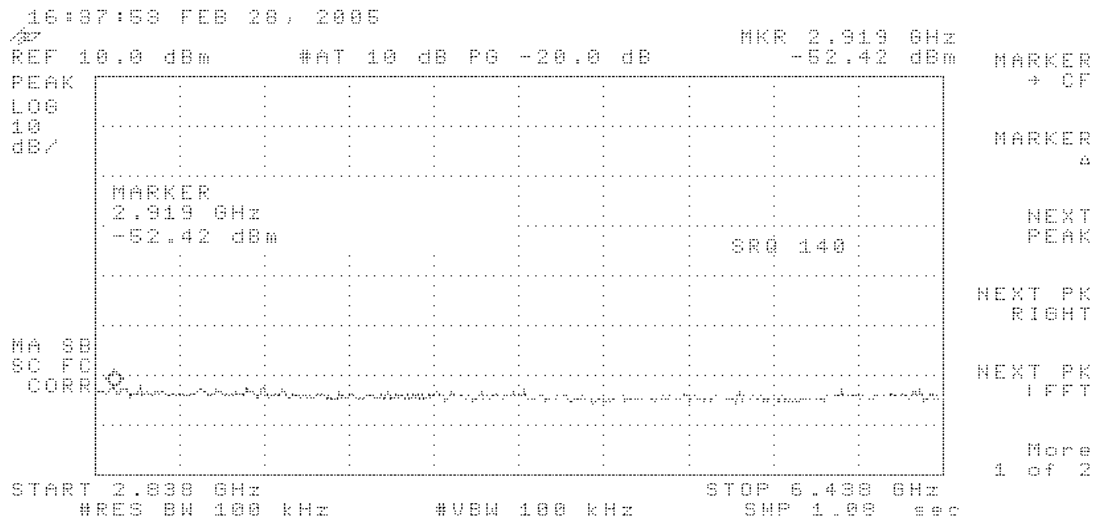
Tested By: 

DESCRIPTION OF TEST

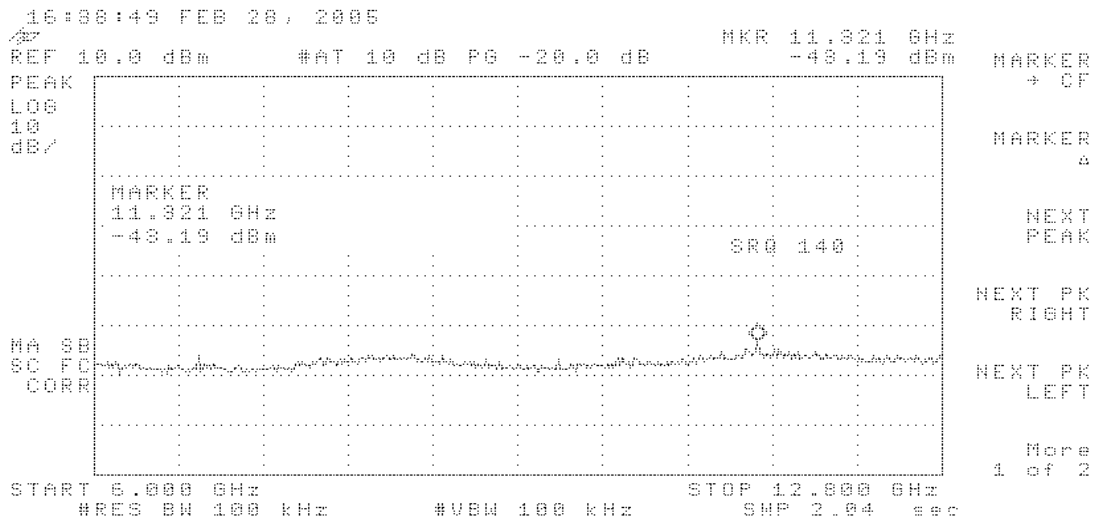
Antenna Conducted Spurious Emissions - High Channel 0MHz-2.9GHz



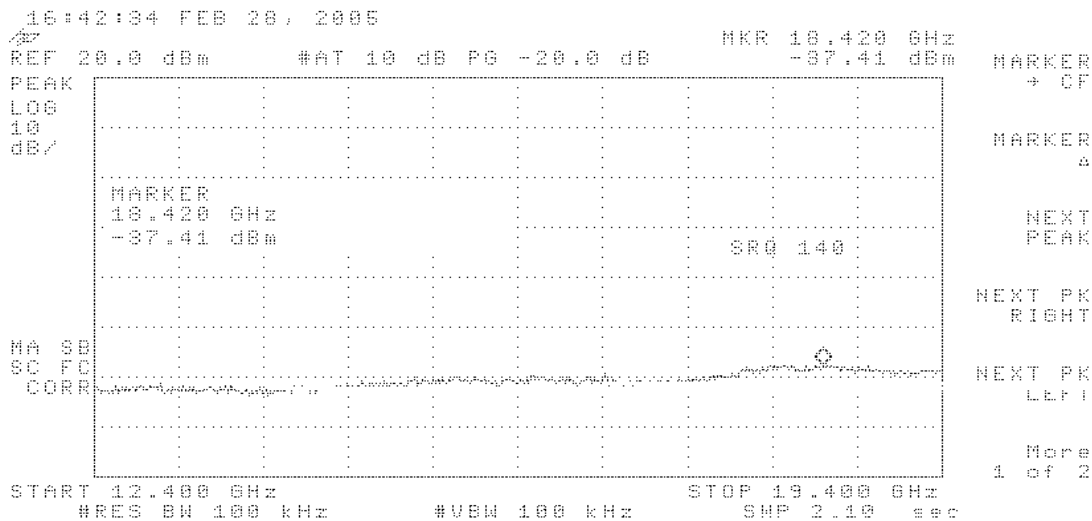
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - High Channel 2.9GHz-6GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - High Channel 6GHz-12.8GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: TrakLite			Work Order: 7LAY0030		
Serial Number: 100057			Date: 3/1/2005		
Customer: WirelessWERX, Inc.			Temperature: 70 °F		
Attendees: None		Tested by: Jonathan Peng		Humidity: 51% RH	
Customer Ref. No.: N/A		Power: 12VDC		Job Site: OC11	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2004		Method: DA 00-705, ANSI C63.4	
				Year: 2003	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
Tested By: 					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - High Channel 12.4GHz-19.4GHz					



EUT:	TrakLite	Work Order:	7LAY0030
Serial Number:	100057	Date:	3/1/2005
Customer:	WirelessWERX, Inc.	Temperature:	70 °F
Attendees:	None	Tested by:	Jonathan Peng
Customer Ref. No.:	N/A	Power:	12VDC
		Humidity:	51% RH
		Job Site:	OC11

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(d)	Year:	2004	Method:	DA 00-705, ANSI C63.4	Year:	2003
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SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

COMMENTS

COMMENTS

EUT OPERATING MODES

List of Erasing Modes	
Modulated at maximum data rate	

DEVIATIONS FROM TEST STANDARD

DEVIATIONS FROM TEST STANDARD
None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

Page

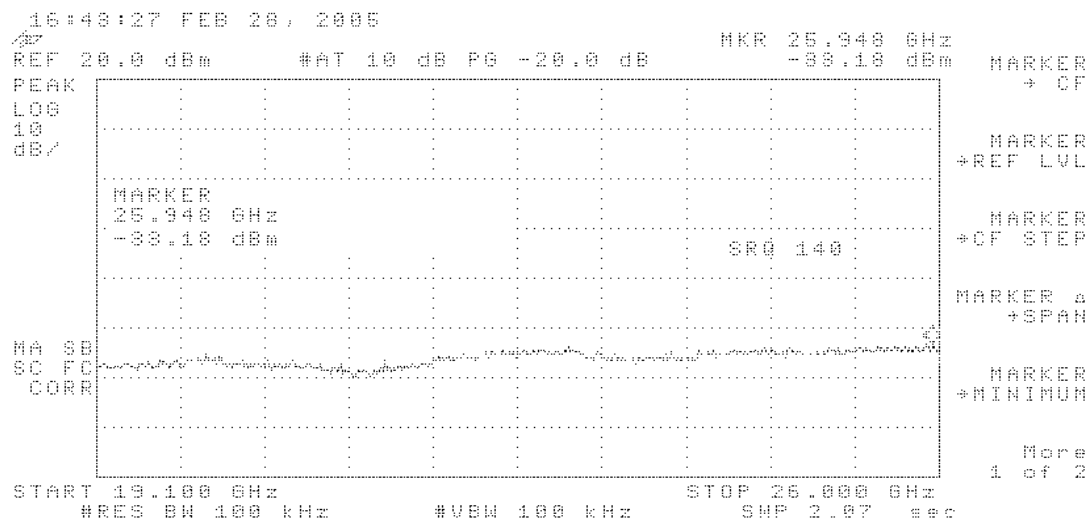
SIGNATURE

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - High Channel 19.1GHz-26GHz





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

12 VDC.

Software\Firmware Applied During Test

Exercise software	Unknown	Version	Unknown
Description			
The system was tested using special firmware developed to test all functions of the device during the test. The firmware put the radio into a no-hop mode with a modulated carrier. Transmit channels were selectable between the lowest, a middle, and the highest channels in the operating band.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT - TrakLite	WirelessWERX, Inc.	TrakLITE C4-B	100057
10 Amp/13.8VDC Power Supply	RadioShack	CAT. No. 22-506	806977
GPS Antenna	LAIPAC Tech	GLP1	334087
GSM Antenna	Radiall/Larsen	MMC/P3ESMA	N/A

Remote Equipment Outside of Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
Computer	Gateway, Inc.	Micro ATX SAN Professional V800 PC	0023764268
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary.			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.3	No	TrakLITE	RadioShack Power Supply
I/O Leads	No	1.3	No	TrakLITE	Unterminated
Serial DB/9	No	3.0	No	TrakLITE	Gateway PC
SMA	No	0.7	No	TrakLITE	HP8593E Spectrum Analyzer
SMA	No	5.2	No	TrakLITE	GPS Antenna
SMA	No	3.7	No	TrakLITE	GSM Antenna
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/06/2004	13 mo

Test Description

Requirement: Per 47 CFR 15.247(e), the peak power spectral density conducted from the antenna port of a direct sequence transmitter must not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

Configuration: The peak power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. Per the procedure outlined in FCC 97-114, the spectrum analyzer was used as follows:

The emission peak(s) were located and zoom in on within the passband. The resolution bandwidth was set to 3 kHz, the video bandwidth was set to greater than or equal to the resolution bandwidth. The sweep speed was set equal to the span divided by 3 kHz (sweep = (SPAN/3 kHz)). For example, given a span of 1.5 MHz, the sweep should be $1.5 \times 10^6 \div 3 \times 10^3 = 500$ seconds. External attenuation was used and added to the reading. The following FCC procedure was used for modifying the power spectral density measurements:

"If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzers will directly measure the noise power density normalized to a 1 Hz noise power bandwidth. Add 34.8 dB for correction to 3 kHz."

Completed by:



EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT:	TrakLite	Work Order:	7LAY0030
Serial Number:	100057	Date:	3/1/2005
Customer:	WirelessWERX, Inc.	Temperature:	70 °F
Attendees:	None	Humidity:	51% RH
Customer Ref. No.:	4_WirelessW_0104_GSM	Power:	12VDC
		Job Site:	OC11

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(e)	Year:	2004	Method:	FCC 97-114, ANSI C63.4	Year:	2003
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SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation.

Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.

Bandwidth Correction Factor = $10 \cdot \log(3\text{kHz}/1\text{Hz}) = 34.8 \text{ dB}$

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

RESULTS

AMPLITUDE

Pass

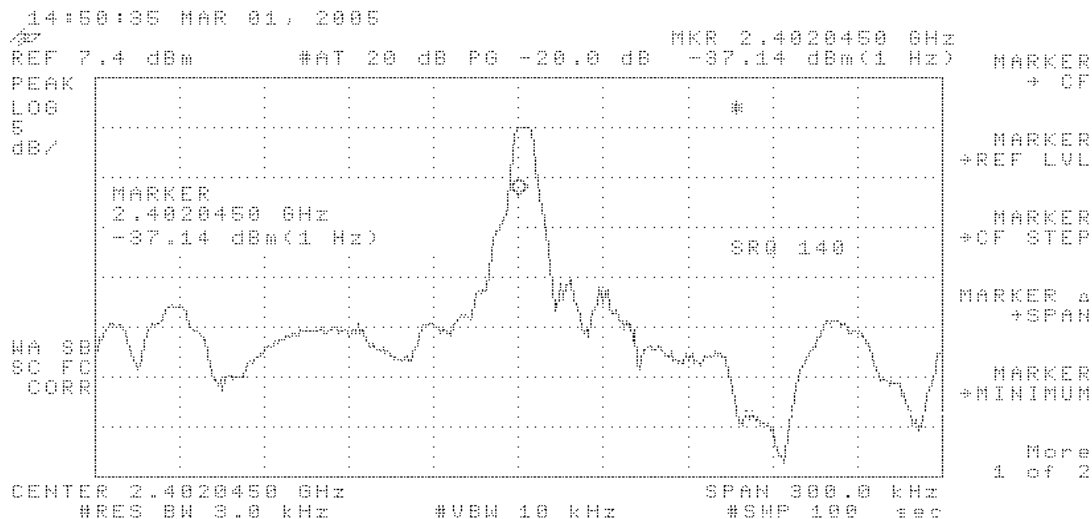
Power Spectral Density = -2.3 dBm / 3kHz

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Power Spectral Density - Low Channel



EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT:	TrakLite	Work Order:	7LAY0030
Serial Number:	100057	Date:	3/1/2005
Customer:	WirelessWERX, Inc.	Temperature:	70 °F
Attendees:	None	Humidity:	51% RH
Customer Ref. No.:	4_WirelessW_0104_GSM	Power:	12VDC
		Job Site:	OC11

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(e)	Year:	2004	Method:	FCC 97-114, ANSI C63.4	Year:	2003
----------------	------------------	-------	------	---------	------------------------	-------	------

SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation

Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.

Bandwidth Correction Factor = $10 \cdot \log(3\text{kHz}/1\text{Hz}) = 34.8 \text{ dB}$

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

RESULTS

AMPLITUDE

Pass

Power Spectral Density = -2.6 dBm / 3kHz

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Power Spectral Density - Mid Channel



EUT:	TrakLite	Work Order:	7LAY0030
Serial Number:	100057	Date:	3/1/2005
Customer:	WirelessWERX, Inc.	Temperature:	70 °F
Attendees:	None	Humidity:	51% RH
Customer Ref. No.:	4_WirelessW_0104_GSM	Power:	12VDC
		Job Site:	OC11

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(e)	Year:	2004	Method:	FCC 97-114, ANSI C63.4	Year:	2003
----------------	------------------	-------	------	---------	------------------------	-------	------

SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation

Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.

Bandwidth Correction Factor = $10 \cdot \log(3\text{kHz}/1\text{Hz}) = 34.8 \text{ dB}$

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

RESULTS

AMPLITUDE

Pass

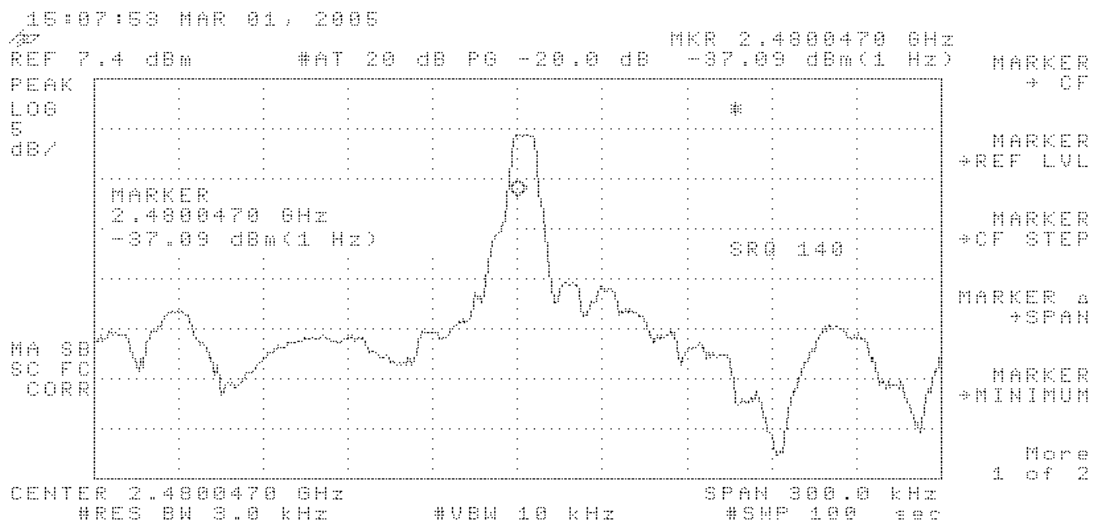
Power Spectral Density = -23 dBm / 3kHz

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Power Spectral Density - High Channel





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Simultaneous transmission of GSM Cellular Channel 132 and Bluetooth Channel 74
Simultaneous transmission of GSM Cellular Channel 251 and Bluetooth Channel 4
Simultaneous transmission of GSM Cellular Channel 207 and Bluetooth Channel 14
Simultaneous transmission of GSM PCS Channel 516 and Bluetooth Channel 67

Operating Modes Investigated:

Typical

Antennas Investigated:

Bluetooth
GPS
Cellular

Data Rates Investigated:

Maximum

Power Input Settings Investigated:

12VDC

Frequency Range Investigated

Start Frequency	30 MHz	Stop Frequency	26GHz
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Software\Firmware Applied During Test

Exercise software	Hyperterminal	Version	1999
Description			
The system was tested using hyperterminal software on a remote pc to access the EUT during the testing. A call was originated by the wireless communications test set and answered via hyperterminal on the EUT.			

EUT and Peripherals			
Description	Manufacturer	Model/Part Number	Serial Number
EUT	Wireless Werx	TrakLITE C4-B	100074
DC Power Supply	Topward Electric Instruments, Co. Ltd.	TPS-2000	Unknown
Cellular Antenna	Radiall/Larsen	MMC/P3ESMA	Unknown
GPS Antenna	Laipac Tech	GLP1	334083
Bluetooth Antenna	Radiall/Larsen	MS3E2400SMA	Unknown

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Communications Test Set	Agilent	8960 Series 10 E5515C	0844051960
Remote laptop	IBM	Thinkpad	78-HKYY6 10/00
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	Yes	6	No	EUT	Remote laptop
Wire harness (16)	No	1.0	No	EUT	Unterminated
Wire harness (3)	No	1.0	No	EUT	DC Power Supply
Bluetooth	Yes	2.0	No	EUT	Bluetooth Antenna
Cellular	Yes	3.0	No	EUT	Cellular Antenna
GPS	Yes	3.0	No	EUT	GPS Antenna
AC Power	No	2.0	No	DC Power Supply	AC Mains

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Antenna, Horn	EMCO	3160-09	AHG	NCR	NA
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	02/15/2005	13 mo
Antenna, Horn	EMCO	3115	AHC	09/07/2004	12 mo
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APC	02/17/2005	13 mo
Antenna, Horn	EMCO	3160-08	AHK	NCR	NA
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APJ	01/05/2004	16 mo
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	03/01/2005	13 mo
Spectrum Analyzer	Tektronix	2784	AAO	01/02/2005	12 mo
Quasi-Peak Adapter	Hewlett-Packard	85650A	AQF	12/02/2004	13 mo
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	12/02/2004	13 mo
Spectrum Analyzer Display	Hewlett Packard	85662A	AALD	12/02/2004	13 mo
Attenuator	Coaxicom	66702 5910-6	ATZ	02/25/2005	13 mo
Attenuator	Coaxicom	66702 5910-20	RBJ	02/25/2005	13 mo
High Pass Filter	Micro-Tronics	HPM50111	HFO	03/09/2005	13 mo
Antenna, Horn	EMCO	3115	AHF	03/18/2004	24 mo
Antenna, Dipole (ADAA included)	Roberts	Roberts	ADA	01/06/2005	24 mo
Signal Generator	Hewlett Packard	8341B	TGN	02/07/2005	13 mo

Test Description

Requirement: The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, is measured. The peak level must comply with the limits specified in 47 CFR 15.35(b). The average level (taken with a 10Hz VBW) must comply with the limits specified in 15.209.

Configuration: The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.4). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

Simultaneous Transmission:

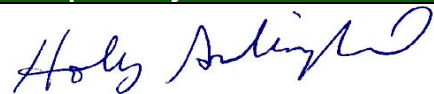
The following is an excerpt from the FCC / TCB Training Q & A, October 2002, Day 2, Question 7:

Assuming that the radios do not share an antenna, only radiated tests for simultaneous transmission is required. If the radios share an antenna, antenna conducted measurements would also be required. Only one set of worst case simultaneous transmission data is going to be requested to be submitted at this time. The test engineer should indicate the worst case condition and provide justification as to why the worst case condition was chosen. The grantee should be reminded that even if the FCC requests one set of data, they are responsible for compliance for all modes of simultaneous transmission.

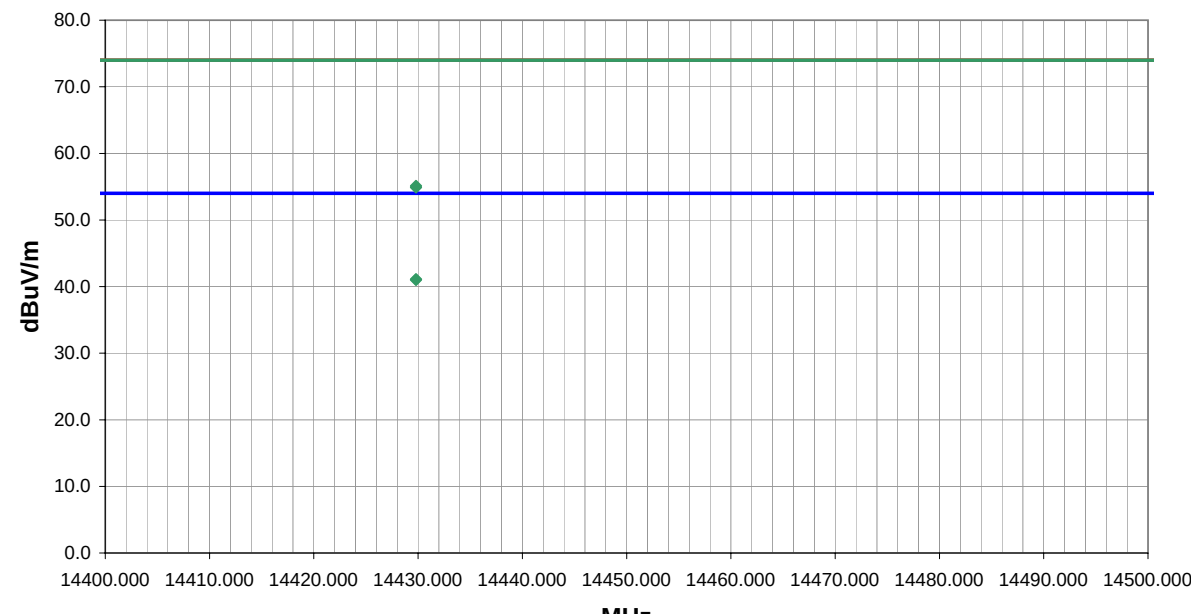
All possible combinations of harmonic emissions from the GSM and Bluetooth radios were compared numerically. It was determined that there were no possible coincidental harmonics below 1 GHz. The frequency range from 1 GHz to 26 GHz was investigated for channel combinations that would produce coincidental harmonics.

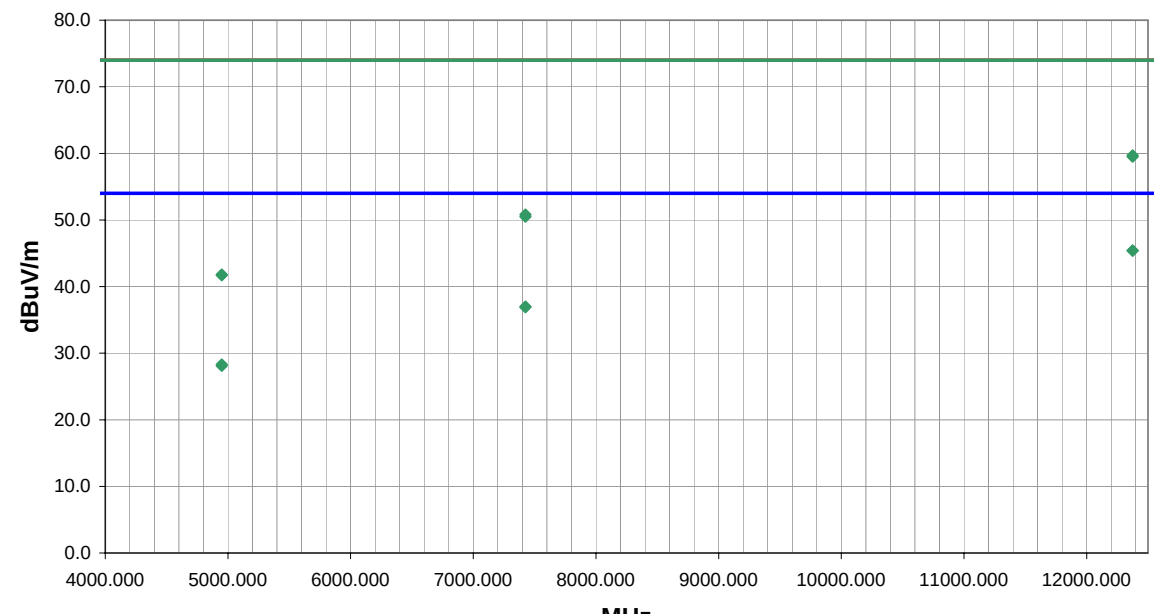
Bandwidths Used for Measurements			
Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 – 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
<i>Measurements were made using the bandwidths and detectors specified. No video filter was used.</i>			

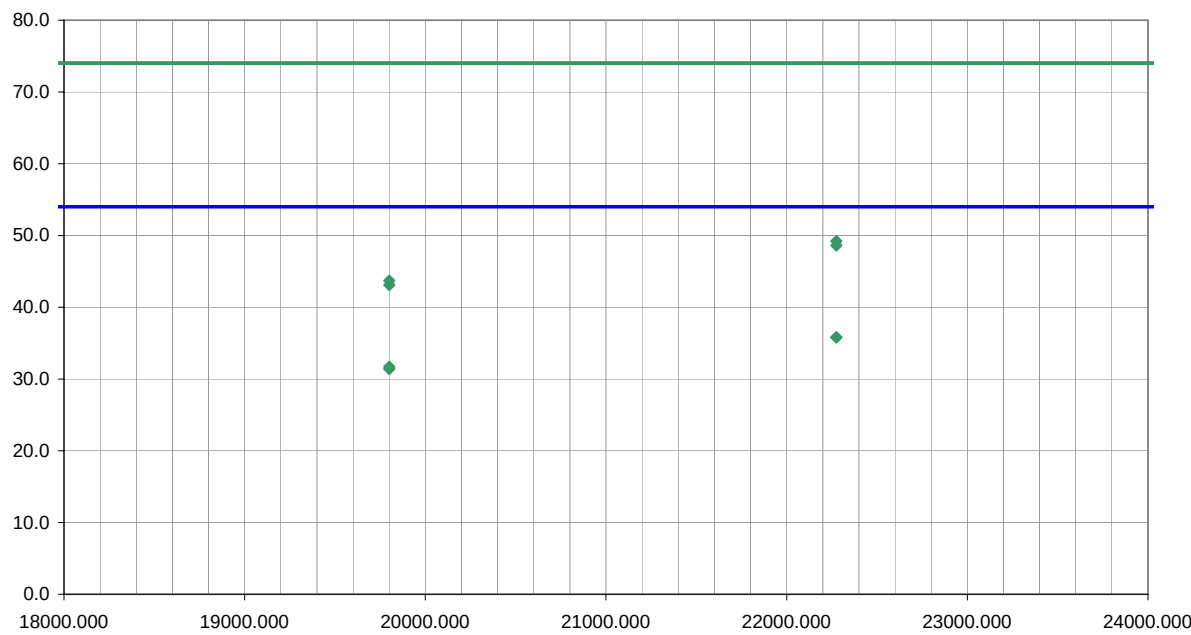
Completed by:

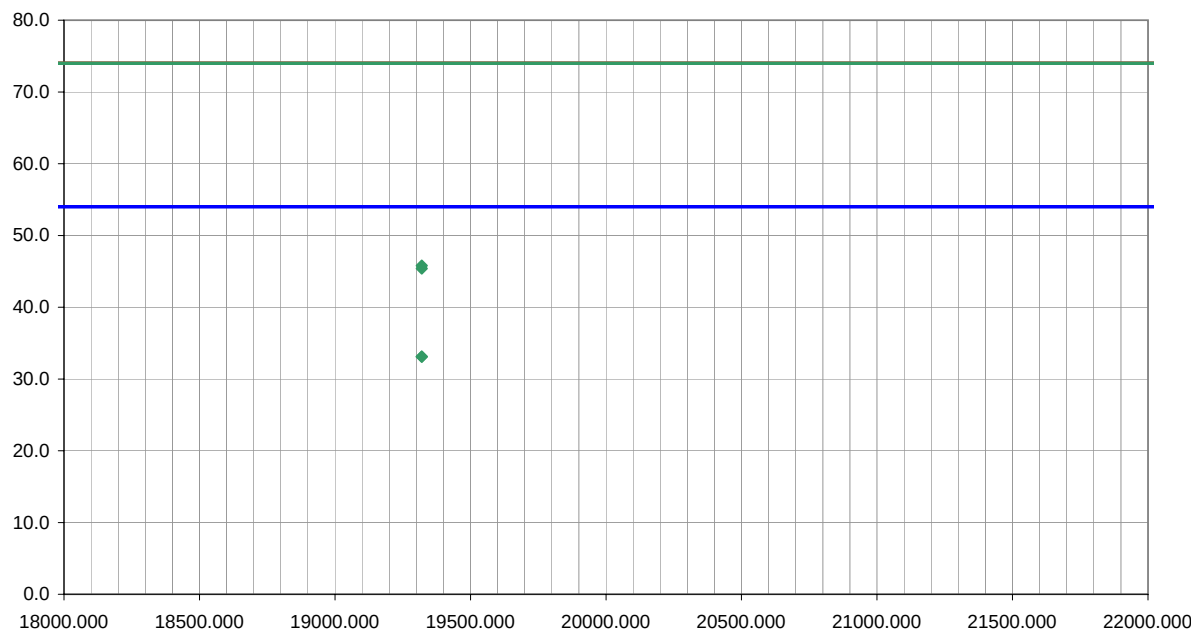


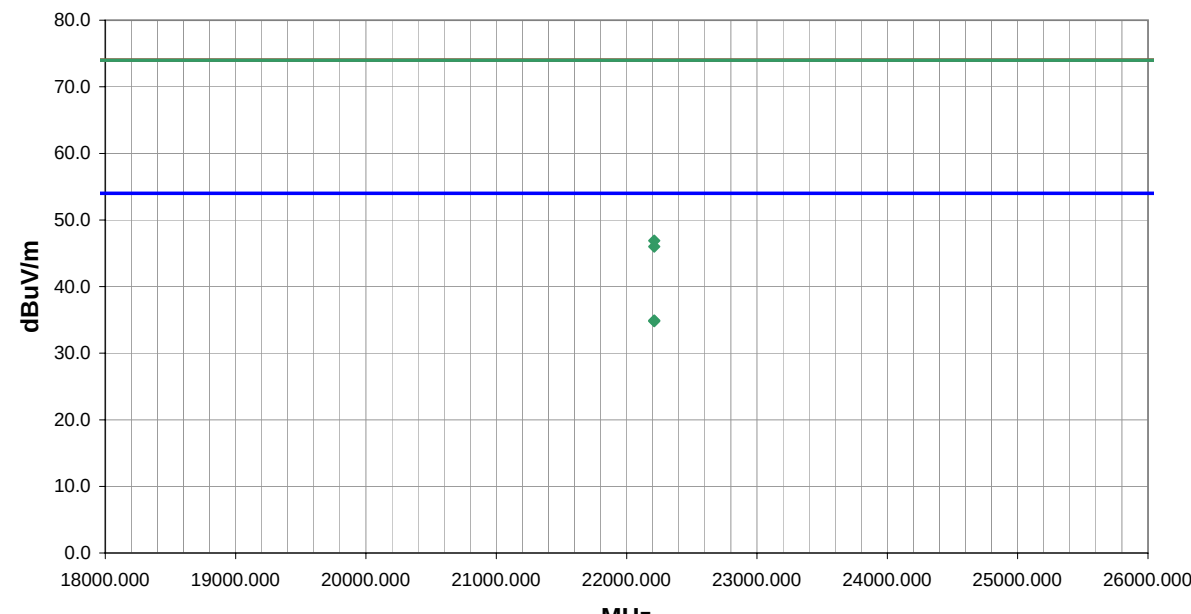
NORTHWEST EMC										RADIATED EMISSIONS DATA SHEET					ACQ 2005.1.3 EMI 2005.1.3																																																																
EUT: TrakLITE C4-B										Work Order: 7LAY0037																																																																					
Serial Number: 100057										Date: 03/21/05																																																																					
Customer: WirelessWERX, Inc.										Temperature: 24																																																																					
Attendees: none										Humidity: 31%																																																																					
Cust. Ref. No.:										Barometric Pressure: 29.67																																																																					
Tested by: Rod Peloquin					Power: 12VDC					Job Site: EV01																																																																					
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<table border="1" style="width: 100%; border-collapse: collapse; font-size: 0.8em;"> <thead> <tr> <th>Freq (MHz)</th> <th>Amplitude (dBuV)</th> <th>Factor (dB)</th> <th>Azimuth (degrees)</th> <th>Height (meters)</th> <th>Distance (meters)</th> <th>External Attenuation (dB)</th> <th>Polarity</th> <th>Detector</th> <th>Distance Adjustment (dB)</th> <th>Adjusted dBuV/m</th> <th>Spec. Limit dBuV/m</th> <th>Compared to Spec. (dB)</th> </tr> </thead> <tbody> <tr> <td>7404.000</td> <td>25.7</td> <td>11.1</td> <td>181.0</td> <td>2.4</td> <td>3.0</td> <td>0.0</td> <td>V-Horn</td> <td>AV</td> <td>0.0</td> <td>36.8</td> <td>54.0</td> <td>-17.2</td> </tr> <tr> <td>7404.000</td> <td>25.4</td> <td>11.1</td> <td>139.0</td> <td>3.2</td> <td>3.0</td> <td>0.0</td> <td>H-Horn</td> <td>AV</td> <td>0.0</td> <td>36.5</td> <td>54.0</td> <td>-17.5</td> </tr> <tr> <td>7404.000</td> <td>40.4</td> <td>11.1</td> <td>181.0</td> <td>2.4</td> <td>3.0</td> <td>0.0</td> <td>V-Horn</td> <td>PK</td> <td>0.0</td> <td>51.5</td> <td>74.0</td> <td>-22.5</td> </tr> <tr> <td>7404.000</td> <td>39.8</td> <td>11.1</td> <td>139.0</td> <td>3.2</td> <td>3.0</td> <td>0.0</td> <td>H-Horn</td> <td>PK</td> <td>0.0</td> <td>50.9</td> <td>74.0</td> <td>-23.1</td> </tr> </tbody> </table>															Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	7404.000	25.7	11.1	181.0	2.4	3.0	0.0	V-Horn	AV	0.0	36.8	54.0	-17.2	7404.000	25.4	11.1	139.0	3.2	3.0	0.0	H-Horn	AV	0.0	36.5	54.0	-17.5	7404.000	40.4	11.1	181.0	2.4	3.0	0.0	V-Horn	PK	0.0	51.5	74.0	-22.5	7404.000	39.8	11.1	139.0	3.2	3.0	0.0	H-Horn	PK	0.0	50.9	74.0	-23.1
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)																																																																			
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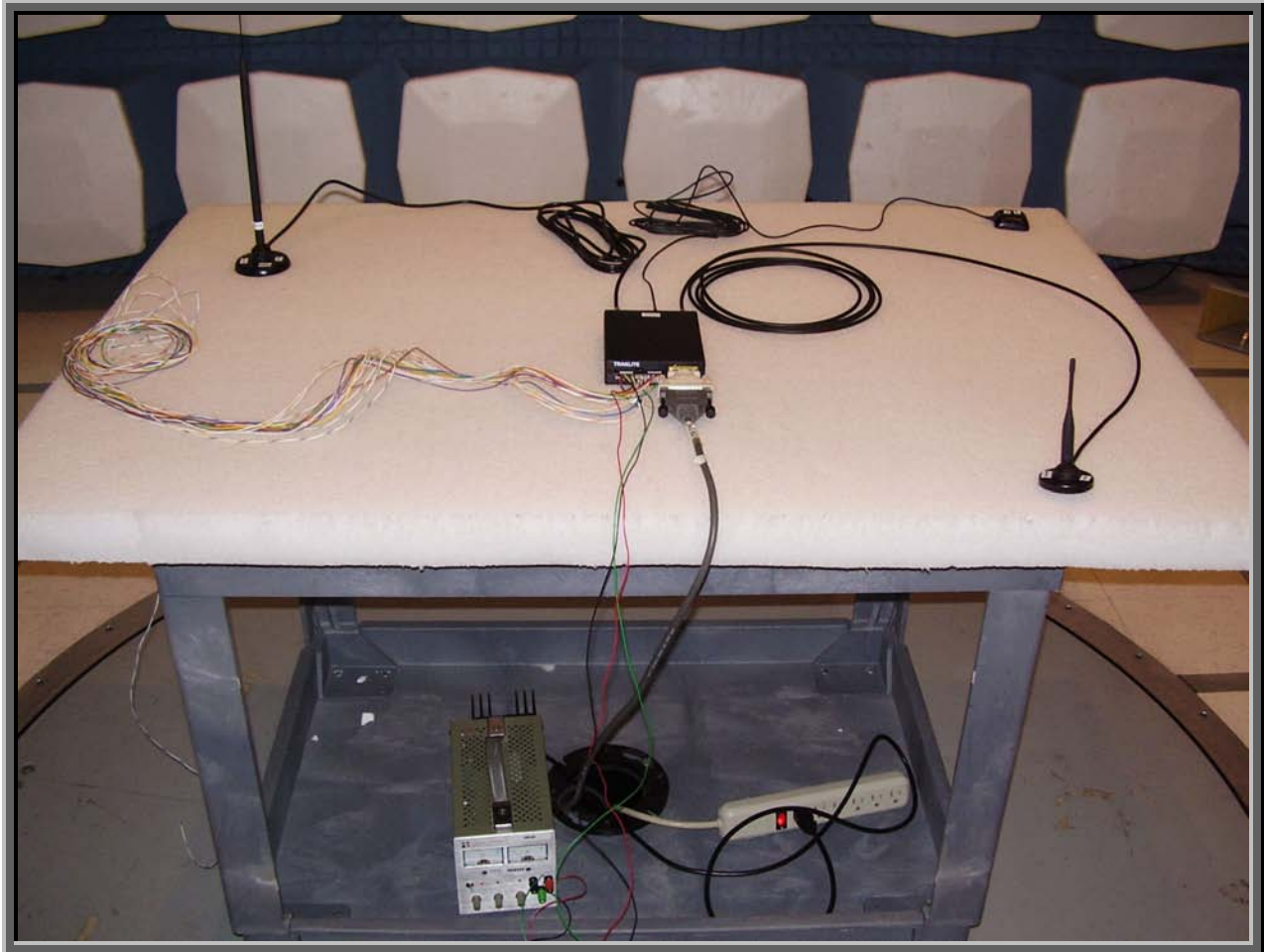
NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET				ACQ 2005.1.3 EMI 2005.1.3						
EUT: TrakLITE C4-B						Work Order: 7LAY0037						
Serial Number: 100057						Date: 03/21/05						
Customer: WirelessWERX, Inc.						Temperature: 24						
Attendees: none						Humidity: 31%						
Cust. Ref. No.:						Barometric Pressure: 29.67						
Tested by: Rod Peloquin				Power: 12VDC		Job Site: EV01						
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004				Method: ANSI C63.4:2003								
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Transmitting GSM Cellular 251, Bluetooth 4												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS						Run #						
Pass						16						
Other						 Tested By:						
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
14429.800	26.7	14.4	276.0	1.2	3.0	0.0	V-Horn	AV	0.0	41.1	54.0	-12.9
14429.800	26.6	14.4	145.0	1.3	3.0	0.0	H-Horn	AV	0.0	41.0	54.0	-13.0
14429.800	40.7	14.4	145.0	1.3	3.0	0.0	H-Horn	PK	0.0	55.1	74.0	-18.9
14429.800	40.5	14.4	276.0	1.2	3.0	0.0	V-Horn	PK	0.0	54.9	74.0	-19.1

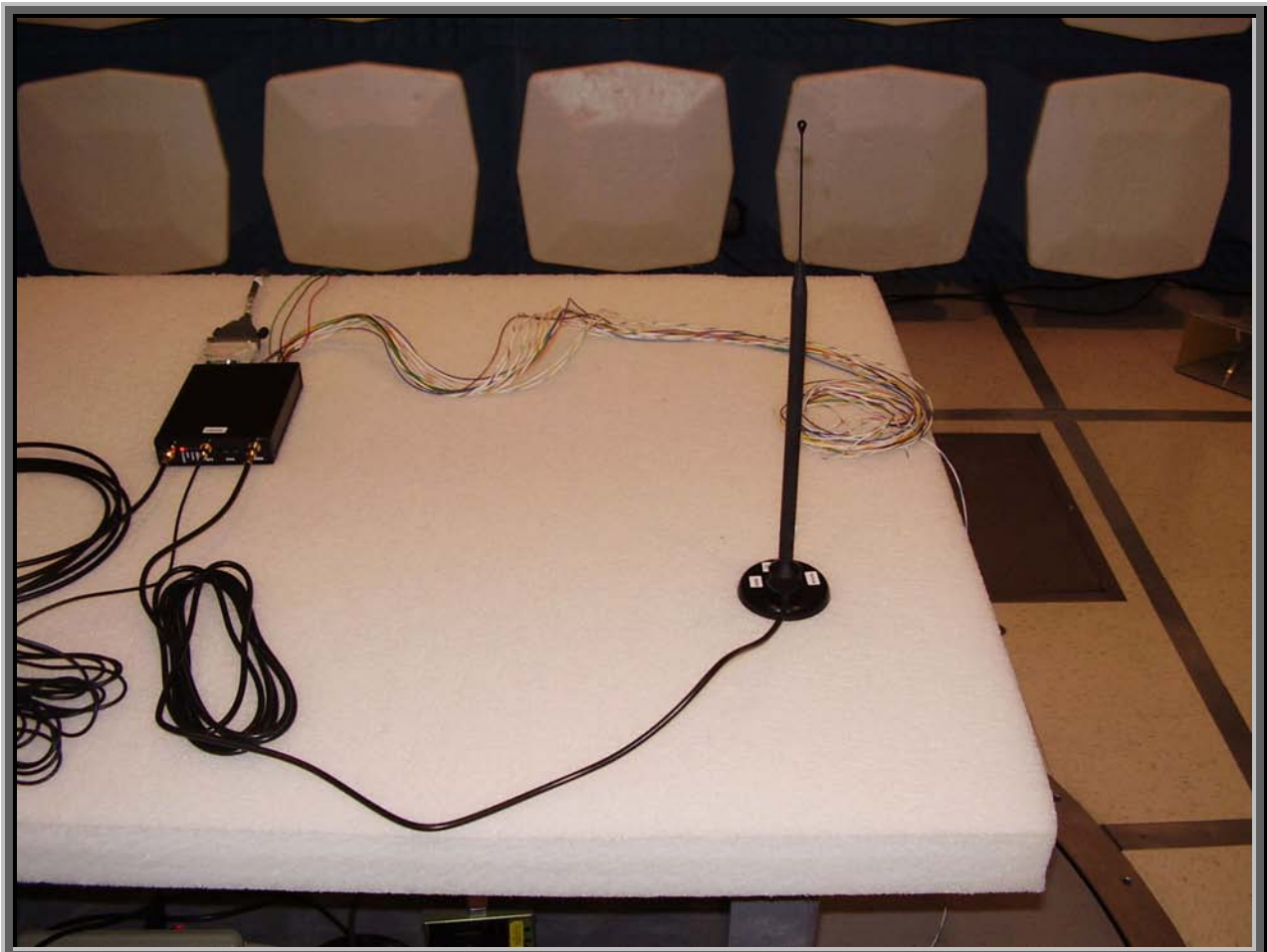
NORTHWEST		RADIATED EMISSIONS DATA SHEET				ACQ 2005.1.3 EMI 2005.1.3						
EMC												
EUT: TrakLITE C4-B						Work Order: 7LAY0037						
Serial Number: 100057						Date: 03/21/05						
Customer: WirelessWERX, Inc.						Temperature: 24						
Attendees: none						Humidity: 31%						
Cust. Ref. No.:						Barometric Pressure: 29.67						
Tested by: Rod Peloquin				Power: 12VDC		Job Site: EV01						
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004				Method: ANSI C63.4:2003								
SAMPLE CALCULATIONS												
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Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Transmitting GSM Cellular 132, Bluetooth 74												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS						Run #						
Pass						17						
Other												
						 Tested By:						
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
12375.000	24.7	20.7	181.0	3.7	3.0	0.0	H-Horn	AV	0.0	45.4	54.0	-8.6
12375.000	24.7	20.7	35.0	1.2	3.0	0.0	V-Horn	AV	0.0	45.4	54.0	-8.6
12375.000	39.0	20.7	181.0	3.7	3.0	0.0	H-Horn	PK	0.0	59.7	74.0	-14.3
12375.000	38.8	20.7	35.0	1.2	3.0	0.0	V-Horn	PK	0.0	59.5	74.0	-14.5
7425.000	25.9	11.1	307.0	1.2	3.0	0.0	V-Horn	AV	0.0	37.0	54.0	-17.0
7425.000	25.8	11.1	360.0	1.3	3.0	0.0	H-Horn	AV	0.0	36.9	54.0	-17.1
7425.000	39.7	11.1	360.0	1.3	3.0	0.0	H-Horn	PK	0.0	50.8	74.0	-23.2
7425.000	39.4	11.1	307.0	1.2	3.0	0.0	V-Horn	PK	0.0	50.5	74.0	-23.5
4950.000	24.7	3.6	254.0	1.2	3.0	0.0	H-Horn	AV	0.0	28.3	54.0	-25.7
4950.000	24.5	3.6	91.0	2.7	3.0	0.0	V-Horn	AV	0.0	28.1	54.0	-25.9
4950.000	38.2	3.6	254.0	1.2	3.0	0.0	H-Horn	PK	0.0	41.8	74.0	-32.2
4950.000	38.1	3.6	91.0	2.7	3.0	0.0	V-Horn	PK	0.0	41.7	74.0	-32.3

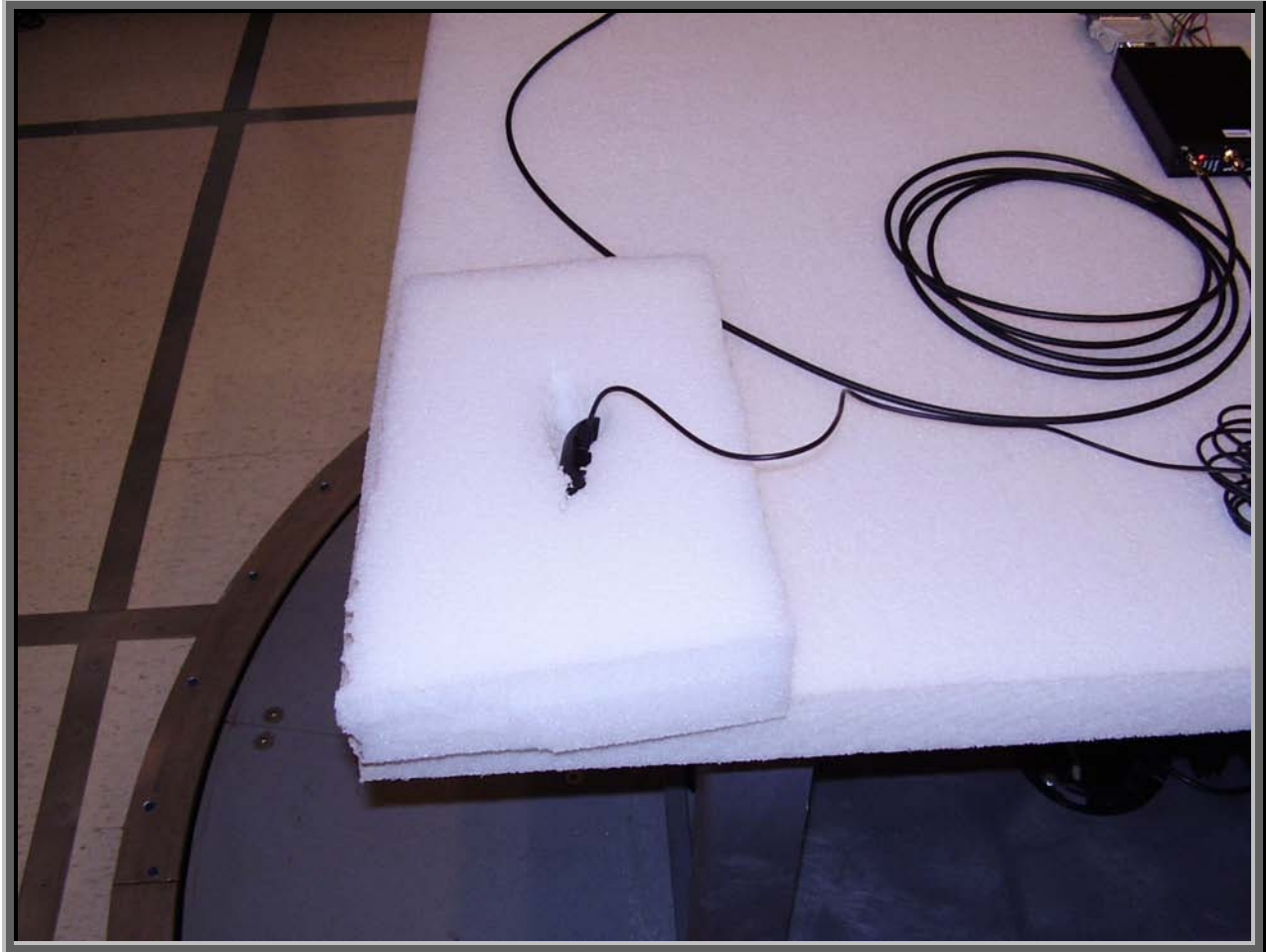
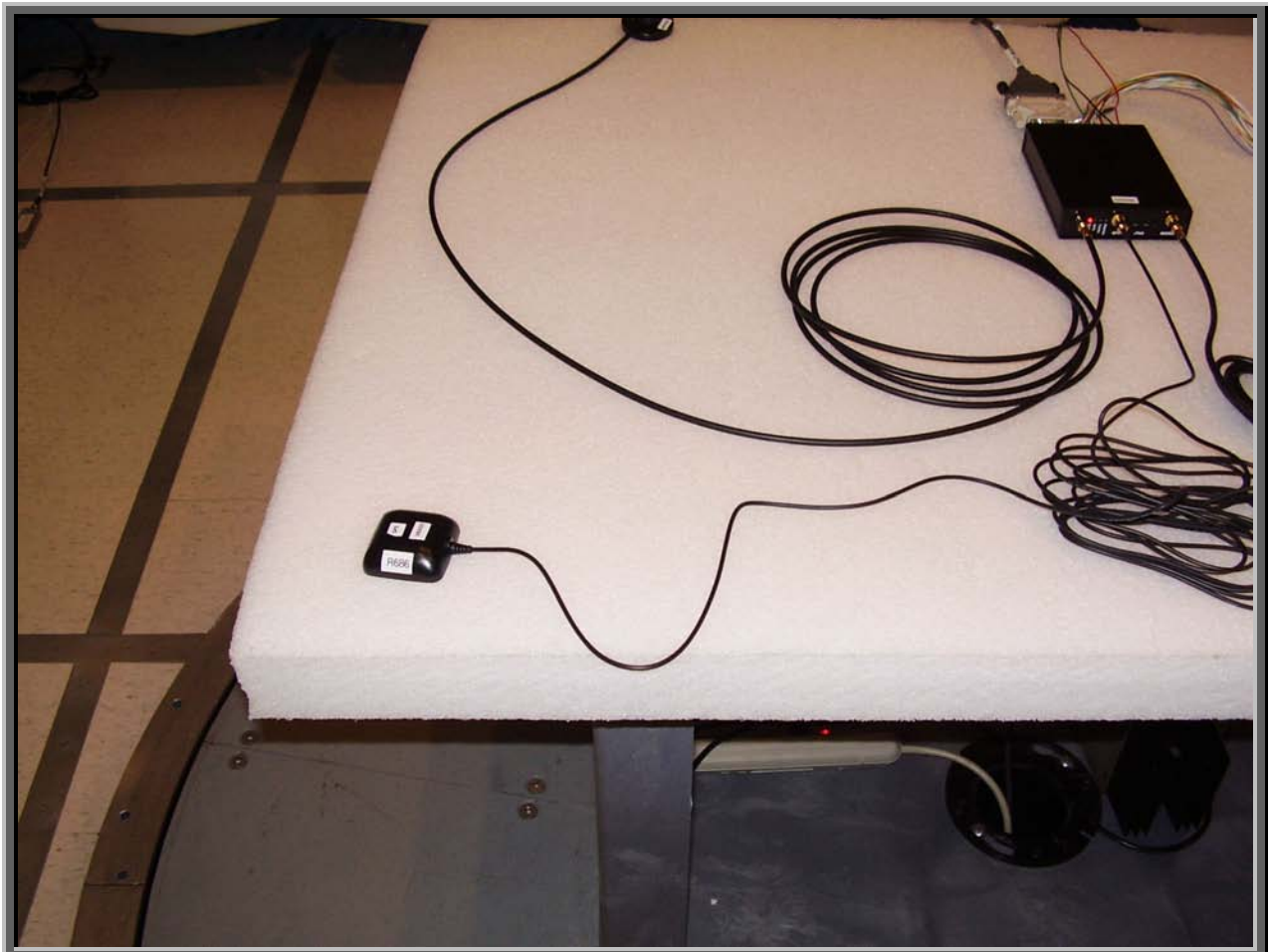
NORTHWEST		ACQ 2005.1.3 EMI A2.13										
EMC		RADIATED EMISSIONS DATA SHEET										
EUT: TrakLITE C4-B		Work Order: 7LAY0037										
Serial Number: 100057		Date: 03/21/05										
Customer: WirelessWERX, Inc.		Temperature: 24										
Attendees: none		Humidity: 31%										
Cust. Ref. No.:		Barometric Pressure: 29.67										
Tested by: Holly Ashkannejhad		Power: 12VDC	Job Site: EV01									
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004		Method: ANSI C63.4:2003										
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
Bluetooth and GSM co-located.												
EUT OPERATING MODES												
Transmitting Bluetooth Channel 74 and GSM (cellular) Channel 132												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS			Run #									
Pass			19									
Other		 Tested By:										
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
22275.000	26.7	9.1	-1.0	1.0	3.0	0.0	I-High Horr	AV	0.0	35.8	54.0	-18.2
22275.000	26.7	9.1	360.0	1.0	3.0	0.0	V-High Horr	AV	0.0	35.8	54.0	-18.2
19800.000	22.9	8.8	360.0	1.0	3.0	0.0	I-High Horr	AV	0.0	31.7	54.0	-22.3
19800.000	22.6	8.8	-1.0	1.0	3.0	0.0	V-High Horr	AV	0.0	31.4	54.0	-22.6
22275.000	40.1	9.1	-1.0	1.0	3.0	0.0	I-High Horr	PK	0.0	49.2	74.0	-24.8
22275.000	39.5	9.1	360.0	1.0	3.0	0.0	V-High Horr	PK	0.0	48.6	74.0	-25.4
19800.000	34.9	8.8	360.0	1.0	3.0	0.0	I-High Horr	PK	0.0	43.7	74.0	-30.3
19800.000	34.3	8.8	-1.0	1.0	3.0	0.0	V-High Horr	PK	0.0	43.1	74.0	-30.9

NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET		ACQ 2005.1.3 EMI A2.13								
EUT: TrakLITE C4-B			Work Order: 7LAY0037									
Serial Number: 100057			Date: 03/21/05									
Customer: WirelessWERX, Inc.			Temperature: 24									
Attendees: none			Humidity: 31%									
Cust. Ref. No.:			Barometric Pressure: 29.67									
Tested by: Holly Ashkannejhad		Power: 12VDC		Job Site: EV01								
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004			Method: ANSI C63.4:2003									
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
Bluetooth and GSM co-located.												
EUT OPERATING MODES												
Transmitting Bluetooth Channel 14 and GSM (cellular) Channel 207												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS					Run #							
Pass					20							
Other												
					 Tested By:							
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
19320.000	25.1	8.0	360.0	1.0	3.0	0.0	V-High Horr	AV	0.0	33.1	54.0	-20.9
19320.000	25.1	8.0	-1.0	1.0	3.0	0.0	I-High Horr	AV	0.0	33.1	54.0	-20.9
19320.000	37.8	8.0	360.0	1.0	3.0	0.0	V-High Horr	PK	0.0	45.8	74.0	-28.2
19320.000	37.4	8.0	-1.0	1.0	3.0	0.0	I-High Horr	PK	0.0	45.4	74.0	-28.6

NORTHWEST		RADIATED EMISSIONS DATA SHEET				ACQ 2005.1.3 EMI A2.13						
EMC												
EUT: TrakLITE C4-B		Work Order: 7LAY0037										
Serial Number: 100057		Date: 03/21/05										
Customer: WirelessWERX, Inc.		Temperature: 24										
Attendees: none		Humidity: 31%										
Cust. Ref. No.:		Barometric Pressure: 29.67										
Tested by: Holly Ashkannejhad		Power: 12VDC		Job Site: EV01								
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004		Method: ANSI C63.4:2003										
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
Bluetooth and GSM co-located.												
EUT OPERATING MODES												
Transmitting Bluetooth Channel 67 and GSM (PCS) Channel 516												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS												
Pass						Run # 21						
Other				 Tested By:								
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
22212.000	25.9	9.0	-1.0	1.0	3.0	0.0	I-High Horr	AV	0.0	34.9	54.0	-19.1
22212.000	25.8	9.0	360.0	1.0	3.0	0.0	V-High Horr	AV	0.0	34.8	54.0	-19.2
22212.000	37.9	9.0	-1.0	1.0	3.0	0.0	I-High Horr	PK	0.0	46.9	74.0	-27.1
22212.000	37.0	9.0	360.0	1.0	3.0	0.0	V-High Horr	PK	0.0	46.0	74.0	-28.0









Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. All of the EUT parameters listed below were investigated. This includes, but may not be limited to, CPU speeds, video resolution settings, operational modes, and input voltages.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

12 VDC
Input Power Setting used for Final Test:
12 VDC

Frequency Range Investigated

Start Frequency	30 MHz	Stop Frequency	26GHz
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Software\Firmware Applied During Test

Operating system	Unknown	Version	Unknown
Exercise software	Unknown	Version	Unknown

Description

The system was tested using special firmware developed to test all functions of the device during the test. The firmware put the radio into a no-hop mode with a modulated carrier. Transmit channels were selectable between the lowest, a middle, and the highest channels in the operating band.

EUT and Peripherals in Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
EUT - TrakLITE	WirelessWERX, Inc.	TrakLITE C4-B	100057
10Amp/13.8VDC Power Supply	RadioShack TM	CAT. No. 22-506	806977
GPS Antenna	LAIPAC Tech	GLP1	334087
GSM Antenna	Radiall/Larsen	MMC/P3ESMA	N/A
Bluetooth Antenna	N/A	N/A	N/A

Remote Equipment Outside of Test Setup Boundary

Description	Manufacturer	Model/Part Number	Serial Number
Computer	Gateway, Inc.	Micro ATX SAN Professional V800 PC	0023764268

Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary.

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	1.3	No	EUT - TrakLITE	10Amp/13.8VDC Power Supply
AC Power	No	1.8	No	10Amp/13.8VDC Power Supply	AC Mains
I/O Leads	No	1.3	No	EUT - TrakLITE	Unterminated
Serial	No	3.0	No	EUT - TrakLITE	Computer
SMA	No	5.2	No	EUT - TrakLITE	GPS Antenna
SMA	No	3.7	No	EUT - TrakLITE	GSM Antenna
SMA	No	3.8	No	EUT - TrakLITE	Bluetooth Antenna

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett Packard	8593E	AAP	12/07/2004	13 mo
Receiver	Schaffner	SCR 3101	ARC	04/28/2003	24 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOM	10/20/2004	13 mo
Antenna, Biconilog	EMCO	3142	AXJ	09/08/2003	24 mo
Antenna, Horn	EMCO	3115	AHB	08/27/2003	24 mo
High Pass Filter	Micro-Tronics	HPM50111	HFM	04/20/2005	13 mo
Pre-Amplifier 0.5-18 GHz	Miteq	AMF-4D-005180-24-10P	APP	05/07/2004	13 mo
Antenna, Horn	EMCO	3160-07	AHP	NCR	NA
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AOK	12/26/2004	13 mo
Antenna, Horn	EMCO	3160-08	AHO	NCR	NA
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AOJ	12/26/2004	13 mo
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/06/2004	13 mo

Test Description

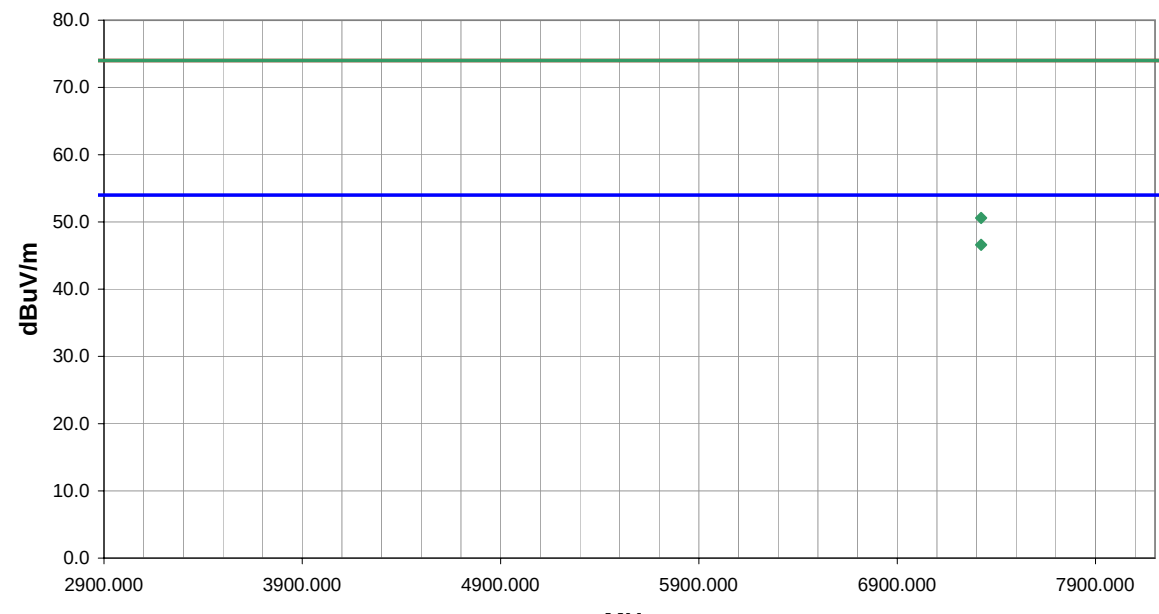
Requirement: The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, is measured. The peak level must comply with the limits specified in 47 CFR 15.35(b). The average level (taken with a 10Hz VBW) must comply with the limits specified in 15.209.

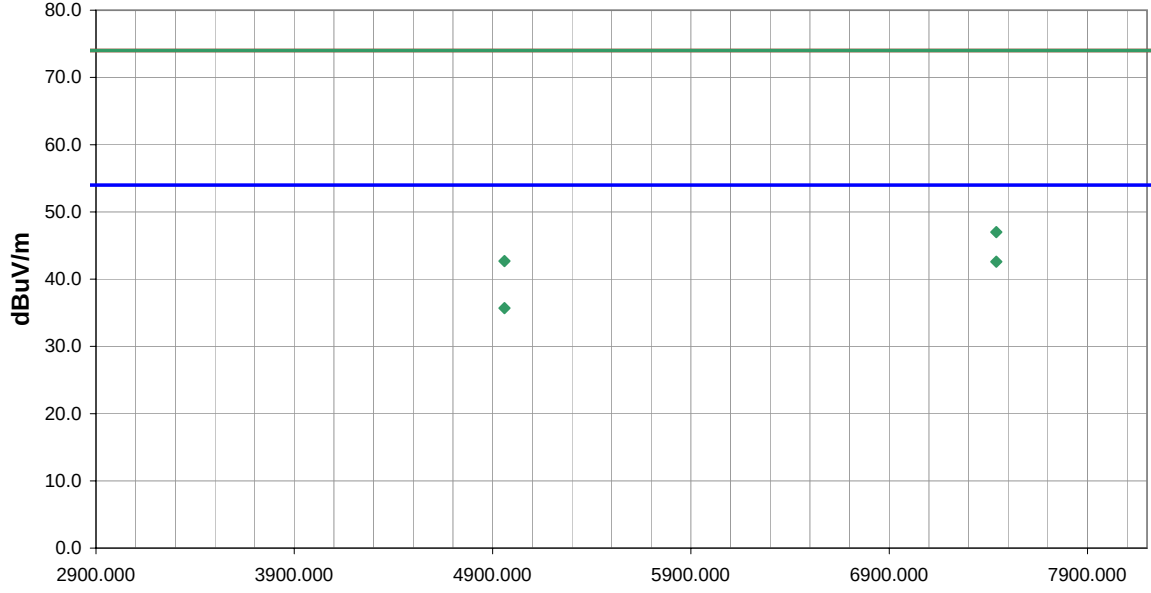
Configuration: The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.4). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

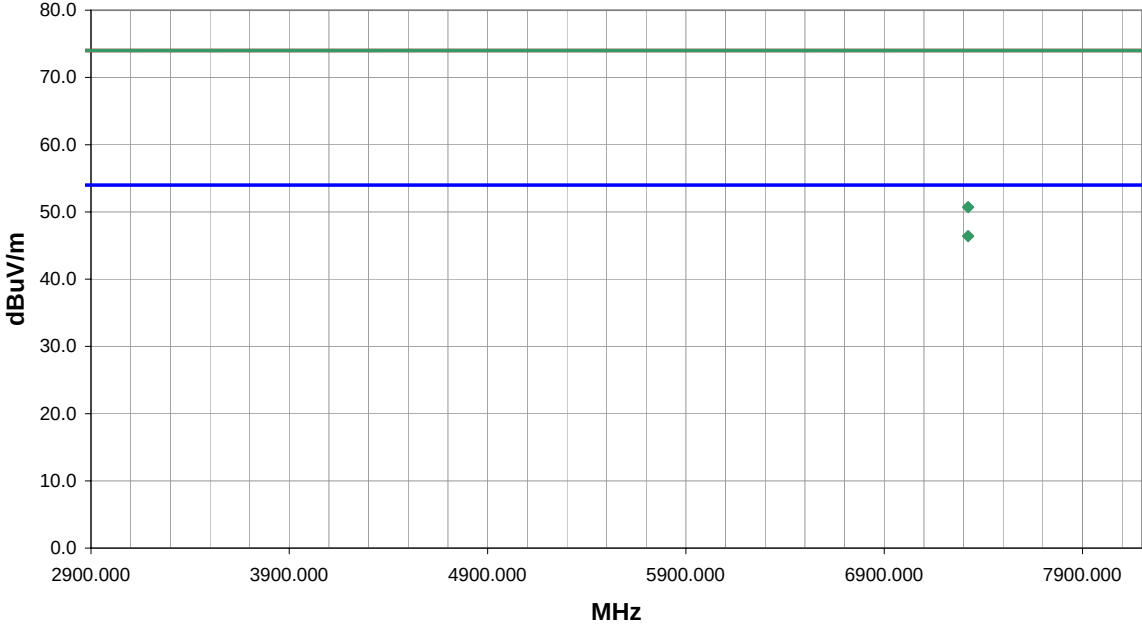
Measurement Bandwidths			
Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
<i>Measurements were made using the bandwidths and detectors specified. No video filter was used.</i>			

Completed by:

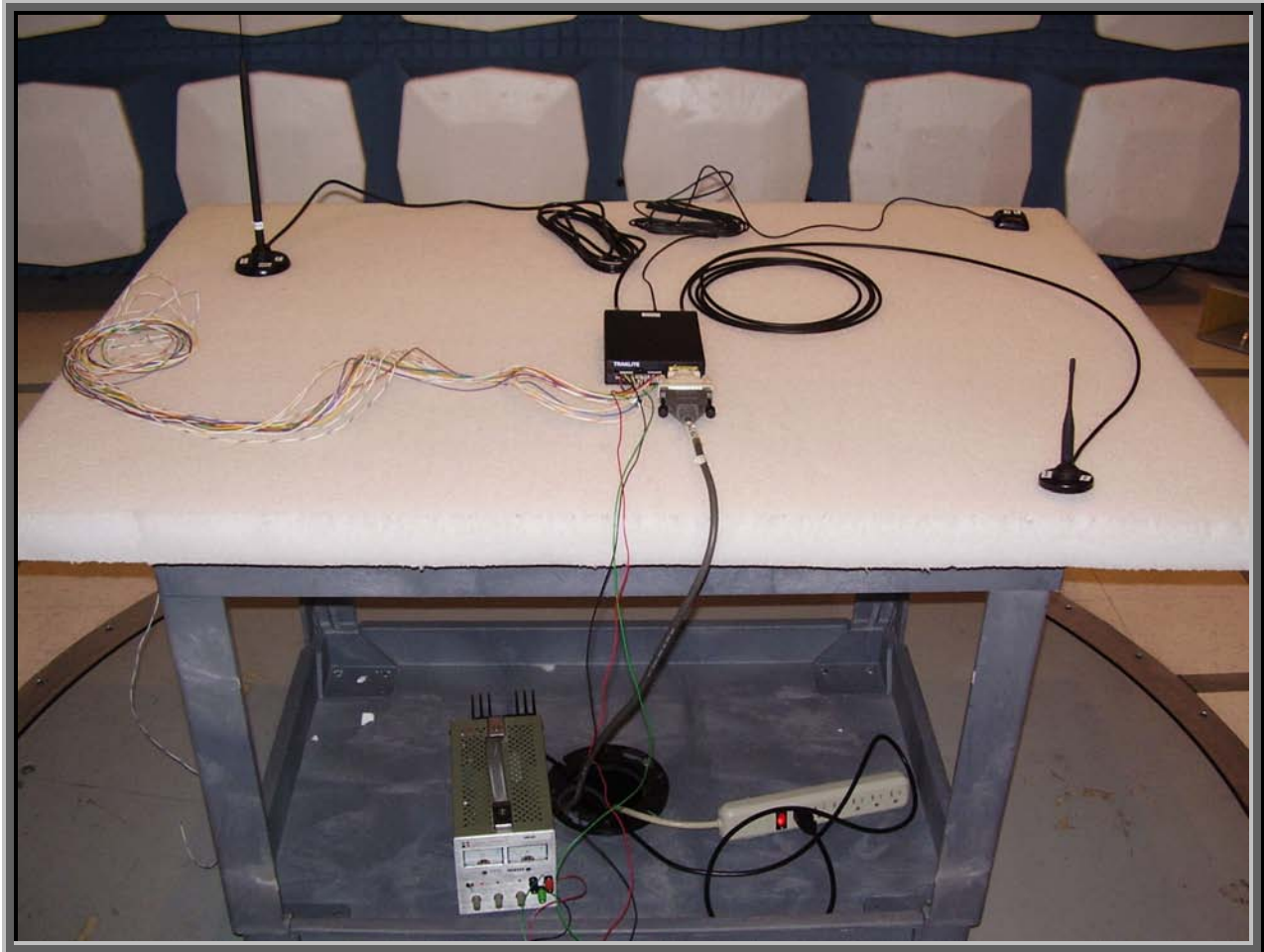


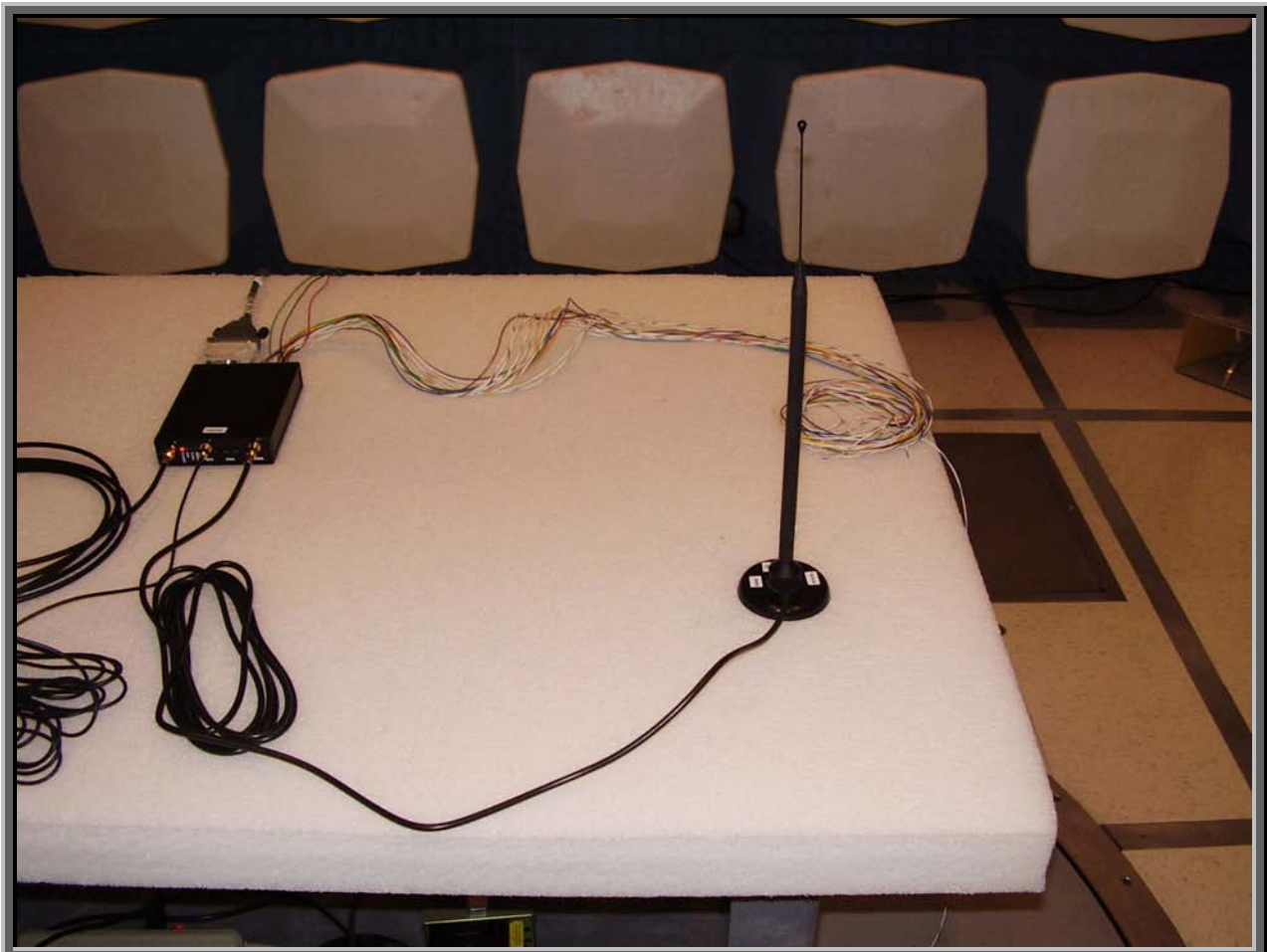
NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET		ACQ 2005.1.3 EMI 2005.1.3								
EUT: TrakLite			Work Order: 7LAY0030									
Serial Number: 100057			Date: 02/23/05									
Customer: WirelessWERX, Inc.			Temperature: 20									
Attendees: none			Humidity: 54%									
Cust. Ref. No.:			Barometric Pressure: 29.98									
Tested by: Jonathan Peng		Power: 12VDC		Job Site: OC10								
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004			Method: ANSI C63.4:2003									
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Transmitting Middle Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS												
Pass			Test Distance (m)		Run #							
			3		5							
Other												
			 Tested By:									
												
Freq (MHz)	Amplitude (dBuV)	Preamp (dB)	Chamber (dB)	Transducer (dB)	Cable (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector (blank equal peaks [pk] from scan)	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
7323.147	34.9	33.0	0.0	36.3	8.4	0.0	V-Horn	AV	0.0	46.6	54.0	-7.4
7323.154	38.9	33.0	0.0	36.3	8.4	0.0	V-Horn	PK	0.0	50.6	74.0	-23.4

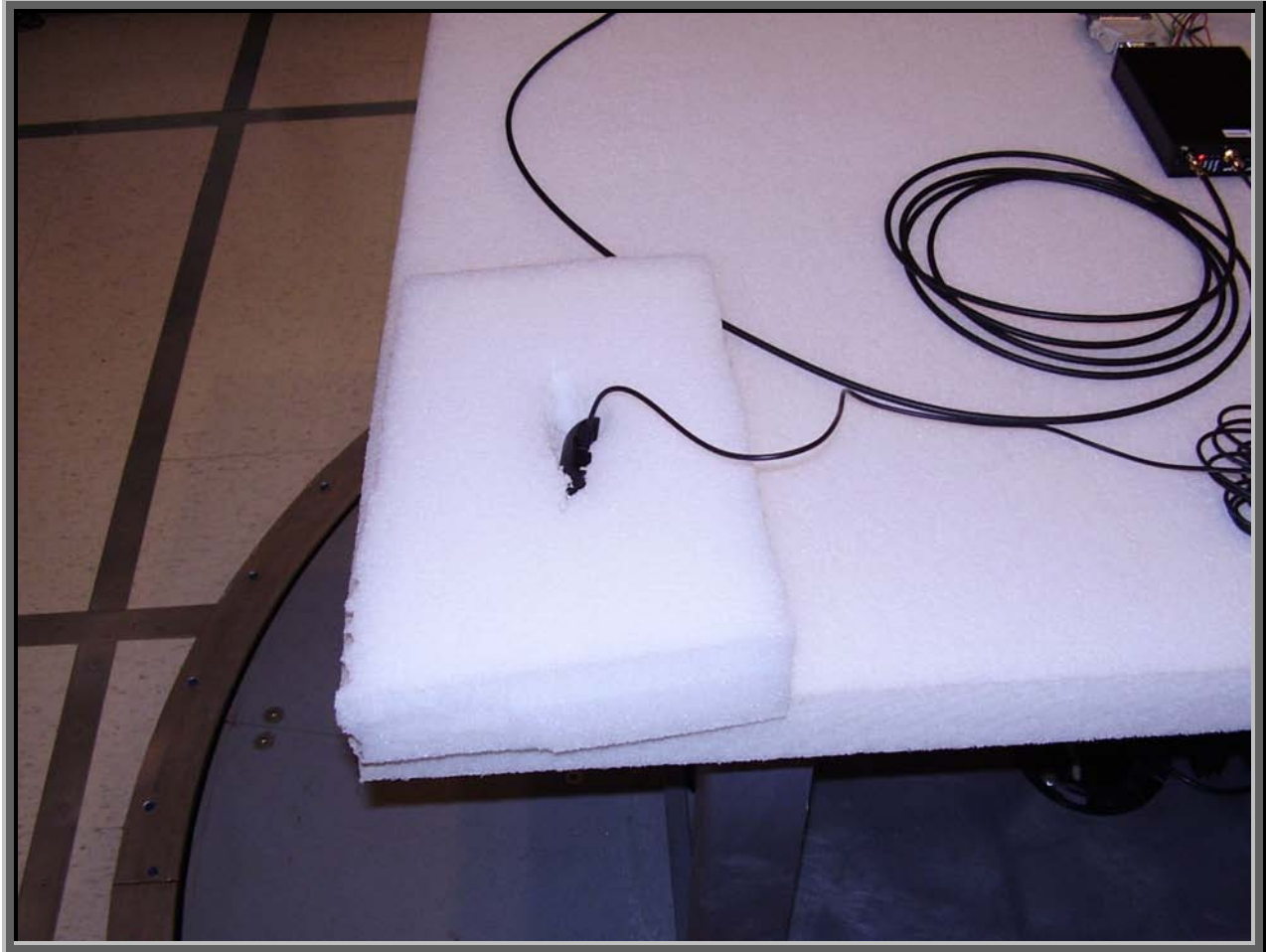
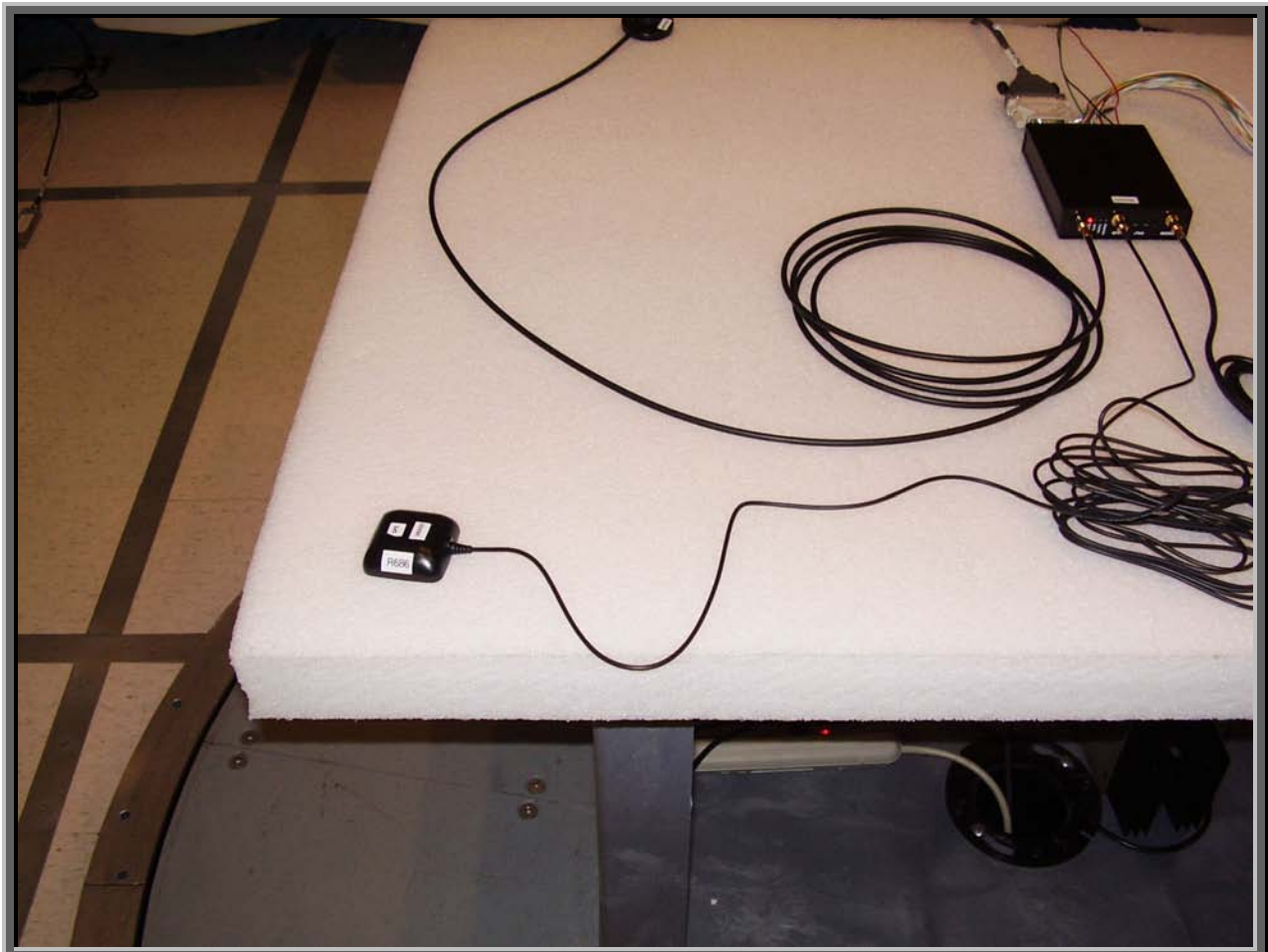
NORTHWEST		RADIATED EMISSIONS DATA SHEET				ACQ 2005.1.3 EMI 2005.1.3						
EMC												
EUT: TrakLite		Work Order: 7LAY0030										
Serial Number: 100057		Date: 02/23/05										
Customer: WirelessWERX, Inc.		Temperature: 20										
Attendees: none		Humidity: 54%										
Cust. Ref. No.:		Barometric Pressure: 29.98										
Tested by: Jonathan Peng		Power: 12VDC		Job Site: OC10								
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004		Method: ANSI C63.4:2003										
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Transmitting High Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS												
Pass		Test Distance (m)		Run #								
		3		6								
Other												
		 Tested By:										
												
Freq (MHz)	Amplitude (dBuV)	Preamp (dB)	Chamber (dB)	Transducer (dB)	Cable (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector (blank equal peaks [pk] from scan)	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
7440.126	30.5	33.0	0.0	36.6	8.5	0.0	V-Horn	AV	0.0	42.6	54.0	-11.4
4960.118	29.0	33.1	0.0	33.4	6.4	0.0	V-Horn	AV	0.0	35.7	54.0	-18.3
7440.126	34.9	33.0	0.0	36.6	8.5	0.0	V-Horn	PK	0.0	47.0	74.0	-27.0
4960.118	36.0	33.1	0.0	33.4	6.4	0.0	V-Horn	PK	0.0	42.7	74.0	-31.3

NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET				ACQ 2005.1.3 EMI 2005.1.3						
EUT: TrakLite		Work Order: 7LAY0030										
Serial Number: 100057		Date: 02/23/05										
Customer: WirelessWERX, Inc.		Temperature: 20										
Attendees: none		Humidity: 54%										
Cust. Ref. No.:		Barometric Pressure: 29.98										
Tested by: Jonathan Peng		Power: 12VDC		Job Site: OC10								
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004		Method: ANSI C63.4:2003										
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
BT Antenna Horizontal												
EUT OPERATING MODES												
Transmitting Middle Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS												
Pass		Test Distance (m) 3		Run # 9								
Other												
		 Tested By:										
												
Freq (MHz)	Amplitude (dBuV)	Preamp (dB)	Chamber (dB)	Transducer (dB)	Cable (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector (blank equal peaks [pk] from scan)	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
7322.982	34.7	33.0	0.0	36.3	8.4	0.0	V-Horn	AV	0.0	46.4	54.0	-7.6
7323.007	39.0	33.0	0.0	36.3	8.4	0.0	V-Horn	PK	0.0	50.7	74.0	-23.3

NORTHWEST		RADIATED EMISSIONS DATA SHEET				ACQ 2005.1.3 EMI 2005.1.3						
EMC												
EUT: TrakLite		Work Order: 7LAY0030										
Serial Number: 100057		Date: 03/25/05										
Customer: WirelessWERX, Inc.		Temperature: 20										
Attendees: none		Humidity: 54%										
Cust. Ref. No.:		Barometric Pressure: 29.98										
Tested by: Jonathan Peng		Power: 12VDC		Job Site: OC10								
TEST SPECIFICATIONS												
Specification: FCC 15.247(d) Spurious Radiated Emissions:2004		Method: ANSI C63.4:2003										
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Transmitting High Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS						Run #						
Pass						2						
Other						 Tested By: _____						
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
2483.500	52.0	-0.2	254.0	1.0	3.0	20.0	V-Horn	PK	0.0	71.8	74.0	-2.2
2483.500	28.8	-0.2	254.0	1.0	3.0	20.0	V-Horn	AV	0.0	48.6	54.0	-5.4
2483.500	45.4	-0.2	276.0	1.0	3.0	20.0	H-Horn	PK	0.0	65.2	74.0	-8.8
2483.500	25.3	-0.2	276.0	1.0	3.0	20.0	H-Horn	AV	0.0	45.1	54.0	-8.9









BLUETOOTH APPROVALS

FCC Procedure Received from Joe Dichoso on 2-15-02

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4 GHz band as of February 2001 operating in the USA. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit provides items that vary for each device and also provides a list of items that are common to Bluetooth devices that explains the remaining requirements. The list of common items can be submitted for each application for equipment authorization. This exhibit only specifies requirements in Section 15.247, requirements in other rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed. A Bluetooth device is a FHSS transmitter in the data mode and applies as a Hybrid spread spectrum device in the acquisition mode.

For each individual device, the following items, 1-7 will vary from one device to another and must be submitted.

- 1) The occupied bandwidth in Section 15.247(a)(1)(ii).
- 2) Conducted output power specified in Section 15.247(b)(1).
- 3) EIRP limit in Section 15.247(b)(3).
- 4) RF safety requirement in Section 15.247(b)(4)
- 5) Spurious emission limits in Section 15.247(c).
- 6) Processing gain and requirements for Hybrids in Section 15.247(f) in the acquisition mode.
- 7) Power spectral density requirement in Section 15.247(f) in the acquisition mode.

For all devices, the following items, 1-12, are common to all Bluetooth devices and will not vary from one device to another. This list can be copied into the filing.

1 Output power and channel separation of a Bluetooth device in the different operating modes:

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device don't influence the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.

Only a different hopping sequence will be used. For this reason, the RF parameters in one op-mode is sufficient.

2 Frequency range of a Bluetooth device:

The maximum frequency of the device is: **2402 – 2480 MHz**.

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for devices which will be operated in the USA. Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification must **not be** supported by the device.

3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:

Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

4 Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,
01, 51, 03, 55, 05, 04

5 Equally average use of frequencies in data mode and short transmissions:

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 μ s. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions, the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 μ s). The hopping sequence will always differ from the first one.

6 Receiver input bandwidth, synchronization and repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz.

In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence

7 Dwell time in data mode

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = 625 μ s * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = $5 * 625 \mu s * 1600 * 1/5 * 1/s / 79 * 30s = 0.3797s$ (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.

This was checked during the Bluetooth Qualification tests.

The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

8 Channel Separation in hybrid mode

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.

The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is $f_{center} = 75 \text{ kHz}$.

This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

9 Derivation and examples for a hopping sequence in hybrid mode

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see item 5), but this time with different input vectors:

****For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.**

****For the page hop sequence, the device address of the paged unit is used as the input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.**

So it is ensured that also in hybrid mode, the frequency is used equally on average.

Example of a hopping sequence in inquiry mode:

48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23

Example of a hopping sequence in paging mode:

08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

10 Receiver input bandwidth and synchronization in hybrid mode:

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code and the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced.

11 Spread rate / data rate of the direct sequence signal

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate / Data rate will be 68/1.

12 Spurious emission in hybrid mode

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.