SPARQ Training

Handheld

January 11, 2006

Report No. SPRQ0001.1

Report Prepared By

NORTHWEST EMC

www.nwemc.com
1-888-EMI-CERT

EMC Test Report

NORTHWEST EMC

22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Issue Date: January 11, 2006
SPARQ Training
Model: Handheld

Emissions				
Test Description	**Specification**	**Test Method**	**Pass**	**Fail**
Occupied Bandwidth	FCC 15.247(a)(1)(i) Occupied Bandwidth:2005-9	ANSI C63.4:2003	☒	☐
Channel Spacing	FCC 15.247(a)(1) Channel Spacing:2005-9	ANSI C63.4:2003	☒	☐
Dwell Time	FCC 15.247(a)(1)(i) Dwell Time:2005-9	ANSI C63.4:2003	☒	☐
Number of Hopping Frequencies	FCC 15.247(a)(1)(i) Number of Hopping Frequencies:2005-9	ANSI C63.4:2003	☒	☐
Output Power	FCC 15.247(b)(2) Output Power:2005-9	ANSI C63.4:2003	☒	☐
Band Edge Compliance	FCC 15.247(d) Band Edge Compliance:2005-9	ANSI C63.4:2003	☒	☐
Spurious Conducted Emissions	FCC 15.247(d) Spurious Conducted Emissions:2005-9	ANSI C63.4:2003	☒	☐
Spurious Radiated Emissions	FCC 15.247(d) Spurious Radiated Emissions:2005-9	ANSI C63.4:2003	☒	☐
Radiated Emissions	FCC 15.109(g) (CISPR 22:1997) Class B:2005-10	ANSI C63.4:2003	☒	☐

Modifications made to the product
See the Modifications section of this report

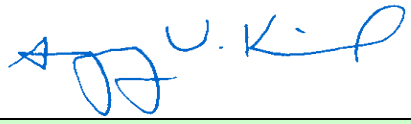
Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.
22975 NW Evergreen Parkway, Suite 400; Hillsboro, OR 97124
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:



Greg Kiemel, Director of Engineering

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
00	None		

Accreditations and Authorizations

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.

200629-0
200630-0
200676-0

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 TUV Product Service Group's Listing of Recognized Laboratories. It qualifies in connection with the TUV Certification after Recognition of Agent's Testing Program for the product categories and/or standards shown in TUV's current Listing of CARAT Laboratories, available from TUV. A certificate was issued to represent that this laboratory continues to meet TUV'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?

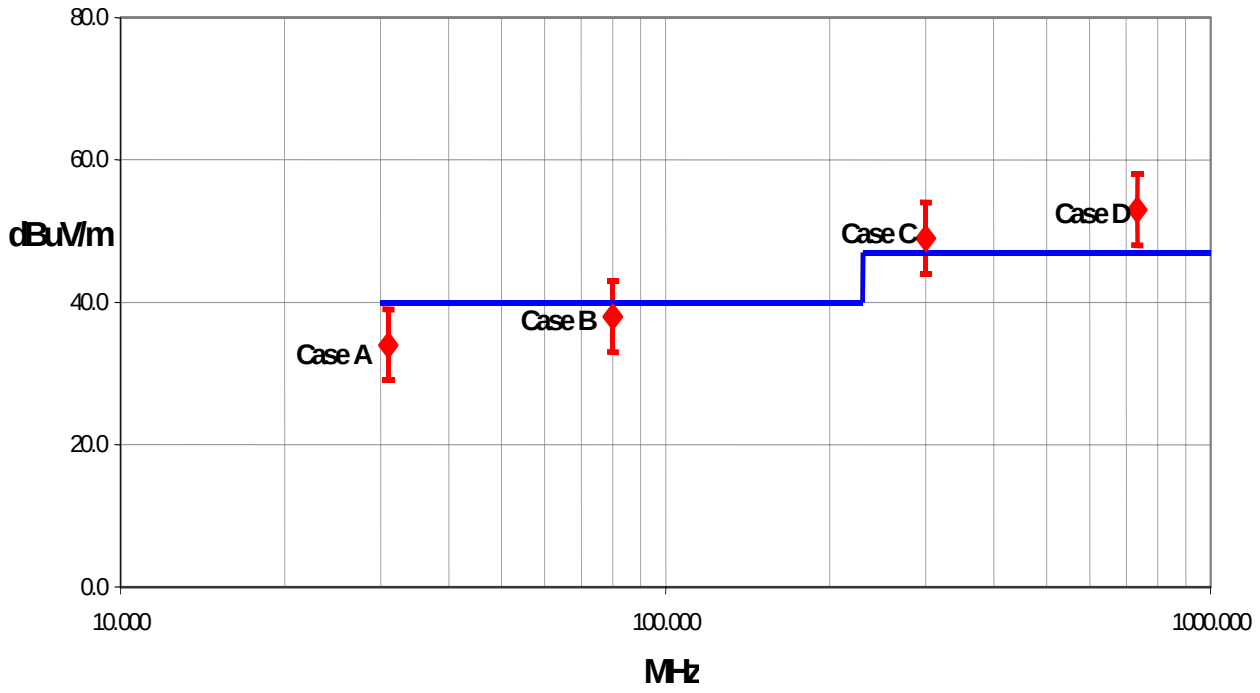
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following 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)					
	Probability Distribution	Biconical Antenna		Log Periodic Antenna		Dipole Antenna	
Test Distance		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 ≈ 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)		
	Probability Distribution	Without High Pass Filter	With High Pass Filter
Combined standard uncertainty $u_c(y)$	normal	+ 1.29 - 1.25	+ 1.38 - 1.35
Expanded uncertainty ***U*** (level of confidence ≈ 95%)	normal (k=2)	+ 2.57 - 2.51	+ 2.76 - -2.70

Conducted Emissions		
	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.48
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.97

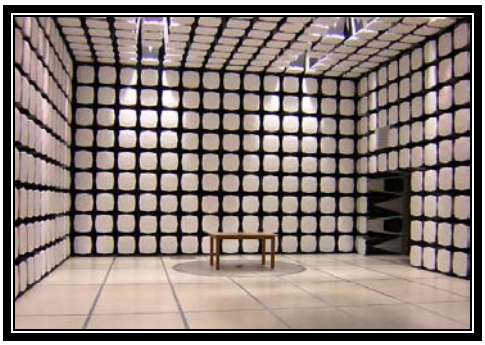
Radiated Immunity		
	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.05
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.11

Conducted Immunity		
	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.05
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.10

Legend

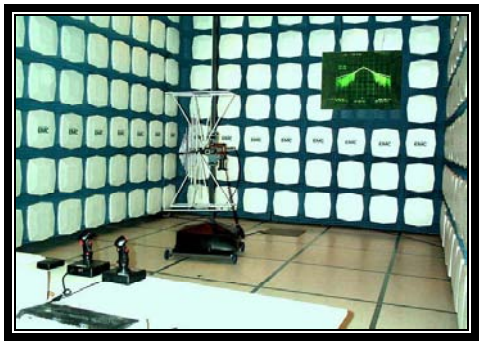
$u_c(y)$ = square root of the sum of squares of the individual standard uncertainties

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, uc(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

Washington – Sultan Facility
Labs SU01 – SU07

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

Party Requesting the Test	
Company Name:	SPARQ Training
Address:	411 NW 13th Avenue
City, State, Zip:	Porltand, OR 97209
Test Requested By:	Hamid Arjomand
Model:	Handheld
First Date of Test:	January 5, 2006
Last Date of Test:	January 9, 2006
Receipt Date of Samples:	January 4, 2006
Equipment Design Stage:	Prototype
Equipment Condition:	No visual damage.

Information Provided by the Party Requesting the Test

Clocks/Oscillators:	Not provided.
I/O Ports:	None

Functional Description of the EUT (Equipment Under Test):

The Digital Cone and Handheld are used in athletic gym or field environments to measure athlete performance. Optical sensors in the Digital Cone(s) detect passage of athletes and transmit timing data to the Handheld unit.

Client Justification for EUT Selection:

The product is an engineering sample, representative of the final product.

The radio in the Digital Cone is identical to the radio in the Handheld; so direct connect measurements on only one unit will be representative for both units. Both the Digital Cone and Handheld are battery powered with no provision for transmitting while powered from the AC mains.

Client Justification for Test Selection:

TCB Certification.

Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	1/5/2006	Spurious Radiated Emissions	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	1/6/2006	Dwell Time	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	1/6/2006	Number of Hopping Frequencies	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	1/6/2006	Occupied Bandwidth	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	1/6/2006	Output Power	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
6	1/6/2006	Band Edge Compliance	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
7	1/6/2006	Channel Spacing	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
8	1/9/2006	Radiated Emissions from Receiver and Digital Portion	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
9	1/9/2006	Spurious Conducted Emissions	Same configuration as delivered.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

RADIATED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

MODES OF OPERATION

Receive mode

MODE USED FOR FINAL DATA

Receive mode

POWER SETTINGS INVESTIGATED

Battery

POWER SETTINGS USED FOR FINAL DATA

Battery

FREQUENCY RANGE INVESTIGATED

Start Frequency	30MHz	Stop Frequency	1000MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Pre-Amplifier	Miteq	AM-1551	AOY	11/28/2005	13
Antenna, Biconilog	EMCO	3142	AXB	1/6/2005	24
Spectrum Analyzer	Agilent	E4443A	AAS	12/8/2005	12

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

Measurements were made using the bandwidths and detectors specified. No video filter was used.

MEASUREMENT UNCERTAINTY

Measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" or theoretically correct value. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. In the case of transient tests our test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements. The measurement uncertainty for any test is available upon request.

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, a final radiated emissions test was performed. The frequency range investigated (scanned), is also noted in this report. Radiated emissions measurements were made at the EUT azimuth and antenna height such that the maximum radiated emissions level will be detected. This requires the use of a turntable and an antenna positioner. The preferred method of a continuous azimuth search is utilized for frequency scans of the EUT field strength with both polarities of the measuring antenna. A calibrated, linearly polarized antenna was positioned at the specified distance from the periphery of the EUT.

Tests were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. Though specified in the report, the measurement distance shall be 3 meters or 10 meters. At any measurement distance, the antenna height was varied from 1 meter to 4 meters. These height scans apply for both horizontal and vertical polarization, except that for vertical polarization the minimum height of the center of the antenna shall be increased so that the lowest point of the bottom of the antenna clears the ground surface by at least 25 cm.

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

PSA 2005.01.05
EMI 2006.1.5

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22
Attendees:	None			Humidity:	34%
Project:	None			Barometric Pres.:	30.02
Tested by:	Travis Rychener	Power:	Battery	Job Site:	EV11

TEST SPECIFICATIONS	Test Method
FCC 15.109(g) (CISPR 22:1997) Class B:2005-10	ANSI C63.4:2003

TEST PARAMETERS			
Antenna Height(s) (m)	1 - 4	Test Distance (m)	10

COMMENTS

EUT OPERATING MODES

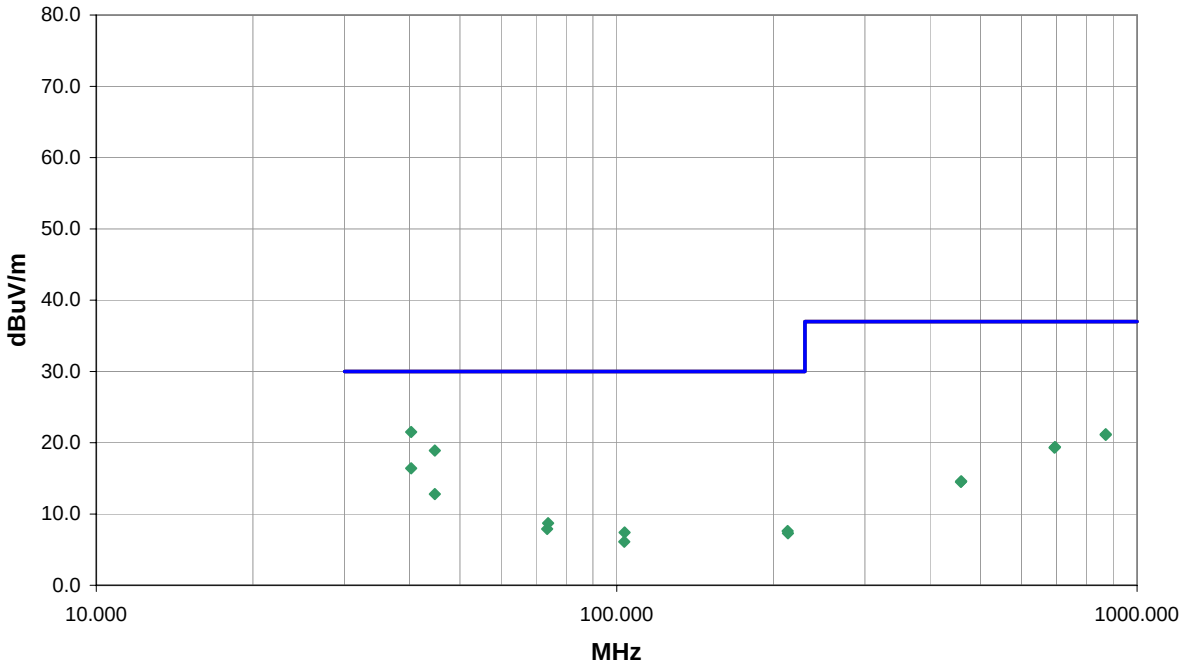
Receive mode

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2
Configuration #	1
Results	Pass

Signature



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)
40.275	42.2	-20.7	145.0	1.0	10.0	0.0	V-Bilog	QP	0.0	21.5	30.0	-8.5
44.721	41.2	-22.3	205.0	3.9	10.0	0.0	V-Bilog	QP	0.0	18.9	30.0	-11.1
40.267	37.1	-20.7	191.0	1.0	10.0	0.0	H-Bilog	QP	0.0	16.4	30.0	-13.6
870.697	31.0	-9.8	250.0	3.6	10.0	0.0	V-Bilog	QP	0.0	21.2	37.0	-15.8
870.734	30.9	-9.8	54.0	1.1	10.0	0.0	H-Bilog	QP	0.0	21.1	37.0	-15.9
44.717	35.1	-22.3	354.0	3.1	10.0	0.0	H-Bilog	QP	0.0	12.8	30.0	-17.2
695.539	30.9	-11.5	150.0	2.8	10.0	0.0	V-Bilog	QP	0.0	19.4	37.0	-17.6
694.221	30.8	-11.5	300.0	1.0	10.0	0.0	H-Bilog	QP	0.0	19.3	37.0	-17.7
73.850	36.5	-27.8	170.0	2.5	10.0	0.0	V-Bilog	QP	0.0	8.7	30.0	-21.3
73.535	35.7	-27.8	131.0	2.3	10.0	0.0	H-Bilog	QP	0.0	7.9	30.0	-22.1
213.007	30.6	-23.0	201.0	1.0	10.0	0.0	V-Bilog	QP	0.0	7.6	30.0	-22.4
459.182	30.4	-15.8	192.0	1.0	10.0	0.0	V-Bilog	QP	0.0	14.6	37.0	-22.4
458.725	30.3	-15.8	181.0	1.0	10.0	0.0	H-Bilog	QP	0.0	14.5	37.0	-22.5
103.559	34.7	-27.3	201.0	1.7	10.0	0.0	H-Bilog	QP	0.0	7.4	30.0	-22.6
213.417	30.3	-23.0	195.0	2.4	10.0	0.0	H-Bilog	QP	0.0	7.3	30.0	-22.7
103.440	33.4	-27.3	348.0	2.9	10.0	0.0	V-Bilog	QP	0.0	6.1	30.0	-23.9

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:
All

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

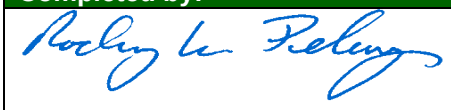
Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4443A	AAS	12/08/2005	12 mo

Test Description

Requirement: Per 47 CFR 15.247(a)(1), the hopping channel carrier frequencies must be separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The measurement is made with the spectrum analyzer's resolution bandwidth set to greater than or equal to 1% of the span, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The carrier frequency separation was measured between each of 2 hopping channels in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

Completed by:



NORTHWEST EMC

CHANNEL SPACING

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV11

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

If the occupied bandwidth is less than 250 kHz, the system shall use at least 50 hopping frequencies.

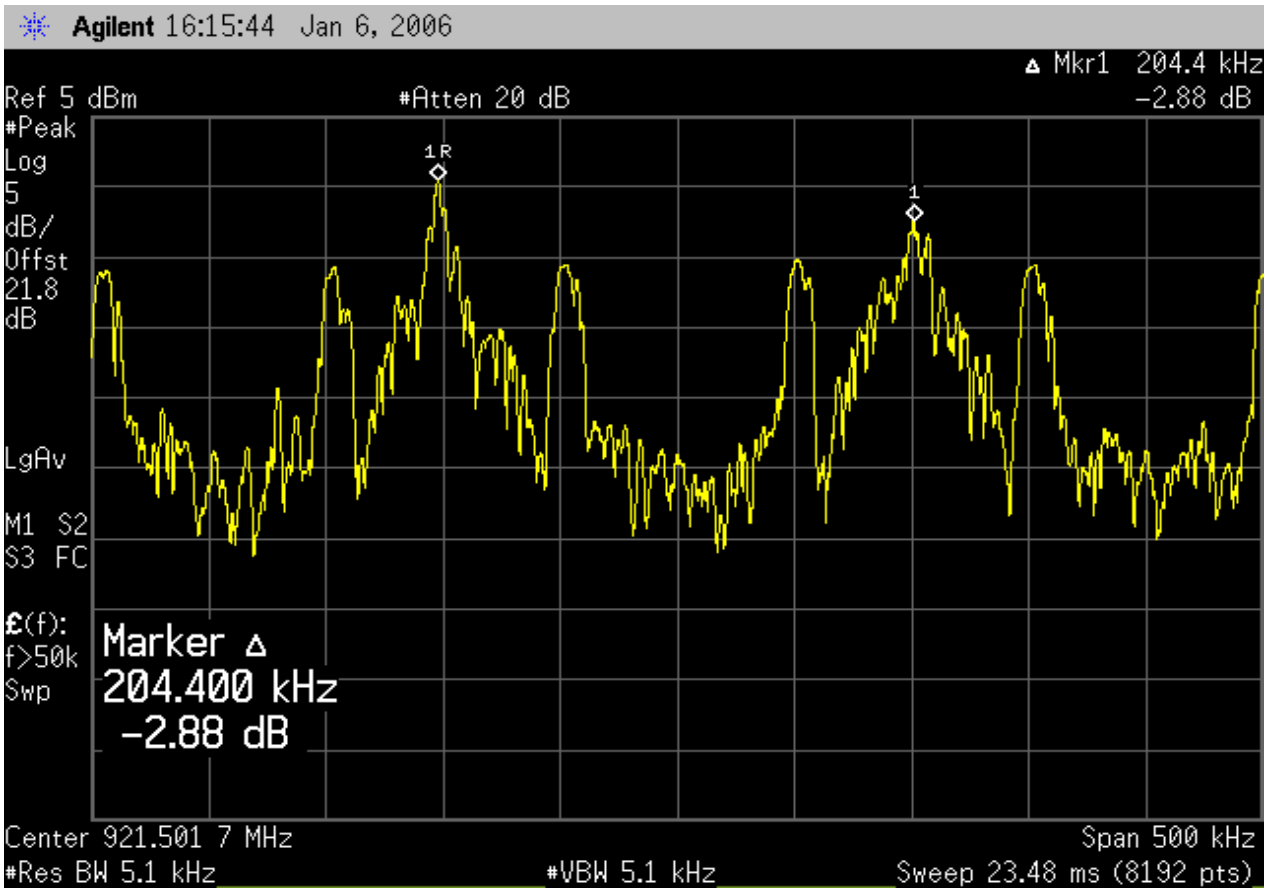
RESULTS	CHANNEL SPACING
Pass	204.4 kHz

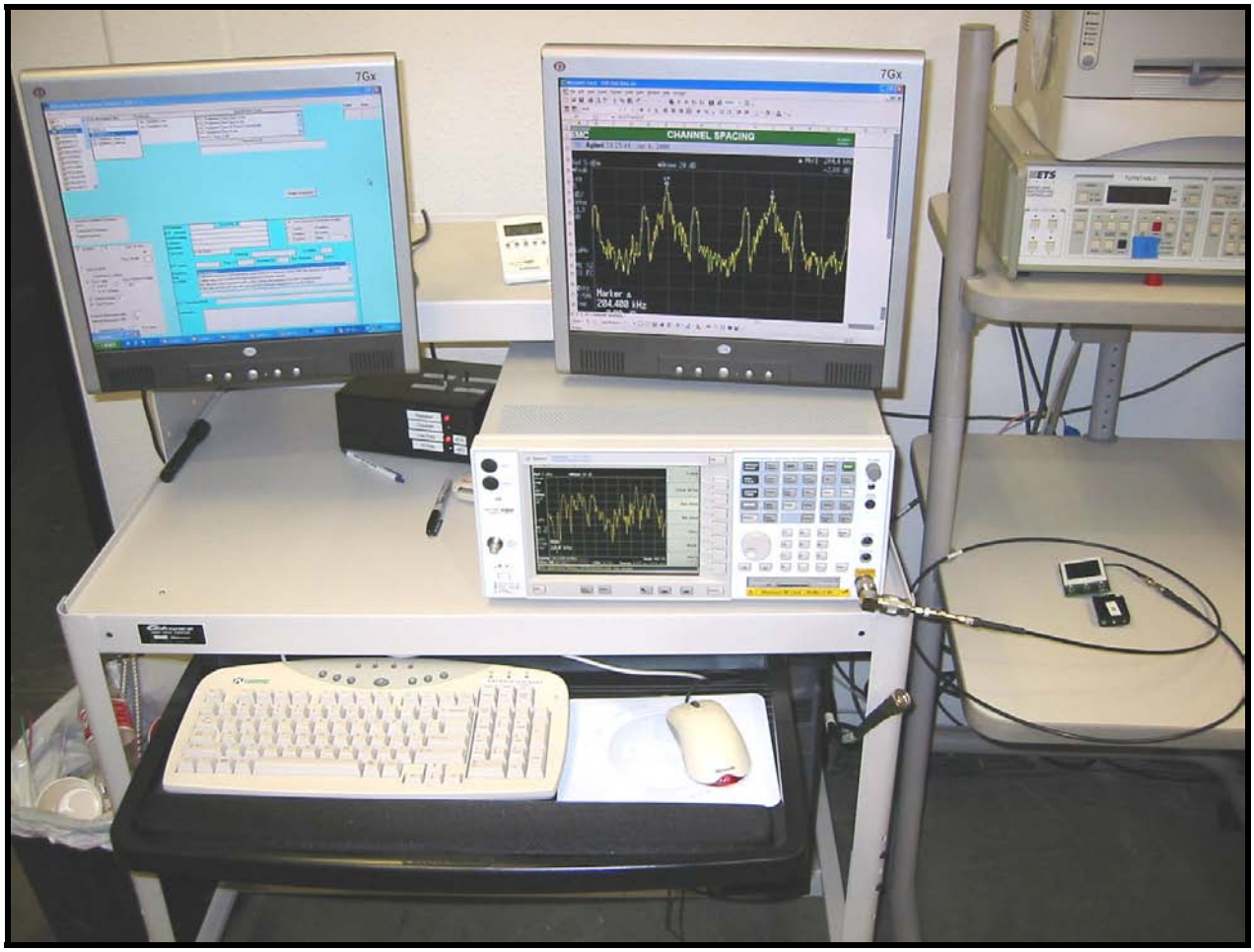
SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Channel Spacing




7Gx
7Gx
CHANNEL SPACING
Marker 1
284.480 kHz
ETS

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:
Mid

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4446A	AAQ	06/15/2005	12 mo

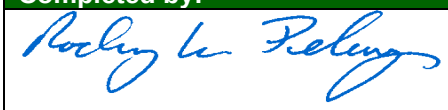
Test Description

Requirement: Per 47 CFR 15.247(a)(1), the average dwell time per hopping channel is measured. For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

The measurement is made with the spectrum analyzer's span set to zero, the resolution bandwidth set to 1 MHz, and the video bandwidth set to 7 MHz. The measurement is made in two steps. First, the sweep speed is adjusted to capture the pulse width or dwell time of a single transmission. Then, the sweep speed is set to 30 seconds to count the number of transmissions during that period. The dwell time of a single transmission multiplied by the number of transmissions during a 30 second period equals the average time of occupancy during a 30 second period.

Configuration: The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

Completed by:



NORTHWEST
EMC

DWELL TIME

Rev BETA
01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Total Dwell time = (Dwell Time during a single transmission) X (Number of transmissions during a 20 second period)
Total Dwell time = (2.033) X (8) = 1.626 mS

COMMENTS

EUT OPERATING MODES

Modulated by PRBS at maximum data rate. Hopping carrier.

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

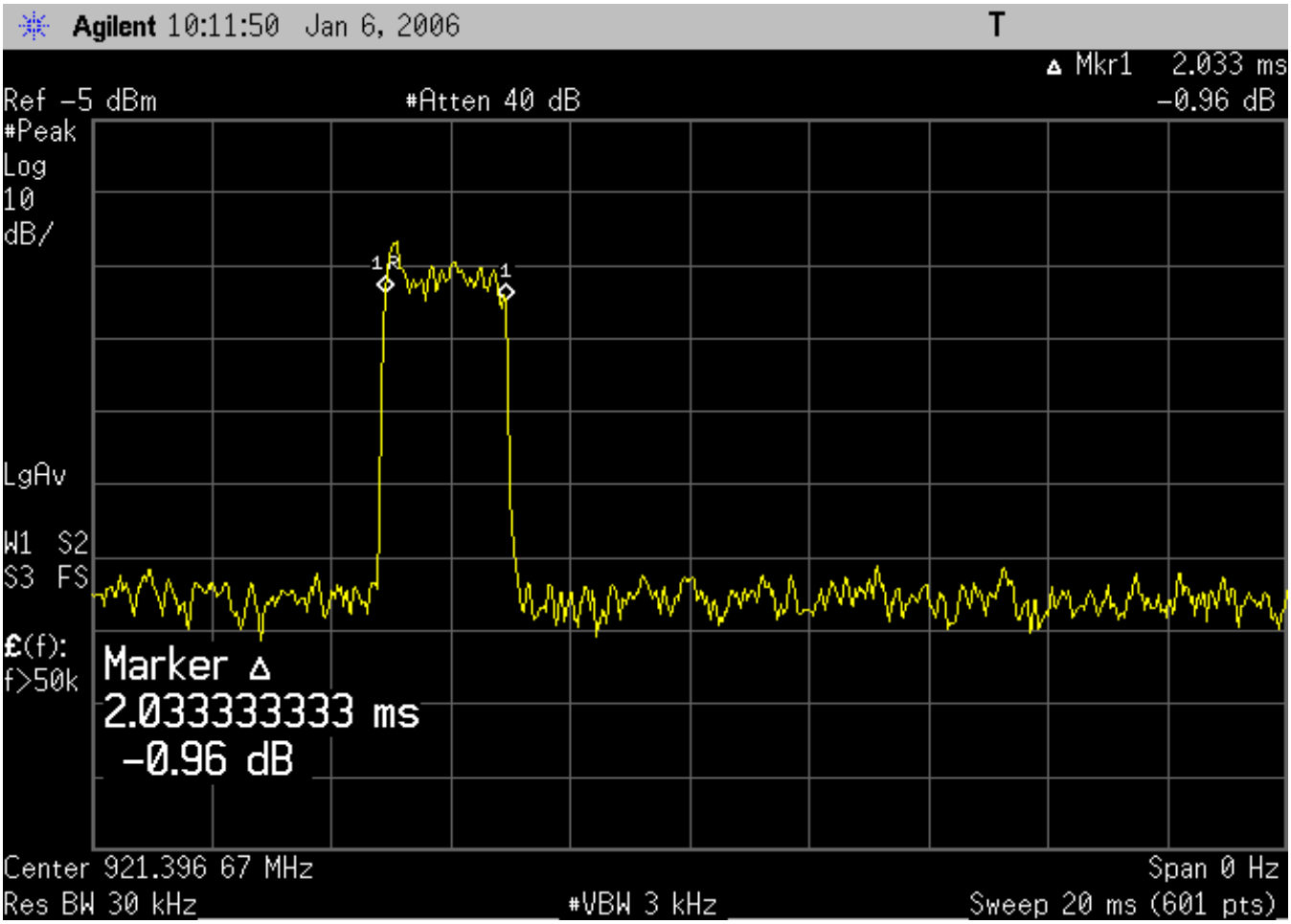
RESULTS	DWELL TIME DURING A SINGLE TRANSMISSION
Pass	2.033 mS

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Time of Occupancy (Dwell Time) - Single Transmission



NORTHWEST
EMC

DWELL TIME

Rev BETA
01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Total Dwell time = (Dwell Time during a single transmission) X (Number of transmissions during a 20 second period)
Total Dwell time = (2.033) X (8) = 1.626 mS

COMMENTS

EUT OPERATING MODES

Modulated by PRBS at maximum data rate. Hopping carrier.

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

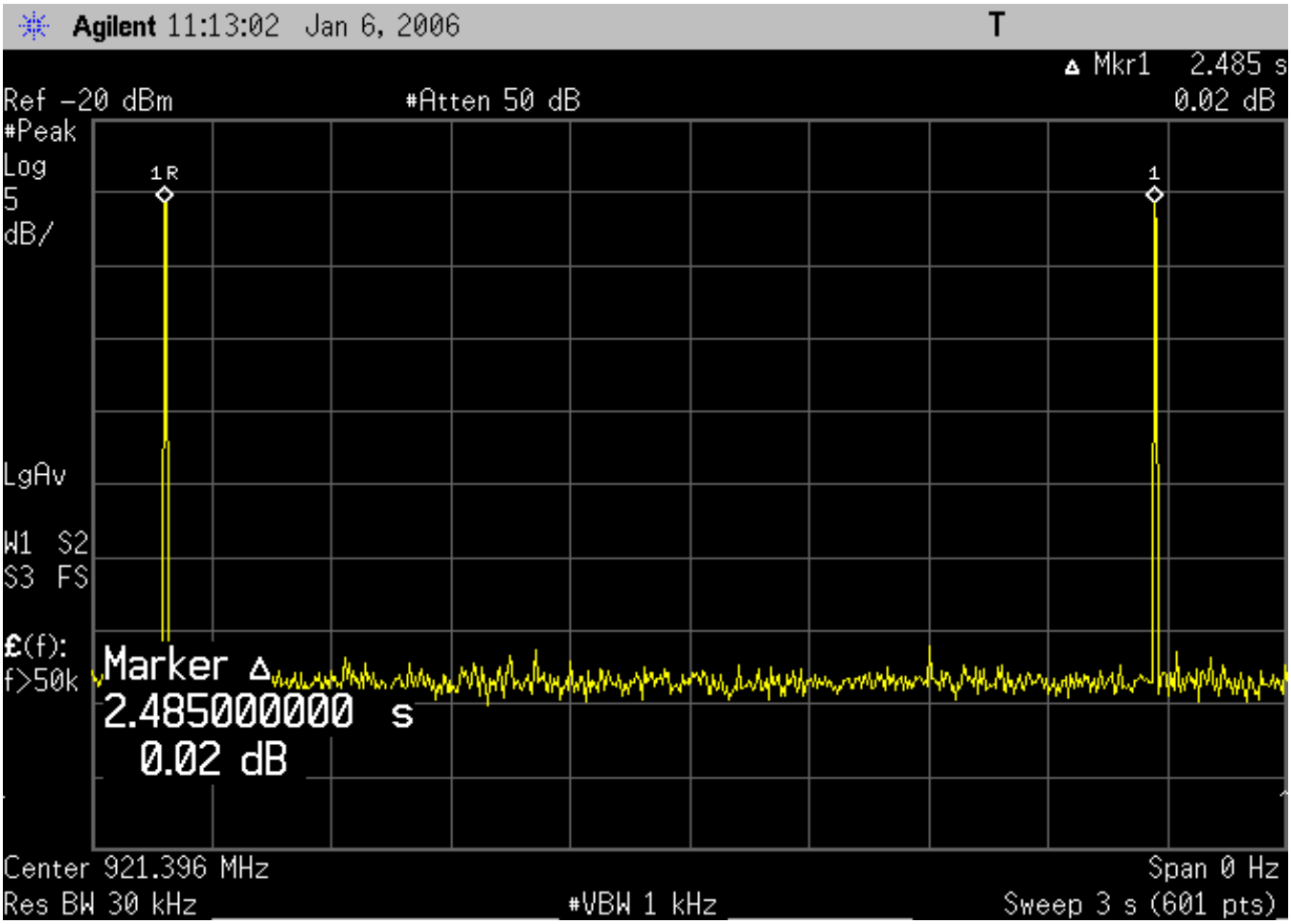
RESULTS	TOTAL PERIOD
Pass	2.845 Seconds

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Time of Occupancy (Dwell Time) - Period



NORTHWEST
EMC

DWELL TIME

Rev BETA
01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Total Dwell time = (Dwell Time during a single transmission) X (Number of transmissions during a 20 second period)
Total Dwell time = (2.033) X (8) = 1.626 mS

COMMENTS

EUT OPERATING MODES

Modulated by PRBS at maximum data rate. Hopping carrier.

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

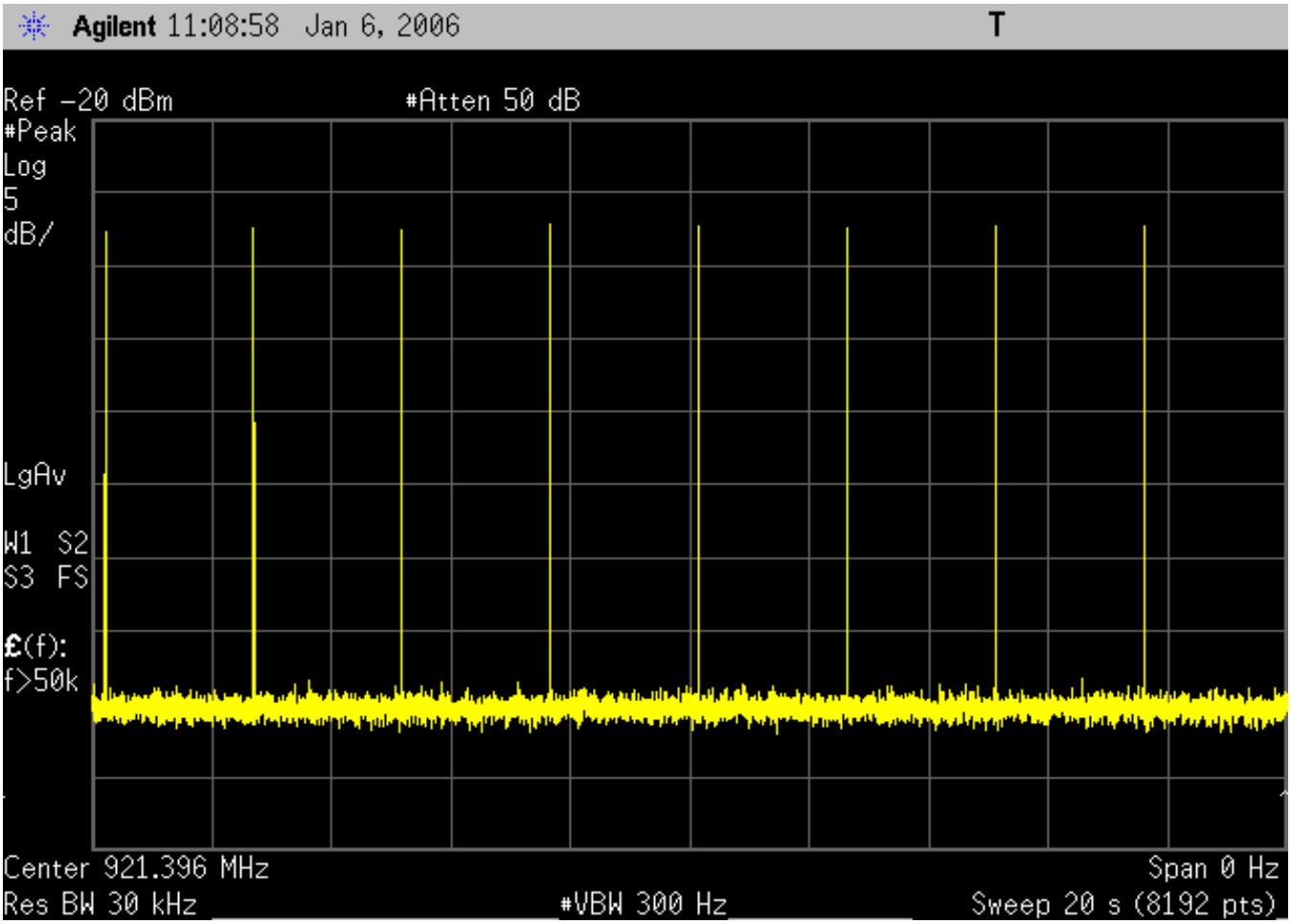
RESULTS	NUMBER OF TRANSMISSIONS DURING A 20 SECOND PERIOD
Pass	8

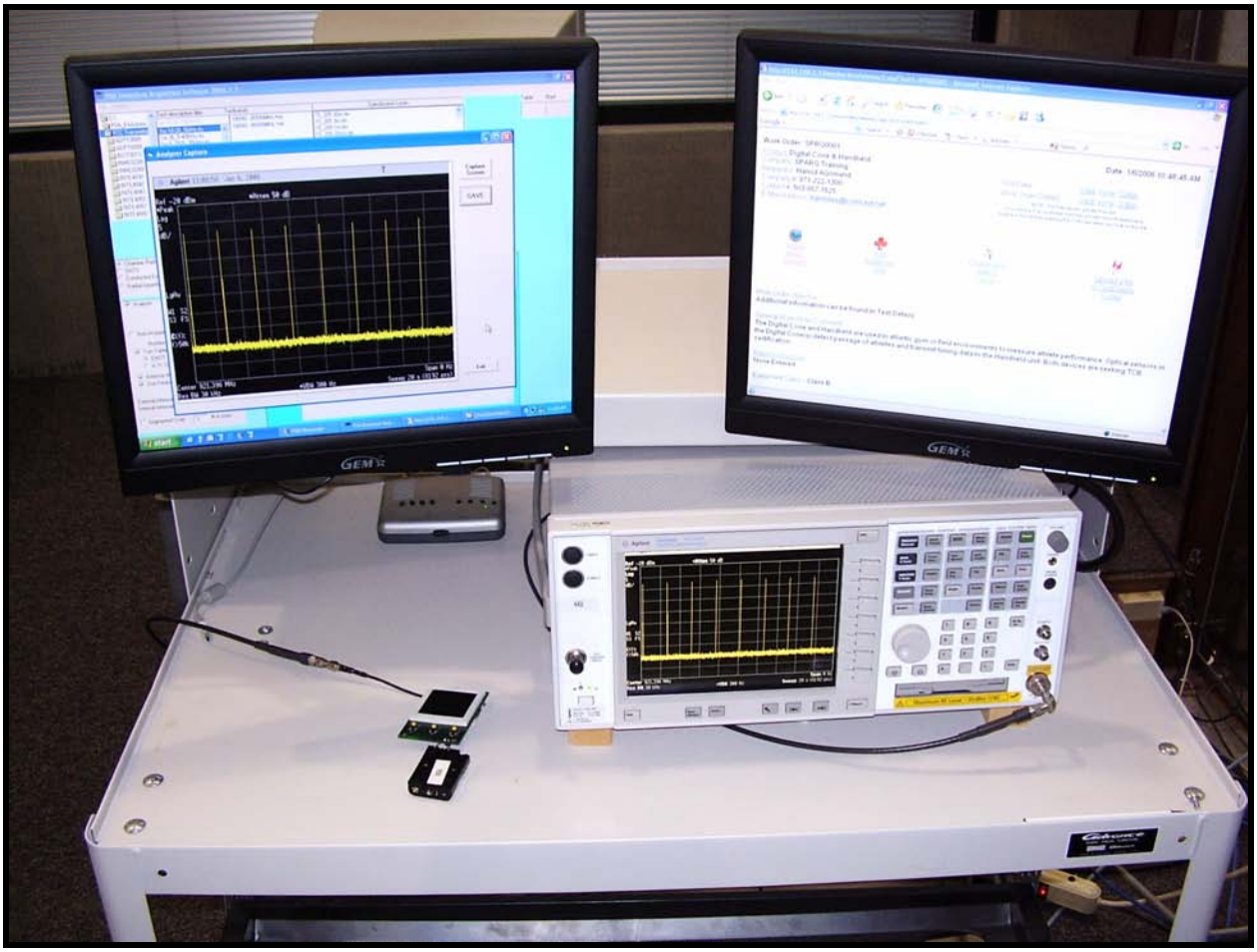
SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Time of Occupancy (Dwell Time) - Number of transmissions during a 20 second period





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:
All

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4446A	AAQ	06/15/2005	12 mo

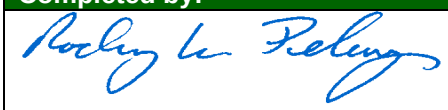
Number of Hopping Frequencies

Test Description

Requirement: Per 47 CFR 15.247(a)(1)(iii), the number of hopping channels must be at least 75. 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 number of hopping frequencies was measured across the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

Completed by:



NORTHWEST EMC

NUMBER OF HOPPING FREQUENCIES

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

If the occupied bandwidth is less than 250 kHz, the system shall use at least 50 hopping frequencies.

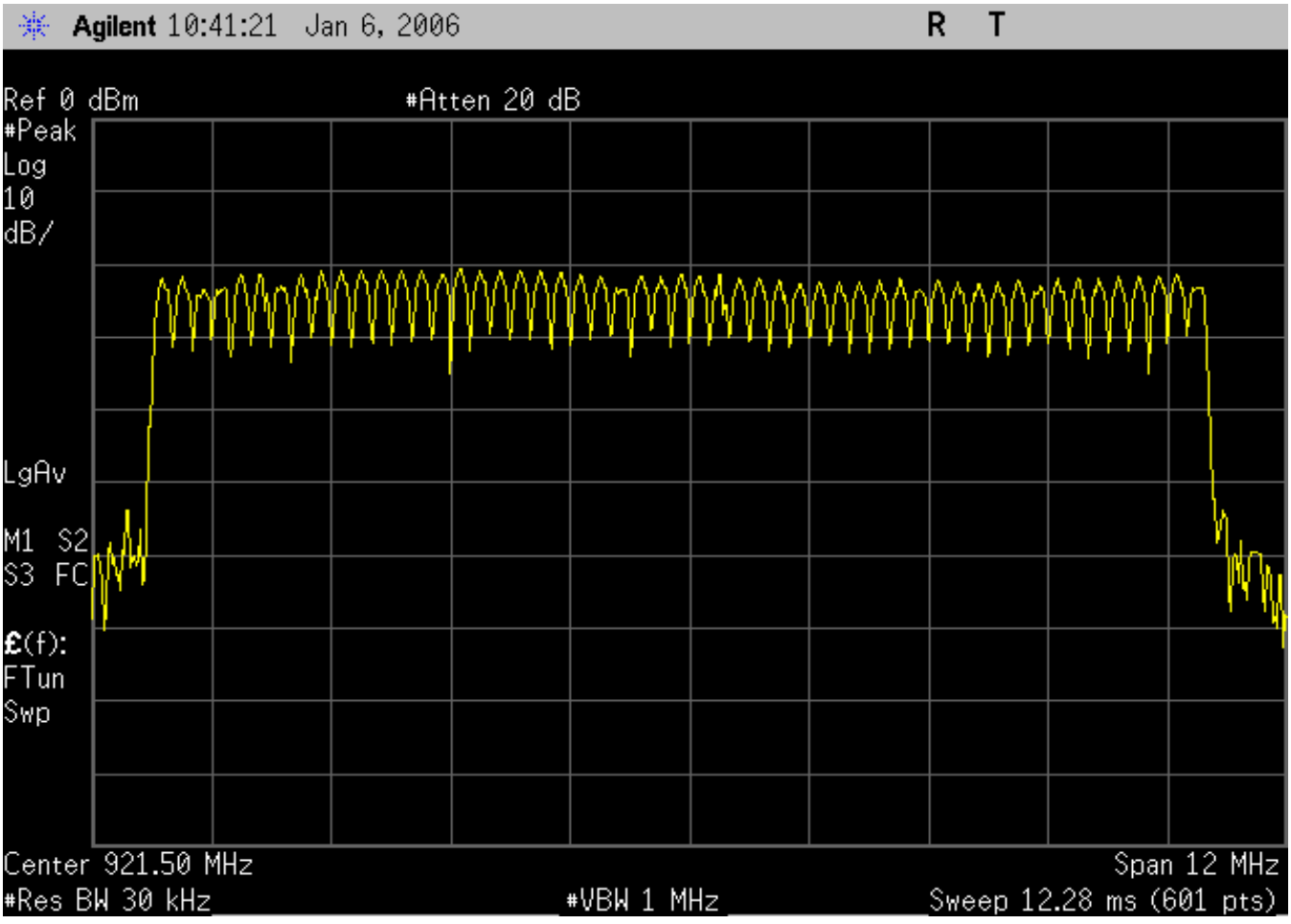
RESULTS	NUMBER OF HOPPING FREQUENCIES
Pass	53

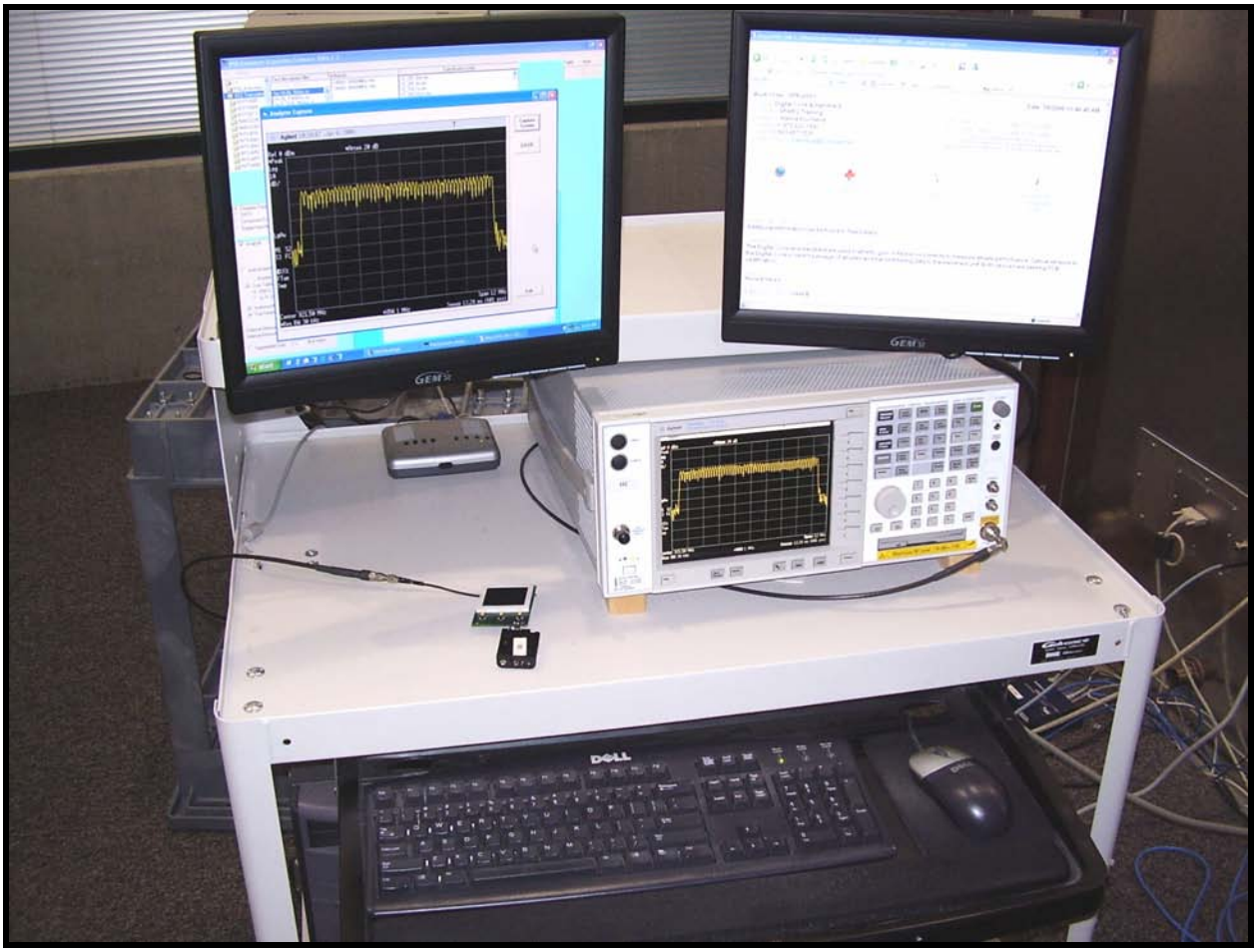
SIGNATURE

Tested By: Rodney La Peloquin

DESCRIPTION OF TEST

Number of Hopping Frequencies




DELL

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:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4443A	AAS	12/08/2005	12 mo

Test Description

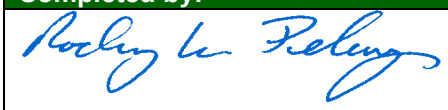
Requirement: Per 47 CFR 15.247(a)(1), the 20 dB bandwidth of a hopping channel must be less than or equal to the channel separation. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have 20 dB bandwidths up to 1.5 times the channel separation, provided the systems operate with an output power no greater than 125 mW.

Per 47 CFR 15.247(a)(1)(I-iii), the maximum 20 dB bandwidth for frequency hopping systems operating in the 902-928 MHz band is 500 kHz. The maximum 20 dB bandwidth for frequency hopping systems operating in the 5725 – 5850 MHz band is 1 MHz.

The measurement is made with the spectrum analyzer's resolution bandwidth set to ≥1% of the 20dB bandwidth, and the video bandwidth set to greater than or equal to the resolution bandwidth.

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

OCCUPIED BANDWIDTH

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV11

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

If the occupied bandwidth is less than 250 kHz, the system shall use at least 50 hopping frequencies with a time of occupancy not greater than 0.4S in 20S.

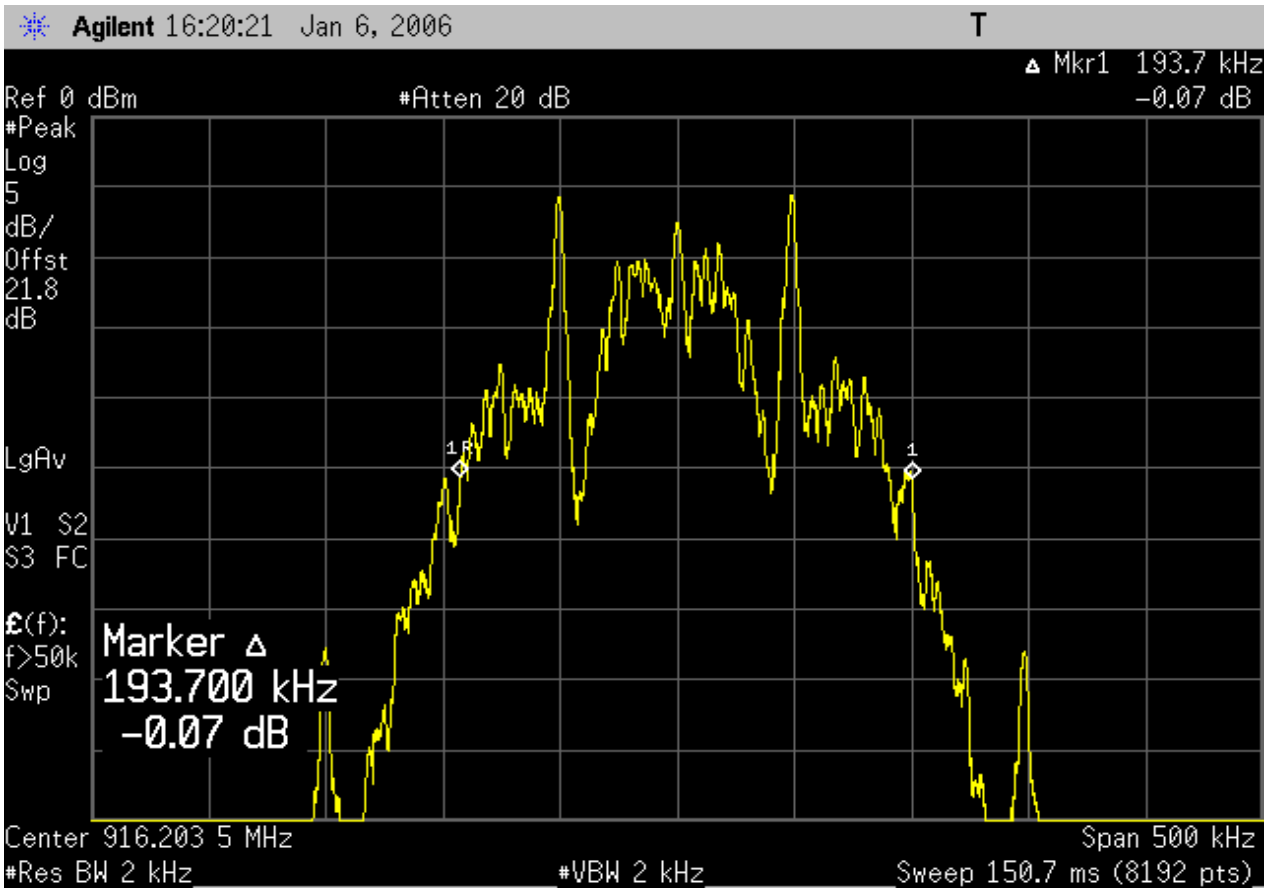
RESULTS	BANDWIDTH
Pass	193.7 kHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Occupied Bandwidth - Low Channel



NORTHWEST EMC

OCCUPIED BANDWIDTH

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV11

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year: 2005-9	Method: ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

If the occupied bandwidth is less than 250 kHz, the system shall use at least 50 hopping frequencies with a time of occupancy not greater than 0.4S in 20S.

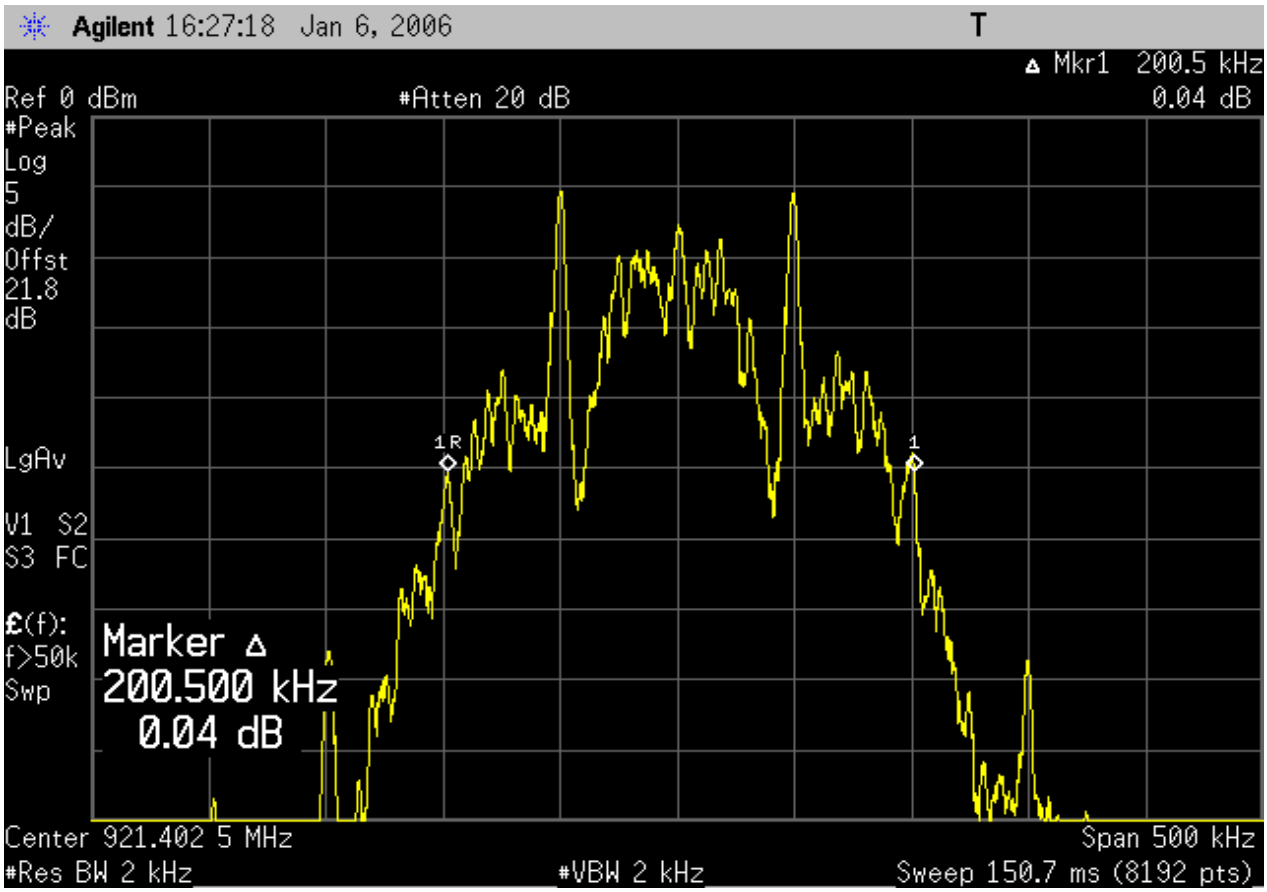
RESULTS	BANDWIDTH
Pass	200.5 kHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Occupied Bandwidth - Mid Channel



NORTHWEST
EMC

OCCUPIED BANDWIDTH

Rev BETA
01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV11

TEST SPECIFICATIONS

Specification:	FCC 15.247(a)(1)(i)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

If the occupied bandwidth is less than 250 kHz, the system shall use at least 50 hopping frequencies with a time of occupancy not greater than 0.4S in 20S.

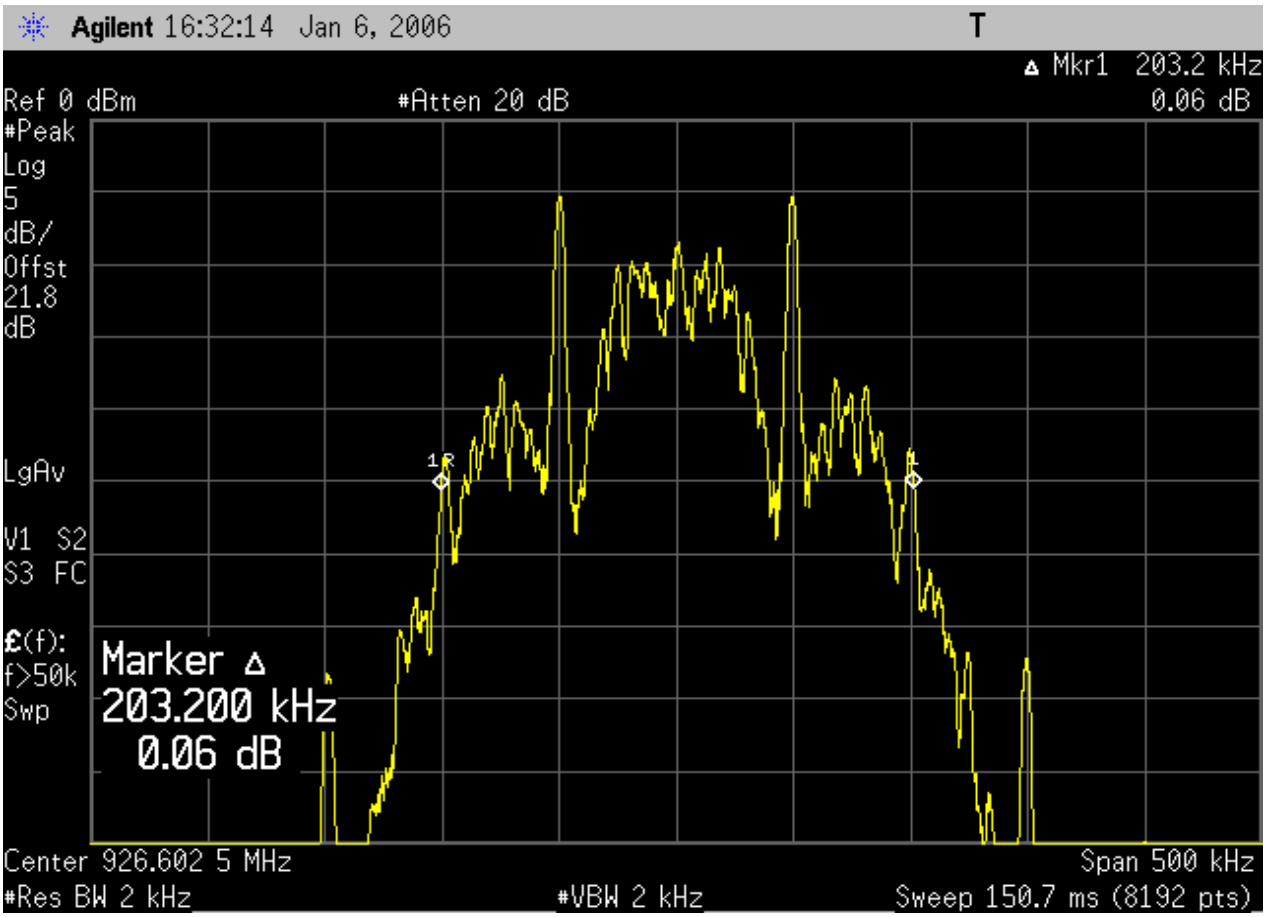
RESULTS	BANDWIDTH
Pass	203.2 kHz

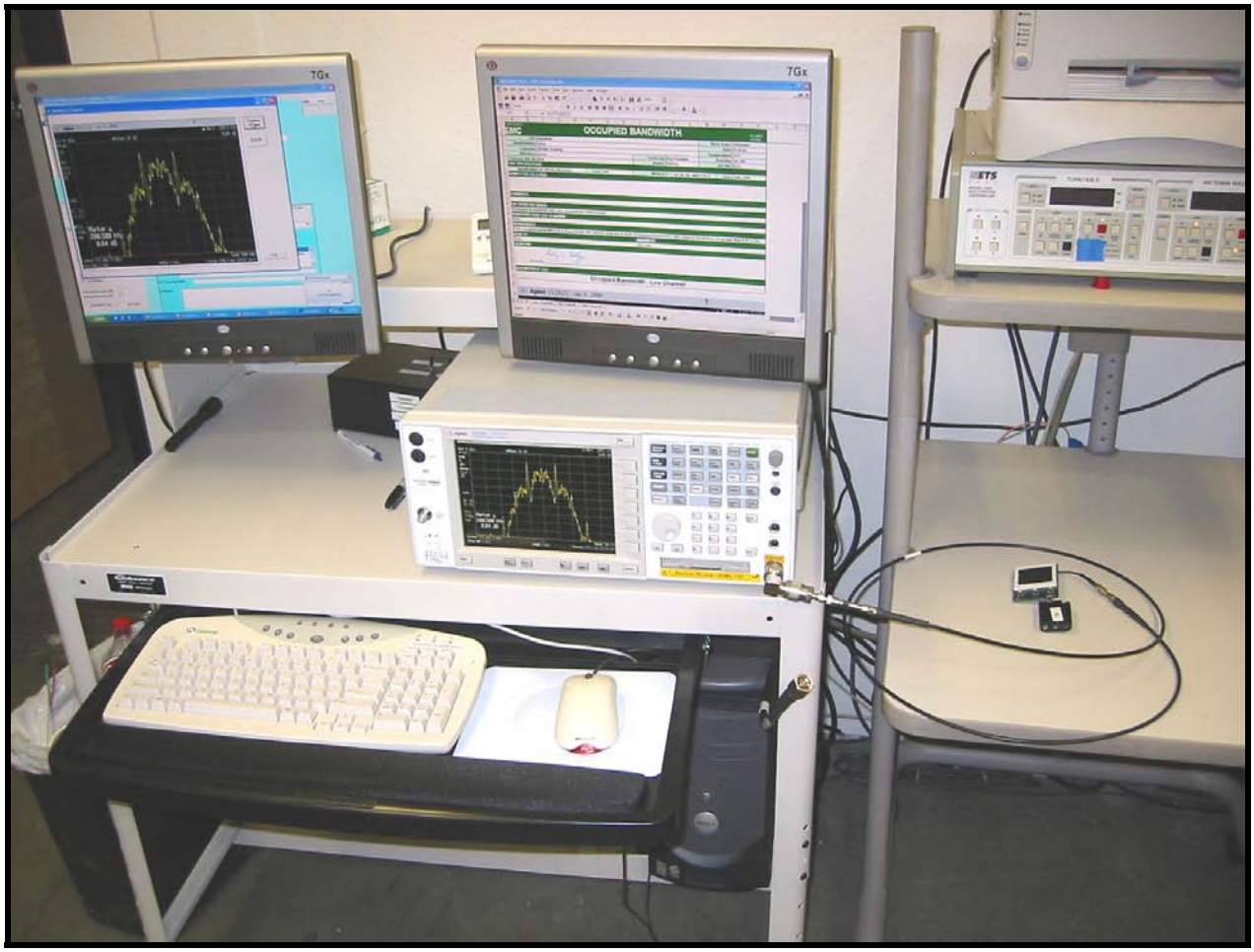
SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Occupied Bandwidth - High Channel




OCCUPIED BANDWIDTH

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:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/08/2005	13 mo

Test Description

Requirement: Per 47 CFR 15.247(b)(1-2), the peak output power shall be measured. For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

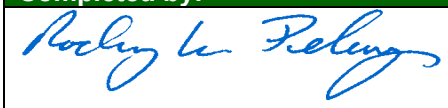
The measurement is made using a spectrum analyzer using the following settings:

- Resolution bandwidth set to greater than the 20 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

OUTPUT POWER

Rev BETA
01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(b)(2)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak conducted output power does not exceed 1 Watt.

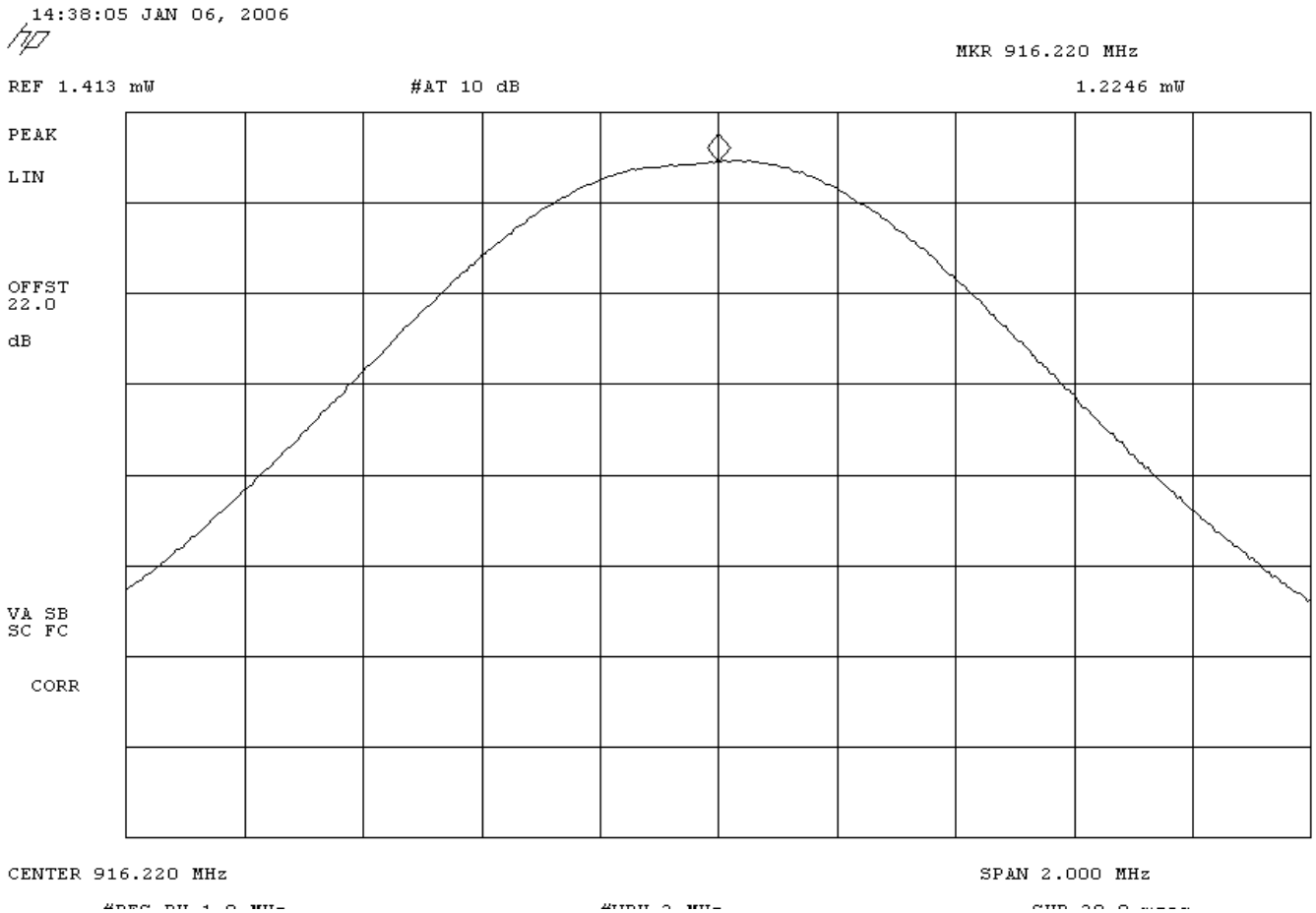
RESULTS	AMPLITUDE
Pass	1.225 mW

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Output Power - Low Channel



NORTHWEST EMC

OUTPUT POWER

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(b)(2)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak conducted output power does not exceed 1 Watt.

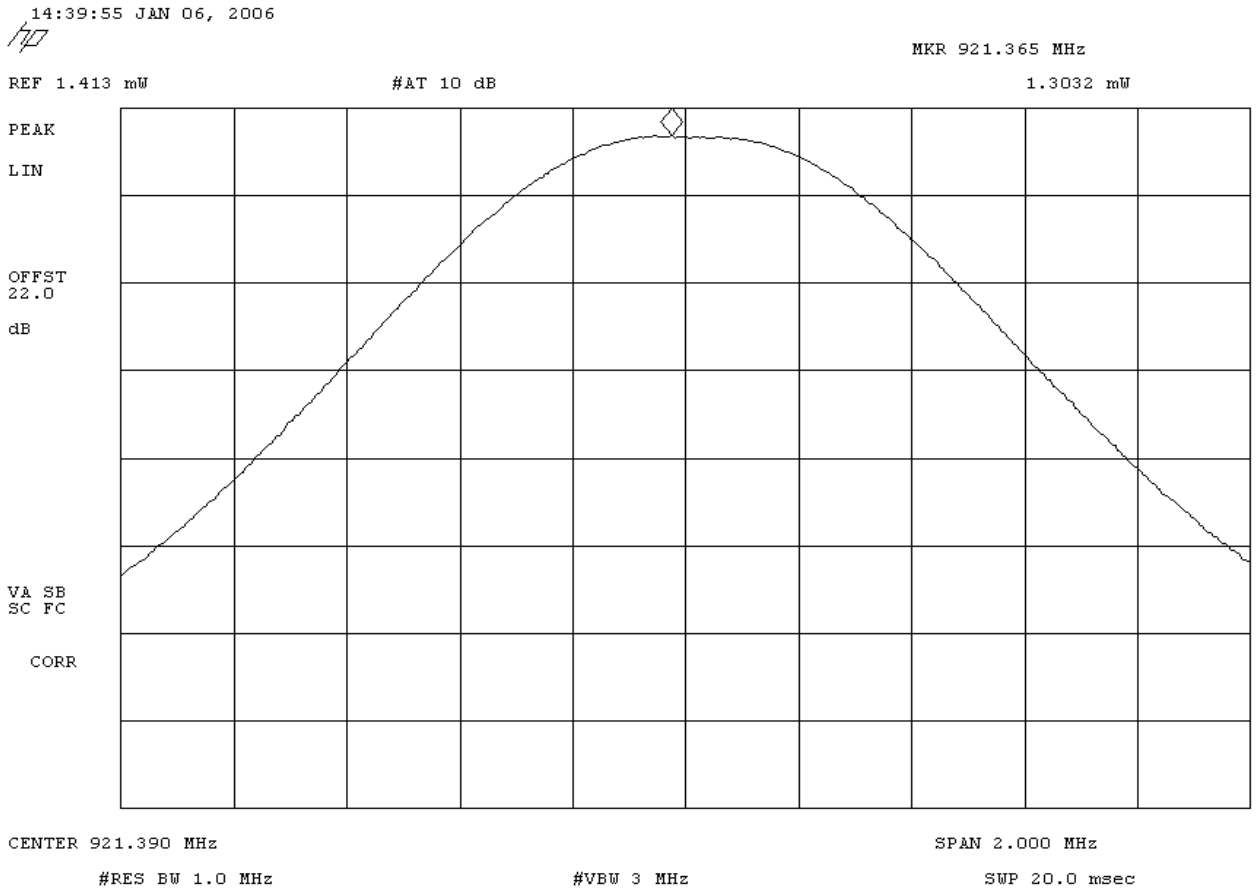
RESULTS	AMPLITUDE
Pass	1.3 mW

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Output Power - Mid Channel



NORTHWEST EMC

OUTPUT POWER

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(b)(2)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak conducted output power does not exceed 1 Watt.

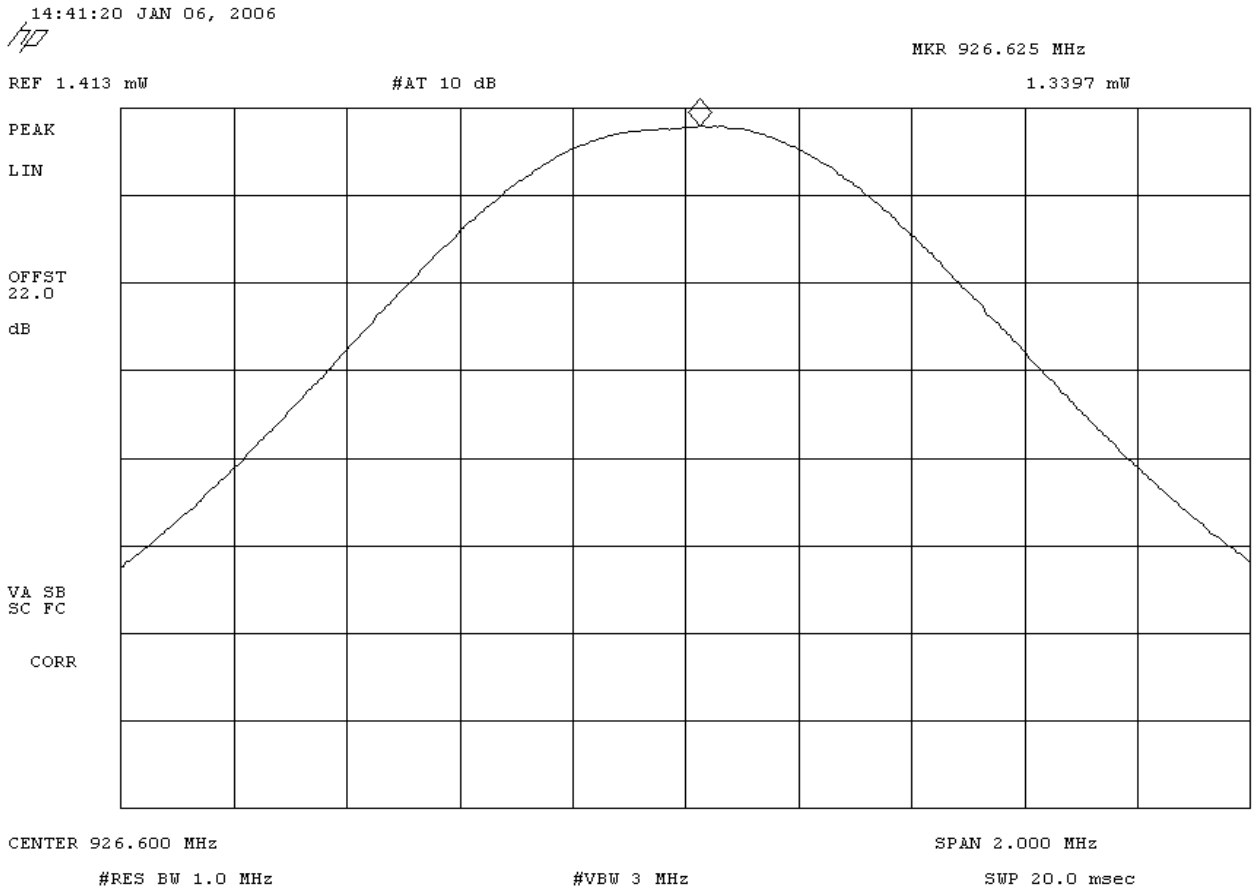
RESULTS	AMPLITUDE
Pass	1.34 mW

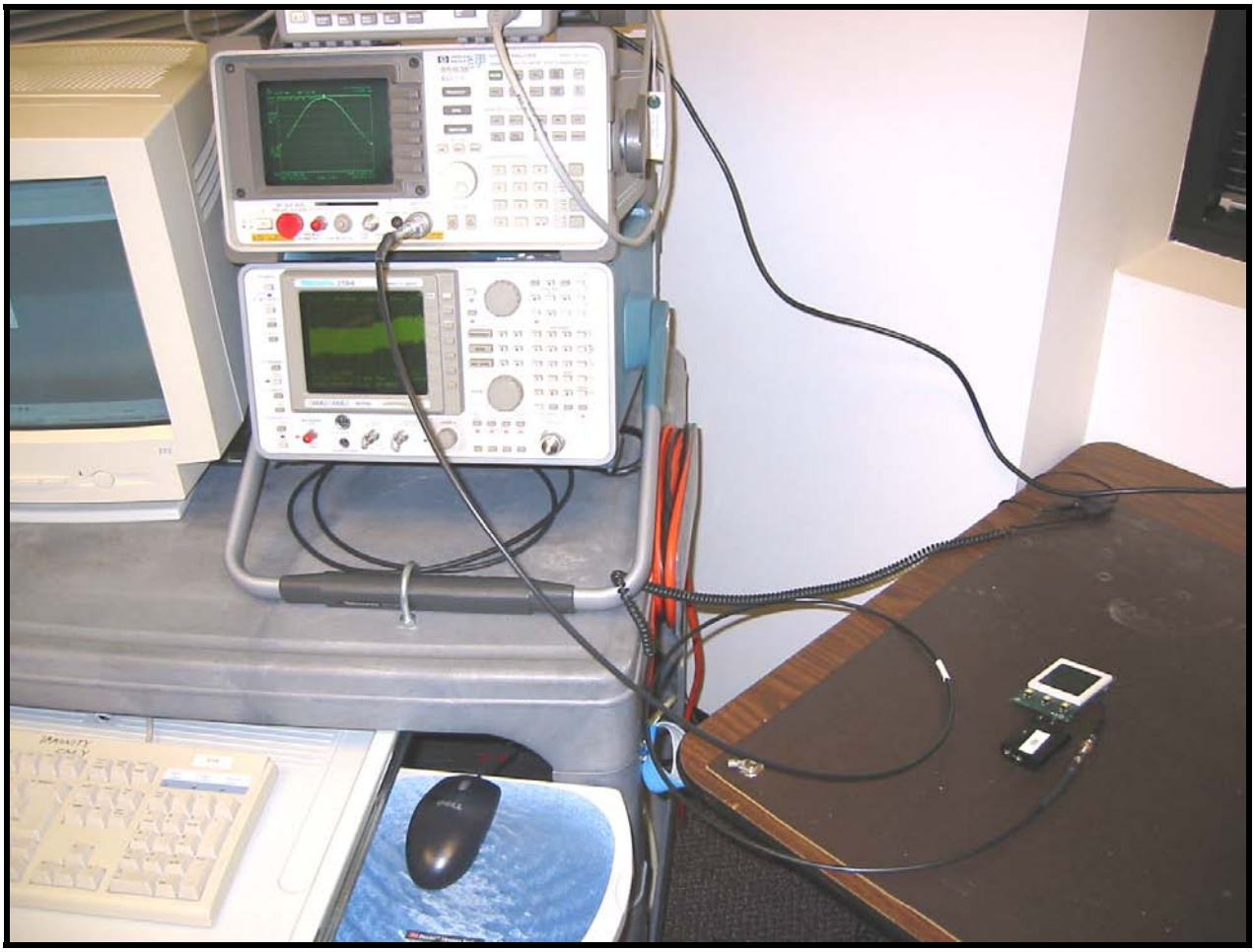
SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Output Power - 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
High

Operating Modes Investigated:
No Hop

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

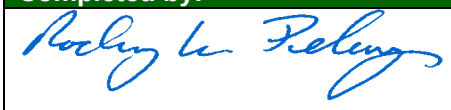
Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Hewlett-Packard	8593E	AAA	12/08/2005	13 mo

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

Band Edge Compliance

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-09	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

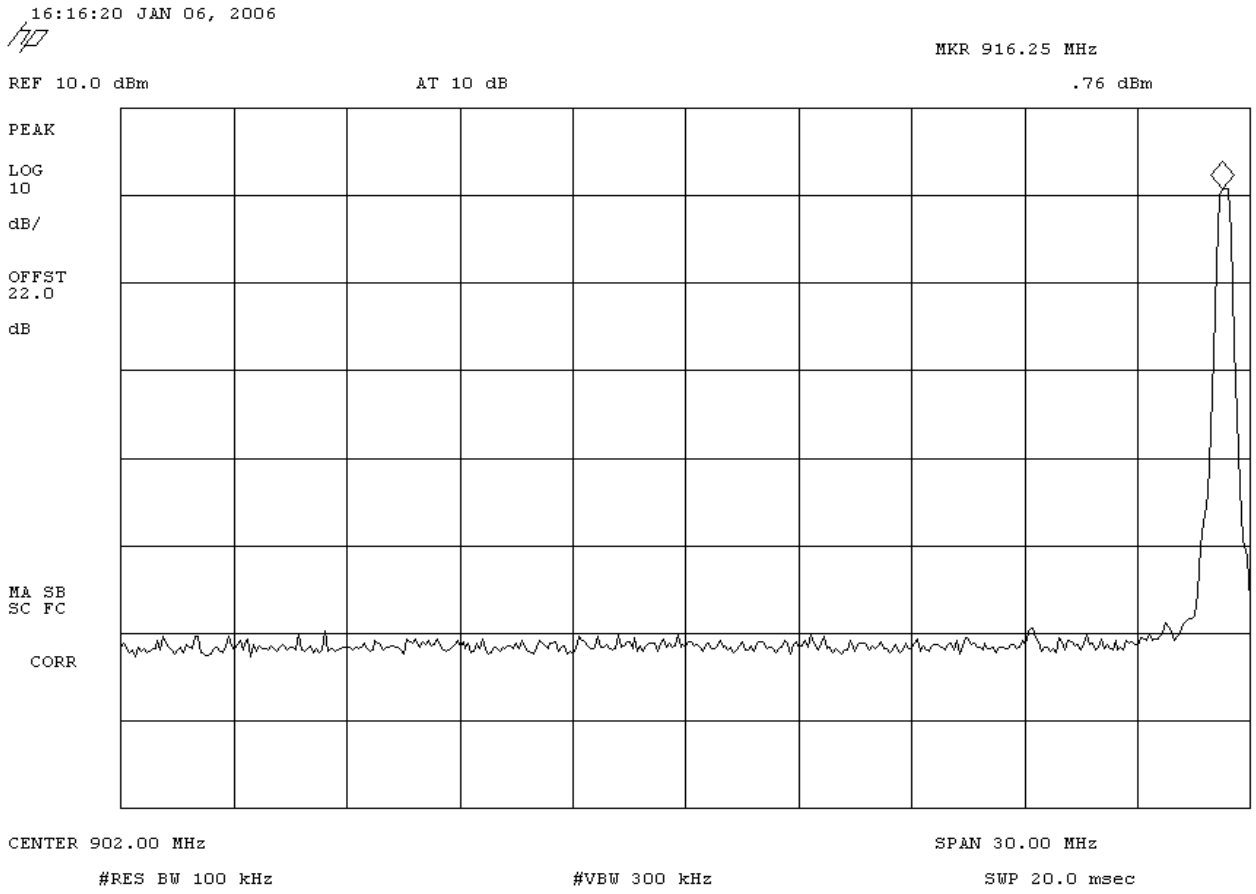
Pass

SIGNATURE

Tested By: Rodney La Peloquin

DESCRIPTION OF TEST

Band Edge Compliance - Low Channel



NORTHWEST EMC

Band Edge Compliance

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/06/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	36% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

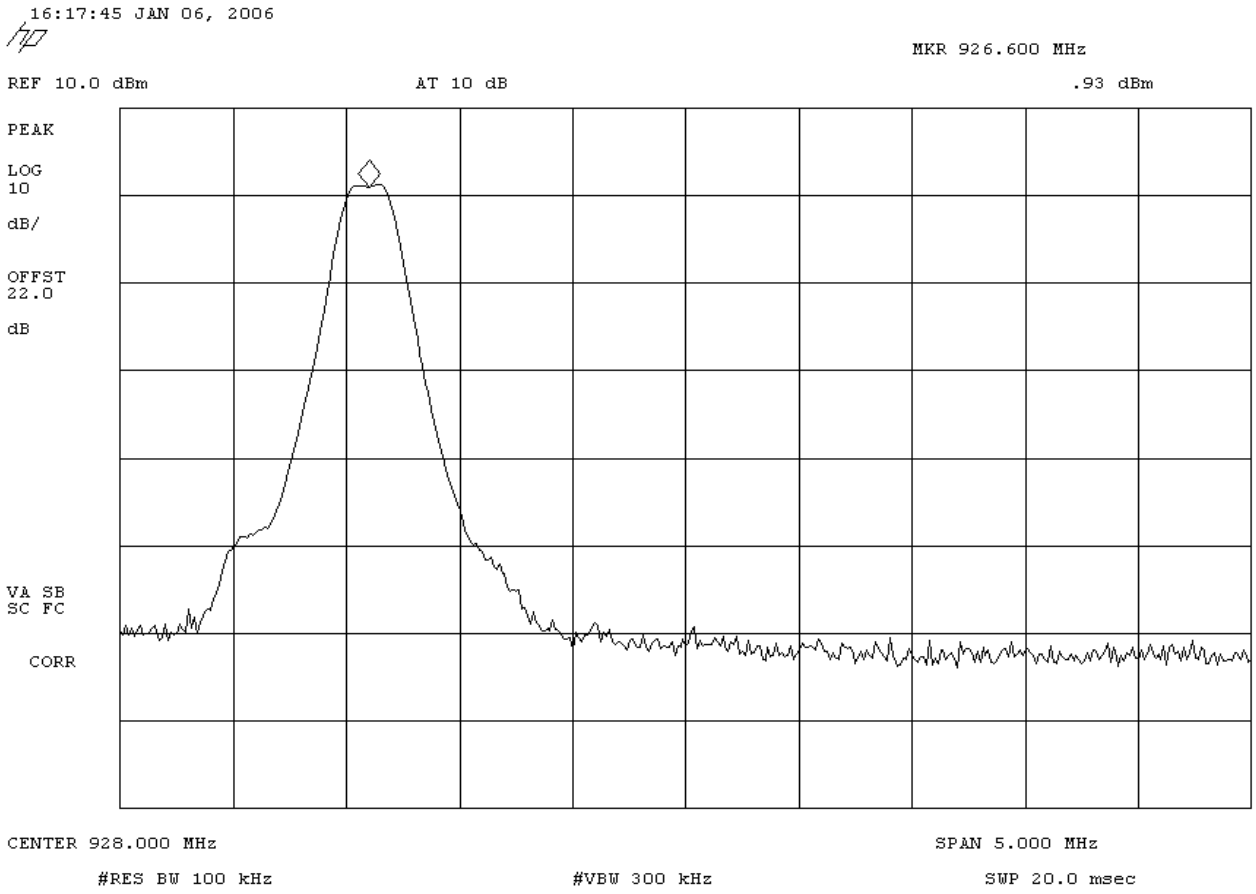
Pass

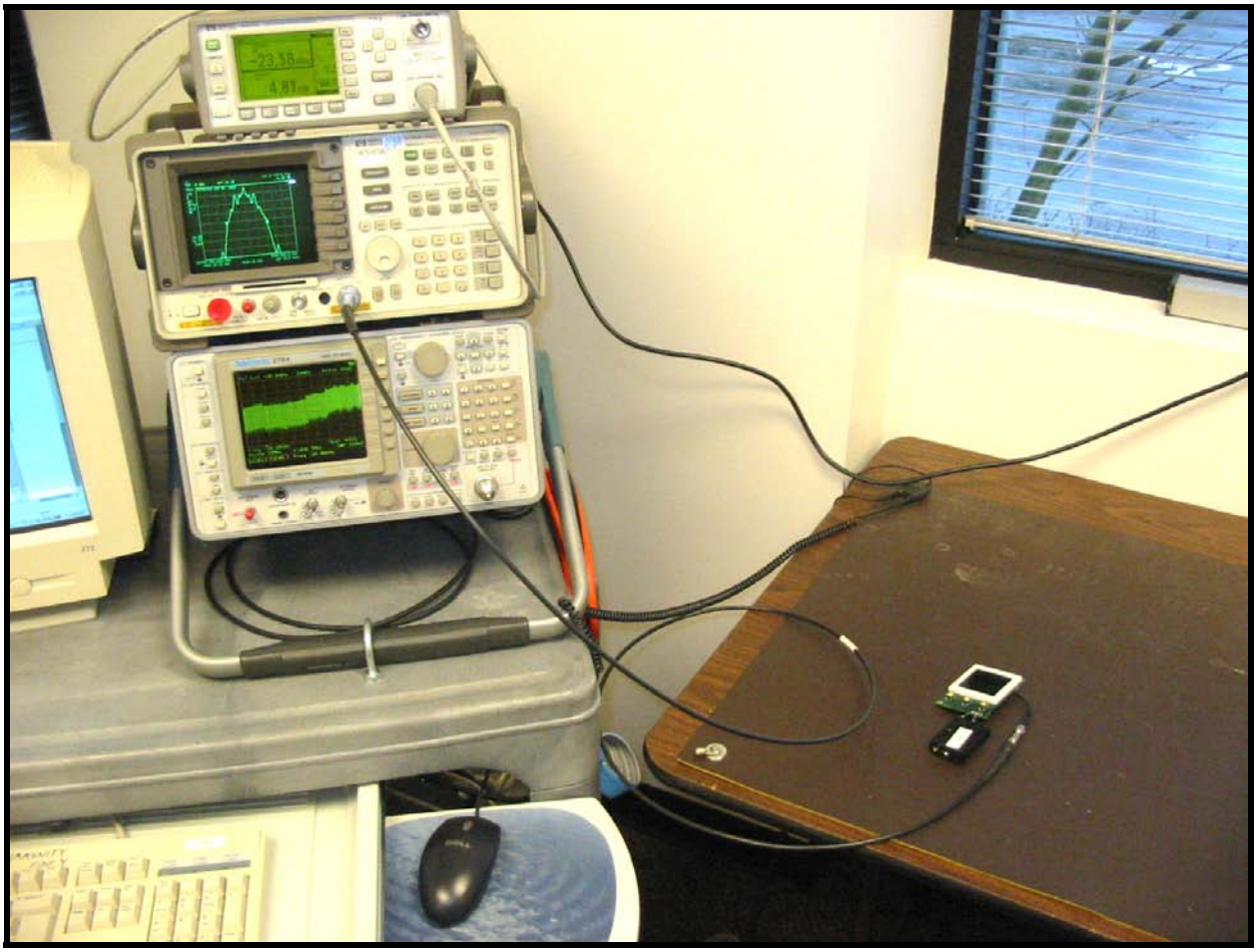
SIGNATURE

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:
Battery

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

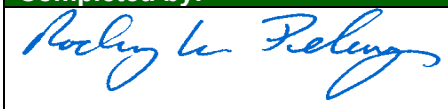
Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Tektronix	2784	AAO	12/02/2004	15 mo

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

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

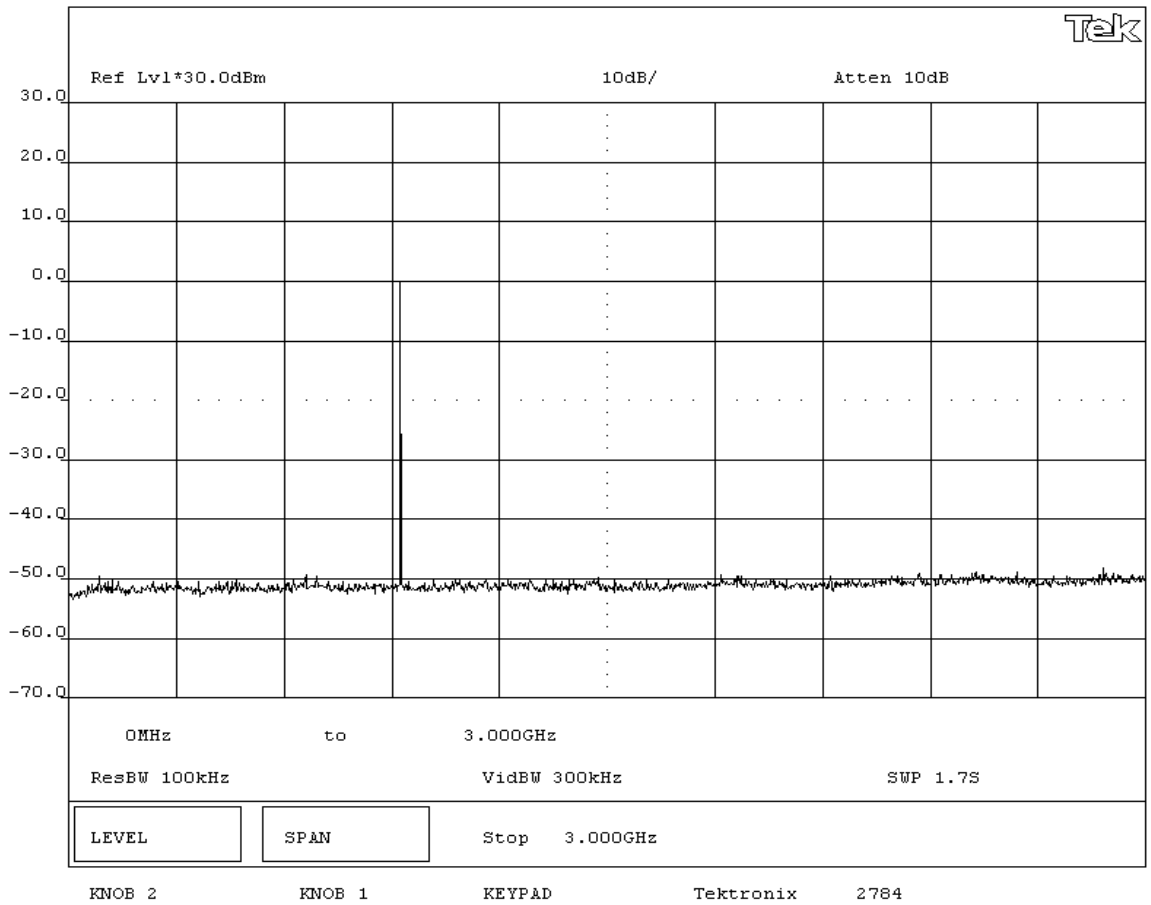
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - Low Channel 0MHz-3GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

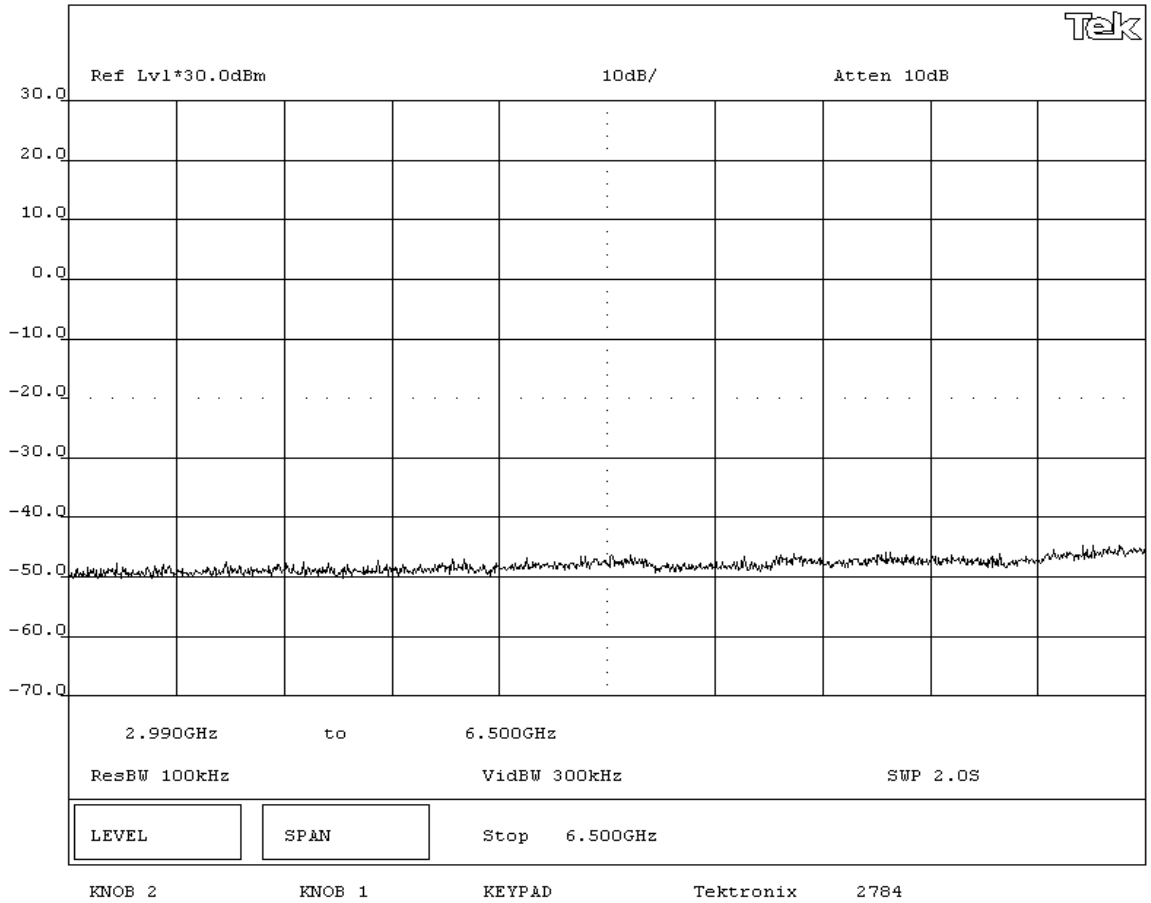
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - Low Channel 3GHz-6.5GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

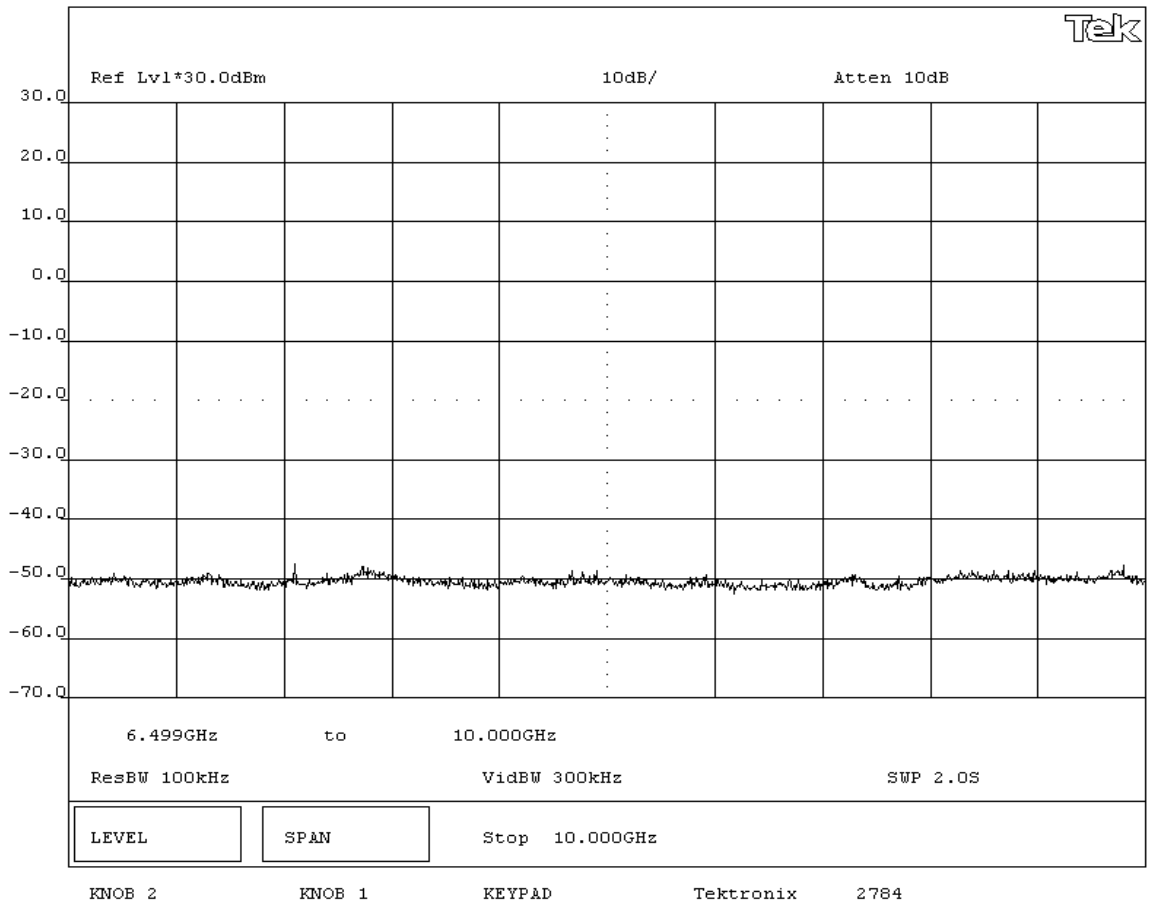
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - Low Channel 6.5GHz-10GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

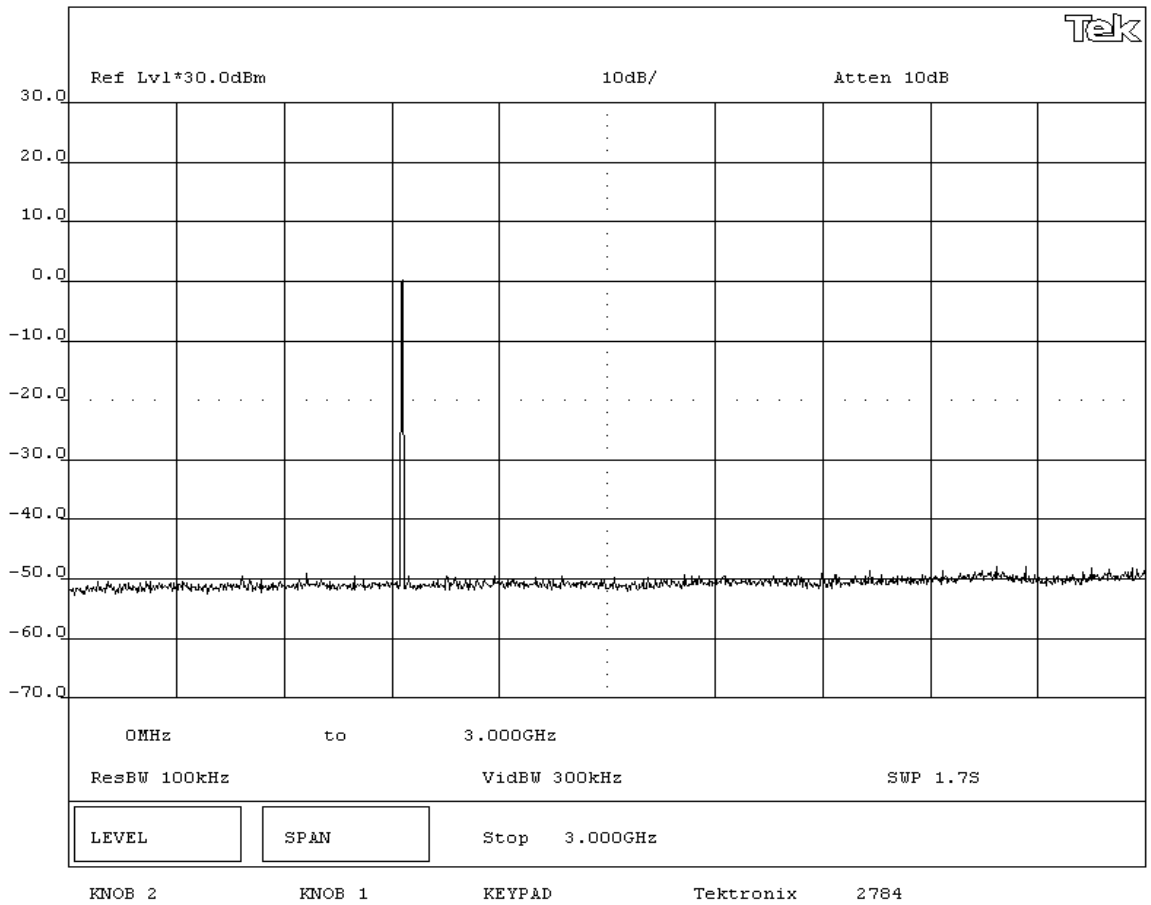
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - Mid Channel 0MHz-3GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

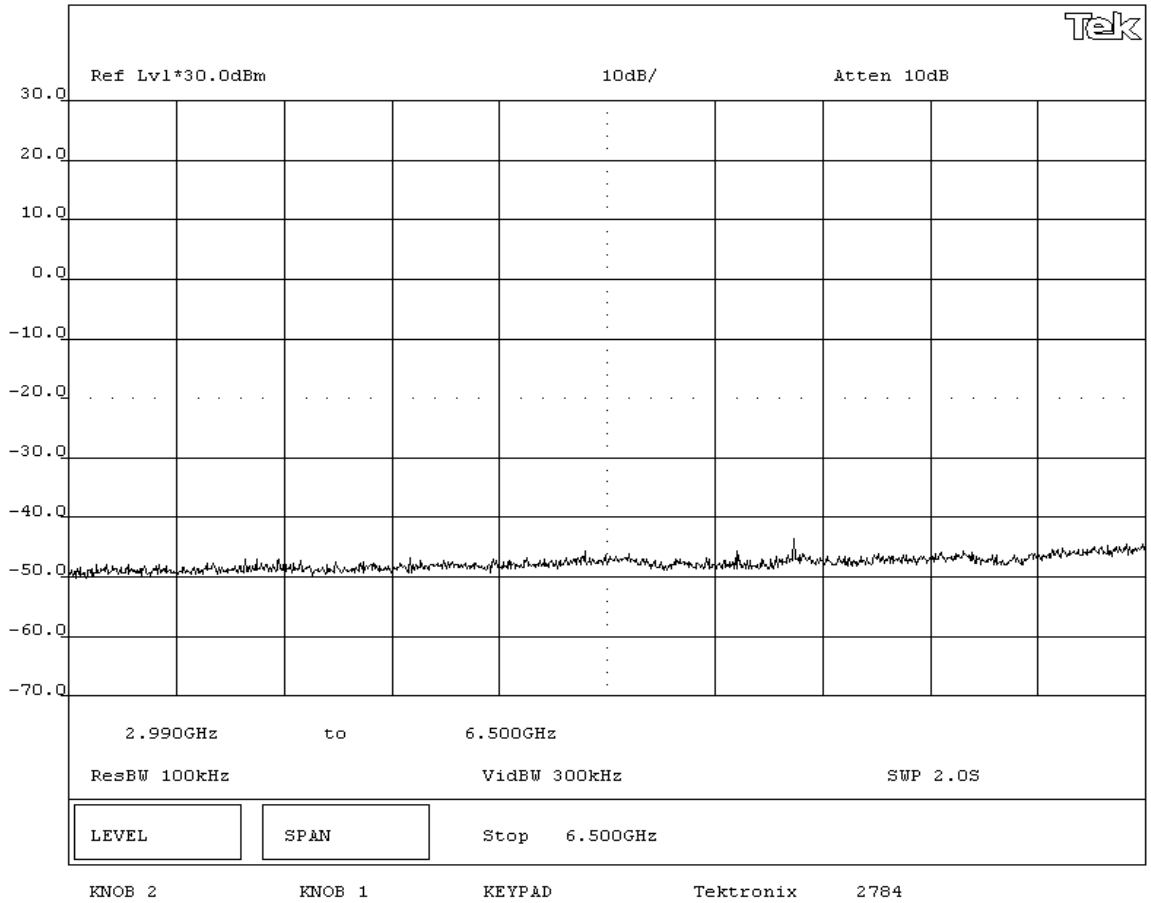
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - Mid Channel 3GHz-6.5GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

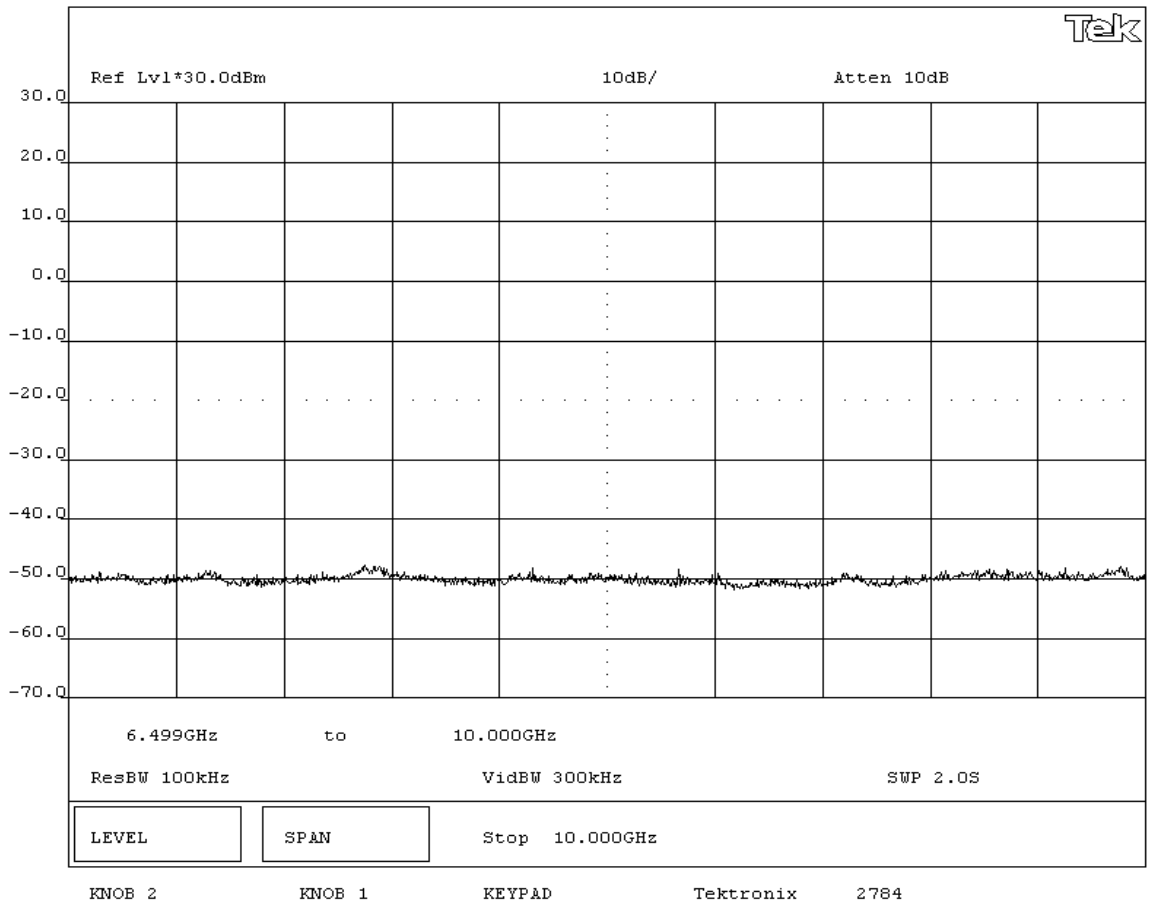
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - Mid Channel 6.5GHz-10GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

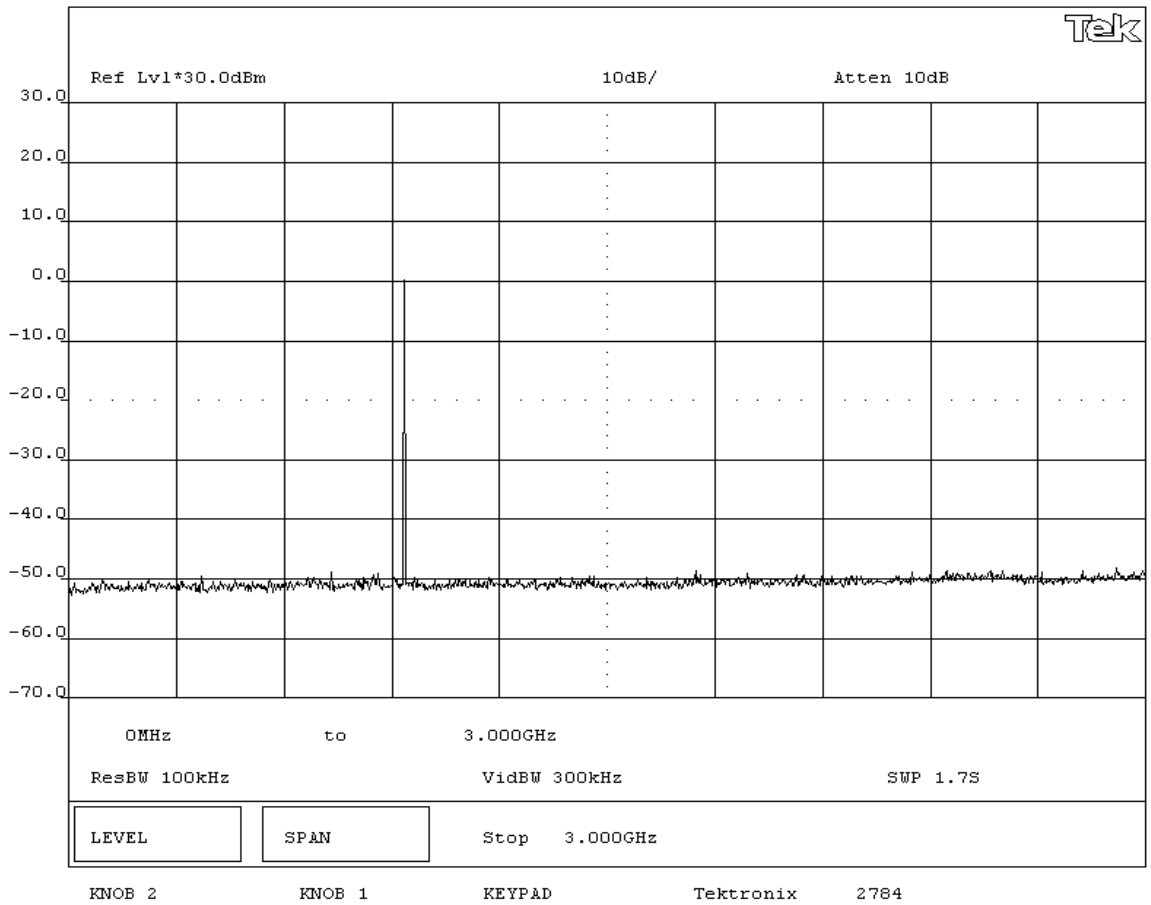
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - High Channel 0MHz-3GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS

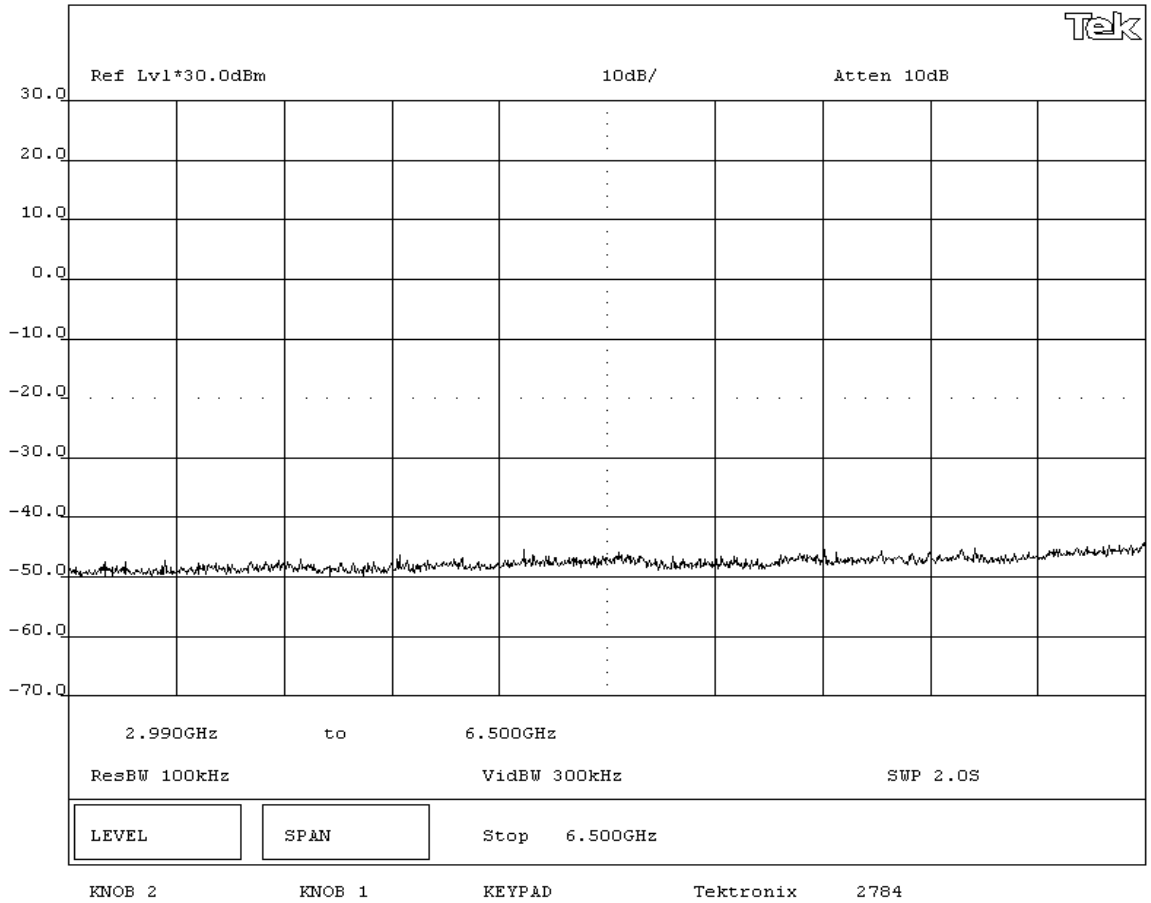
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - High Channel 3GHz-6.5GHz



NORTHWEST EMC

Spurious Conducted Emissions

Rev BETA 01/30/01

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/09/06
Customer:	SPARQ Training			Temperature:	22°C
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	37% RH
Customer Ref. No.:	None	Power:	Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	FCC 15.247(d)	Year:	2005-9	Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated at maximum data rate, at maximum output power

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

In any 100 kHz band outside the allowable band the maximum spurious emission shall be at least 20 dB below the fundamental.

RESULTS — **AMPLITUDE**

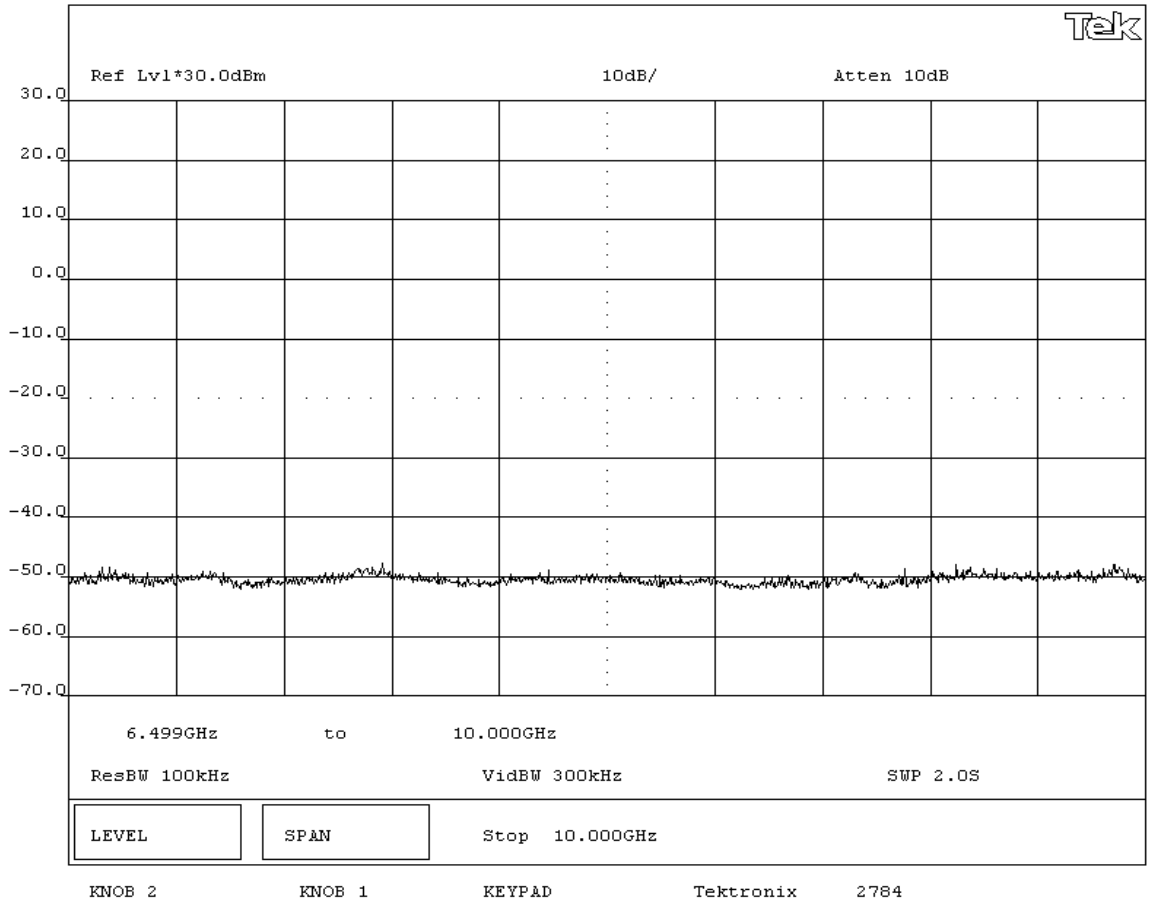
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Spurious Conducted Emissions - High Channel 6.5GHz-10GHz



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

Antennas Investigated:
Integral

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
Battery

Frequency Range Investigated			
Start Frequency	30 MHz	**Stop Frequency**	10 GHz

Software\Firmware Applied During Test			
Exercise software	Special Test Software	**Version**	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Handheld	SPARQ Training	Handheld	None

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Agilent	E4446A	AAQ	06/15/2005	13 mo
Antenna, Biconilog	EMCO	3141	AXE	12/28/2005	24 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOL	08/02/2005	13 mo
Pre-Amplifier	Miteq	AMF-4D-010100-24-10P	APW	08/02/2005	13 mo
Antenna, Horn	EMCO	3115	AHC	08/30/2005	12 mo
High Pass Filter 1.2 - 18 GHz	Micro-Tronics	HPM50108	HFV	09/28/2005	13 mo
High Pass Filter	MicroLab	FH-1001	HFI	02/28/2005	13 mo
.5-1 GHz Notch Filter	K&L Microwave	3TNF-500/1000-N/N	HFT	08/04/2005	13 mo

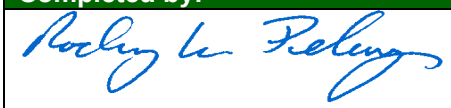
Test Description

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 the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.4:2003). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

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
Measurements were made using the bandwidths and detectors specified. No video filter was used.			

Completed by:



NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

PSA 2005.01.05
EMI 2005.12.23

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/05/06
Customer:	SPARQ Training			Temperature:	22
Attendees:	None			Humidity:	34%
Project:	None			Barometric Pres.:	N/A
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247(d) Spurious Radiated Emissions:2005-9	ANSI C63.4:2003

TEST PARAMETERS			
Antenna Height(s) (m)	1 - 4	Test Distance (m)	3

COMMENTS

EUT OPERATING MODES

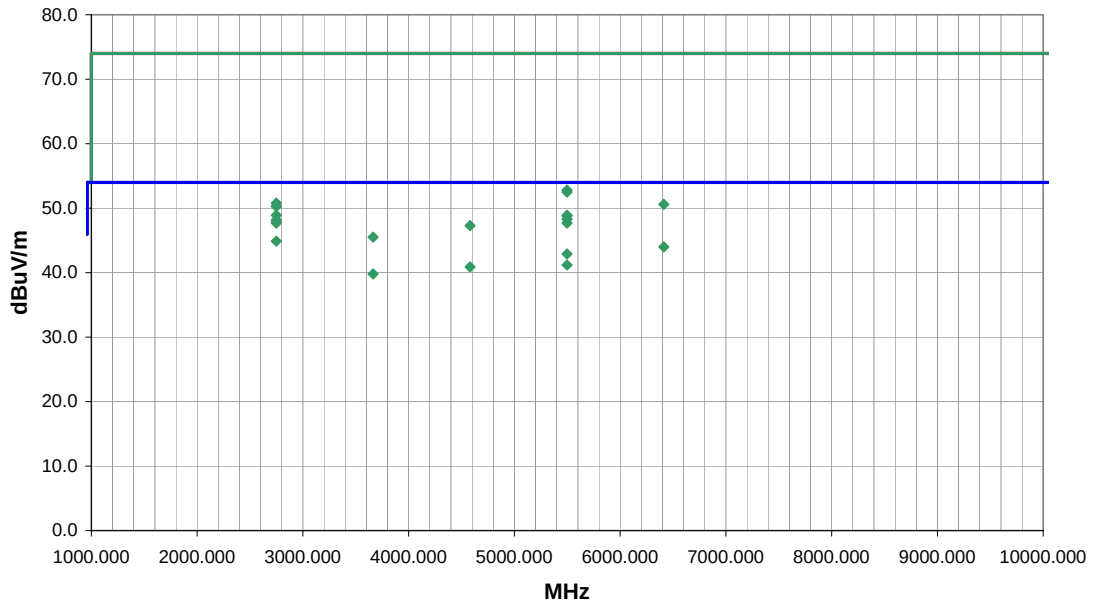
no hop, low channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	1
Configuration #	1
Results	Pass

Signature



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)	Comments
2748.631	47.4	1.5	60.0	1.2	3.0	0.0	H-Horn	AV	0.0	48.9	54.0	-5.1	EUT on side
5497.232	40.7	8.2	146.0	1.3	3.0	0.0	H-Horn	AV	0.0	48.9	54.0	-5.1	EUT vertical
2748.630	46.7	1.5	-1.0	1.3	3.0	0.0	V-Horn	AV	0.0	48.2	54.0	-5.8	EUT vertical
2748.635	46.4	1.5	132.0	1.9	3.0	0.0	H-Horn	AV	0.0	47.9	54.0	-6.1	EUT vertical
5497.235	39.5	8.2	72.0	1.2	3.0	0.0	V-Horn	AV	0.0	47.7	54.0	-6.3	EUT on side
2748.630	43.4	1.5	261.0	1.2	3.0	0.0	V-Horn	AV	0.0	44.9	54.0	-9.1	EUT on side
6413.427	34.2	9.8	342.0	1.3	3.0	0.0	H-Horn	AV	0.0	44.0	54.0	-10.0	EUT vertical
5497.243	34.7	8.2	345.0	1.1	3.0	0.0	V-Horn	AV	0.0	42.9	54.0	-11.1	EUT vertical
5497.216	33.0	8.2	21.0	1.6	3.0	0.0	H-Horn	AV	0.0	41.2	54.0	-12.8	EUT on side
4581.028	35.1	5.8	313.0	1.8	3.0	0.0	H-Horn	AV	0.0	40.9	54.0	-13.1	EUT vertical
3664.836	35.3	4.5	292.0	1.3	3.0	0.0	H-Horn	AV	0.0	39.8	54.0	-14.2	EUT vertical
5497.249	44.6	8.2	146.0	1.3	3.0	0.0	H-Horn	PK	0.0	52.8	74.0	-21.2	EUT vertical
5497.323	44.3	8.2	72.0	1.2	3.0	0.0	V-Horn	PK	0.0	52.5	74.0	-21.5	EUT on side
2748.654	49.3	1.5	60.0	1.2	3.0	0.0	H-Horn	PK	0.0	50.8	74.0	-23.2	EUT on side
6413.532	40.8	9.8	342.0	1.3	3.0	0.0	H-Horn	PK	0.0	50.6	74.0	-23.4	EUT vertical
2748.635	48.8	1.5	132.0	1.9	3.0	0.0	H-Horn	PK	0.0	50.3	74.0	-23.7	EUT vertical
2748.640	48.8	1.5	-1.0	1.3	3.0	0.0	V-Horn	PK	0.0	50.3	74.0	-23.7	EUT vertical
5497.264	40.6	8.2	345.0	1.1	3.0	0.0	V-Horn	PK	0.0	48.8	74.0	-25.2	EUT vertical
5497.148	40.1	8.2	21.0	1.6	3.0	0.0	H-Horn	PK	0.0	48.3	74.0	-25.7	EUT on side
2748.631	46.2	1.5	261.0	1.2	3.0	0.0	V-Horn	PK	0.0	47.7	74.0	-26.3	EUT on side

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

PSA 2005.01.05
EMI 2005.12.23

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/05/06
Customer:	SPARQ Training			Temperature:	22
Attendees:	None			Humidity:	34%
Project:	None			Barometric Pres.:	N/A
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247(d) Spurious Radiated Emissions:2005-9	ANSI C63.4:2003

TEST PARAMETERS			
Antenna Height(s) (m)	1 - 4	Test Distance (m)	3

COMMENTS

EUT OPERATING MODES

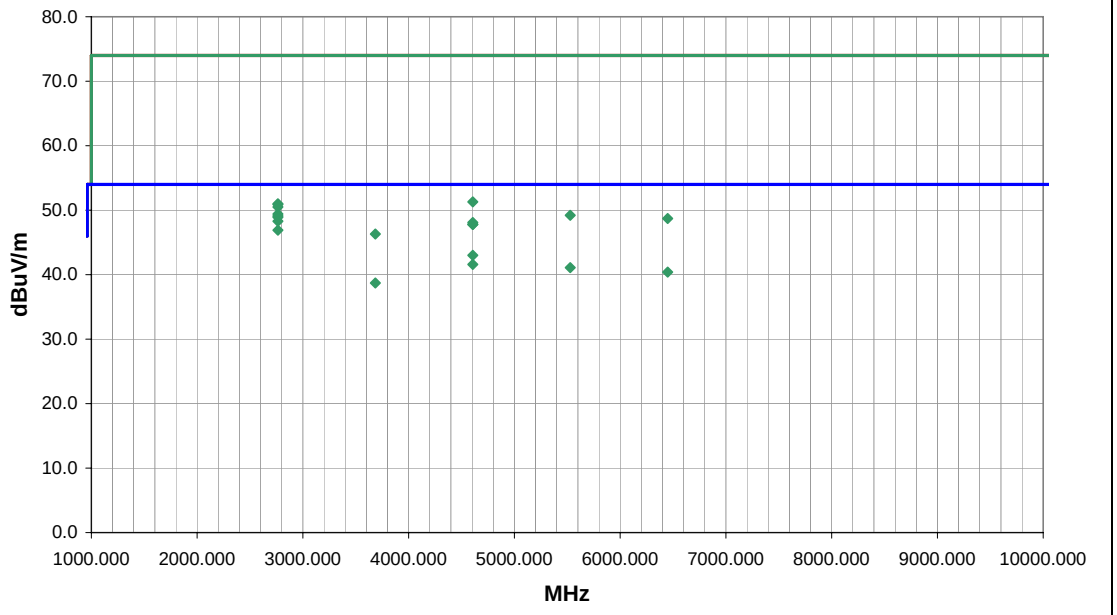
no hop, mid channel

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2
Configuration #	1
Results	Pass

Signature



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)	Comments
2764.225	47.5	1.6	325.0	1.2	3.0	0.0	H-Horn	AV	0.0	49.1	54.0	-4.9	EUT on side
2764.231	47.3	1.6	146.0	1.2	3.0	0.0	H-Horn	AV	0.0	48.9	54.0	-5.1	EUT vertical
2764.228	46.7	1.6	116.0	1.3	3.0	0.0	V-Horn	AV	0.0	48.3	54.0	-5.7	EUT on side
4607.031	41.9	5.9	11.0	1.2	3.0	0.0	V-Horn	AV	0.0	47.8	54.0	-6.2	EUT vertical
2764.231	45.3	1.6	33.0	1.3	3.0	0.0	V-Horn	AV	0.0	46.9	54.0	-7.1	EUT vertical
4607.024	37.1	5.9	323.0	1.3	3.0	0.0	V-Horn	AV	0.0	43.0	54.0	-11.0	EUT on side
4607.046	35.7	5.9	319.0	1.8	3.0	0.0	H-Horn	AV	0.0	41.6	54.0	-12.4	EUT vertical
5528.408	32.9	8.2	316.0	1.3	3.0	0.0	H-Horn	AV	0.0	41.1	54.0	-12.9	EUT vertical
6449.808	30.4	10.0	12.0	1.3	3.0	0.0	H-Horn	AV	0.0	40.4	54.0	-13.6	EUT vertical
3685.616	34.1	4.6	320.0	1.3	3.0	0.0	H-Horn	AV	0.0	38.7	54.0	-15.3	EUT vertical
4607.080	45.4	5.9	11.0	1.2	3.0	0.0	V-Horn	PK	0.0	51.3	74.0	-22.7	EUT vertical
2764.228	49.4	1.6	325.0	1.2	3.0	0.0	H-Horn	PK	0.0	51.0	74.0	-23.0	EUT on side
2764.245	49.3	1.6	146.0	1.2	3.0	0.0	H-Horn	PK	0.0	50.9	74.0	-23.1	EUT vertical
2764.224	48.9	1.6	116.0	1.3	3.0	0.0	V-Horn	PK	0.0	50.5	74.0	-23.5	EUT on side
2764.208	47.8	1.6	33.0	1.3	3.0	0.0	V-Horn	PK	0.0	49.4	74.0	-24.6	EUT vertical
5528.403	41.0	8.2	316.0	1.3	3.0	0.0	H-Horn	PK	0.0	49.2	74.0	-24.8	EUT vertical
6449.760	38.7	10.0	12.0	1.3	3.0	0.0	H-Horn	PK	0.0	48.7	74.0	-25.3	EUT vertical
4607.105	42.2	5.9	323.0	1.3	3.0	0.0	V-Horn	PK	0.0	48.1	74.0	-25.9	EUT on side
4606.829	41.9	5.9	319.0	1.8	3.0	0.0	H-Horn	PK	0.0	47.8	74.0	-26.2	EUT vertical
3685.629	41.7	4.6	320.0	1.3	3.0	0.0	H-Horn	PK	0.0	46.3	74.0	-27.7	EUT vertical

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

PSA 2005.01.05
EMI 2005.12.23

EUT:	Handheld			Work Order:	SPRQ0001
Serial Number:	None			Date:	01/05/06
Customer:	SPARQ Training			Temperature:	22
Attendees:	None			Humidity:	34%
Project:	None			Barometric Pres.:	N/A
Tested by:	Rod Peloquin	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS	Test Method
FCC 15.247(d) Spurious Radiated Emissions:2005-9	ANSI C63.4:2003

TEST PARAMETERS			
Antenna Height(s) (m)	1 - 4	Test Distance (m)	3

COMMENTS

EUT OPERATING MODES

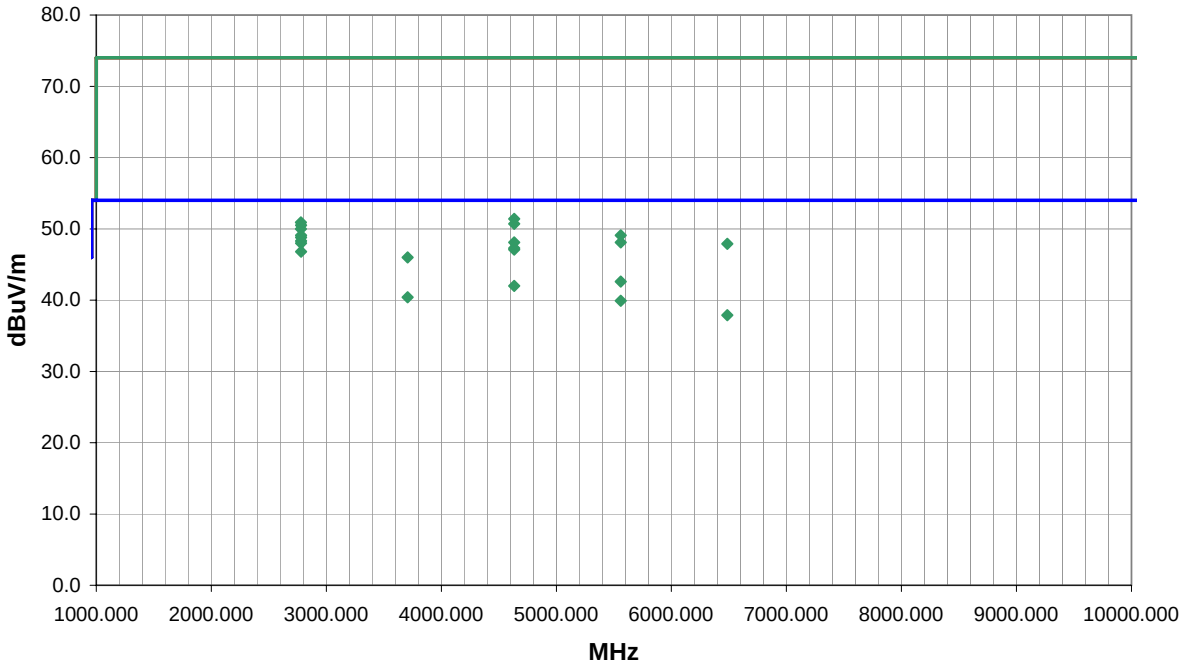
no hop, high channel

DEVIATIONS FROM TEST STANDARD

No deviations.

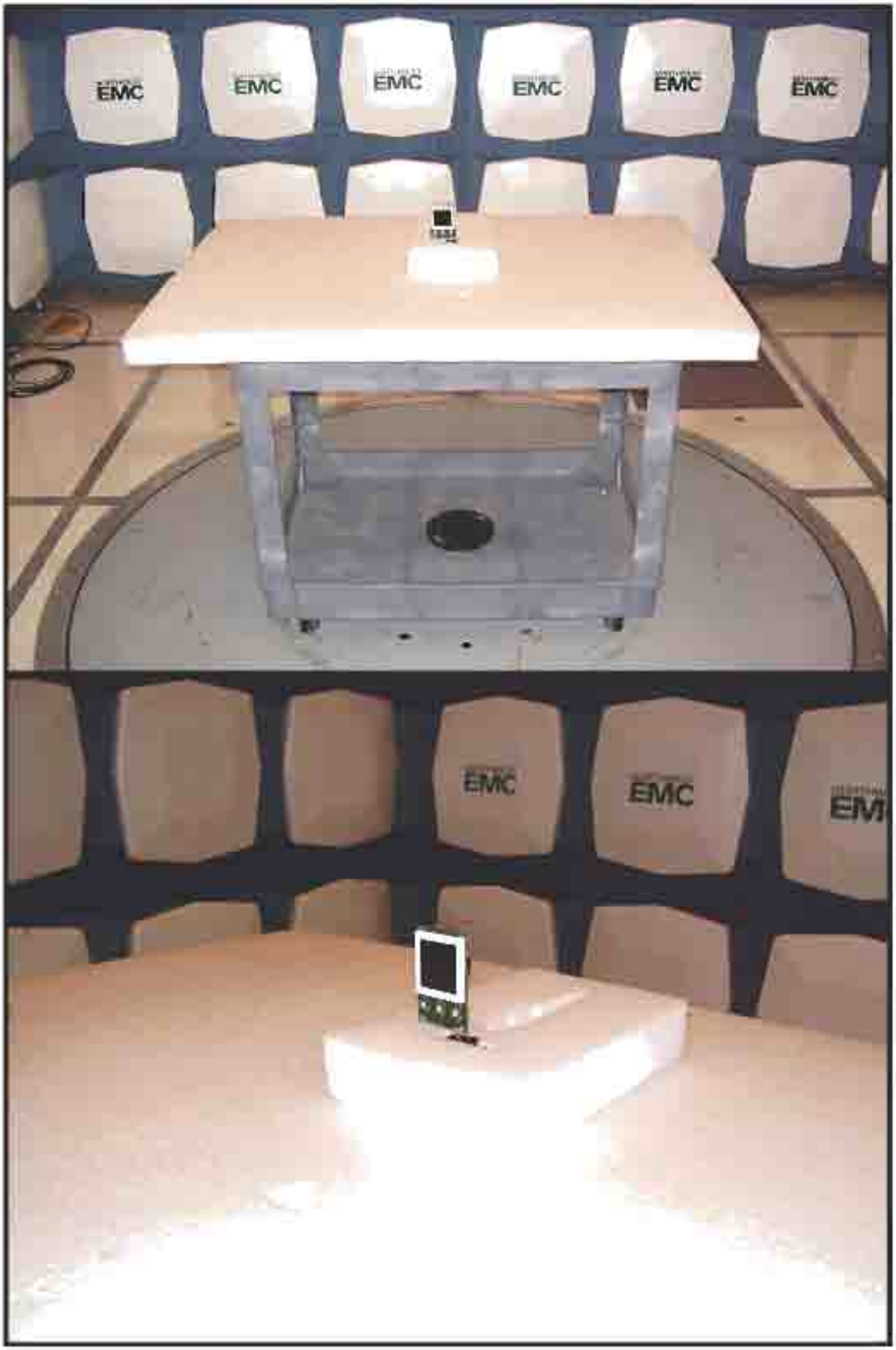
Run #	3
Configuration #	1
Results	Pass

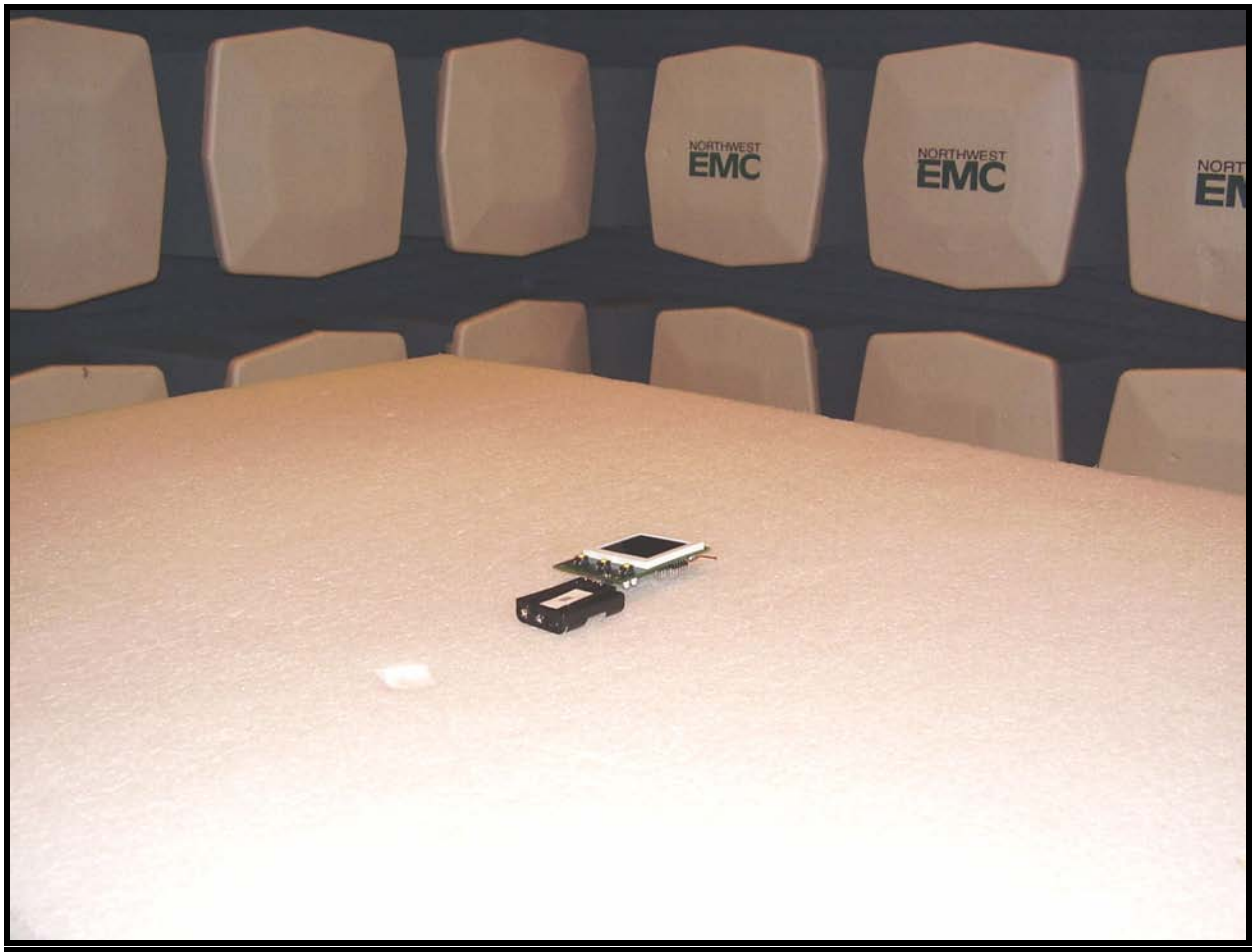
Signature

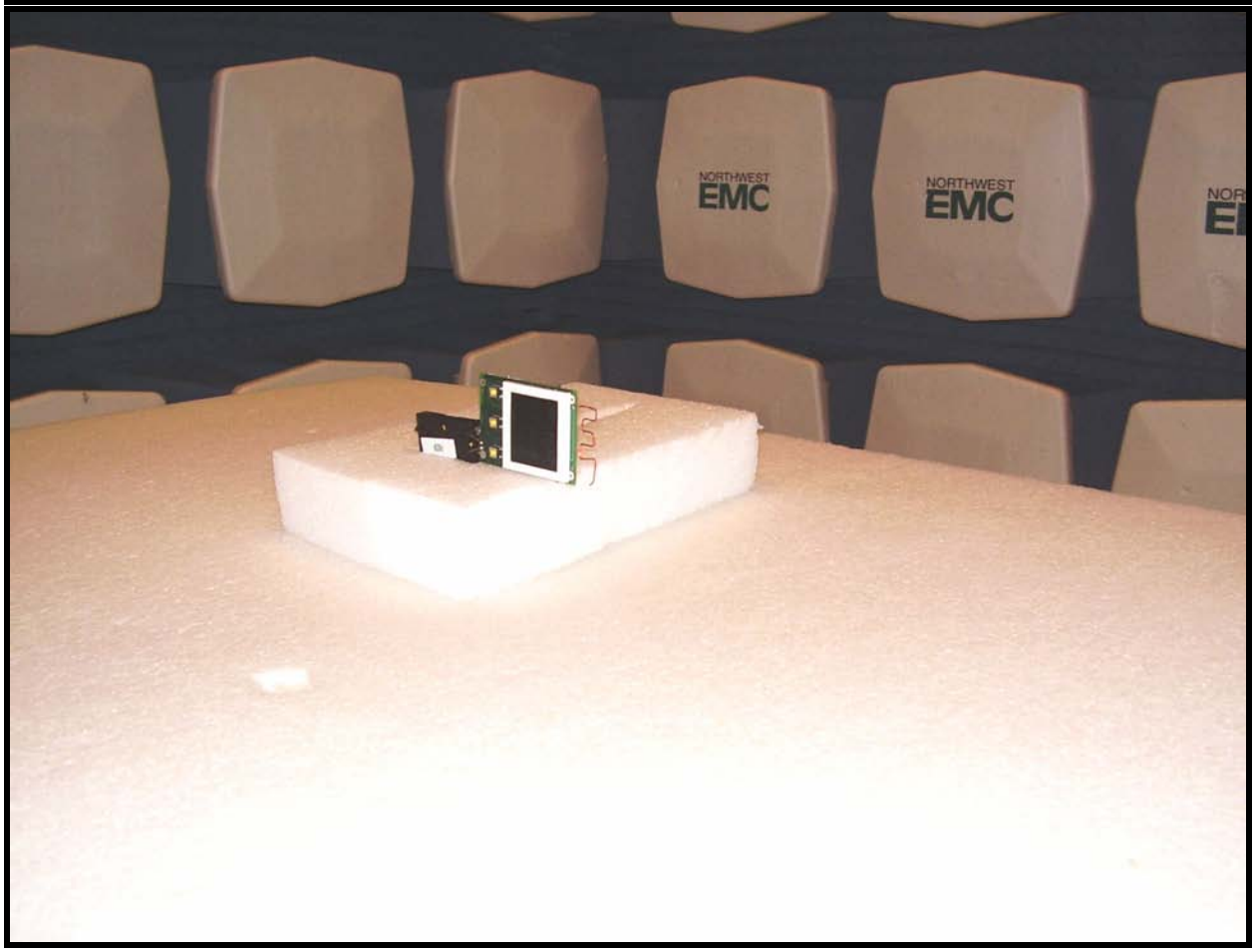


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
2779.831	47.1	1.7	195.0	1.5	3.0	0.0	V-Horn	AV	0.0	48.8	54.0	-5.2
2779.839	46.6	1.7	331.0	1.2	3.0	0.0	H-Horn	AV	0.0	48.3	54.0	-5.7
4633.041	42.2	5.9	183.0	1.3	3.0	0.0	V-Horn	AV	0.0	48.1	54.0	-5.9
2779.833	46.3	1.7	169.0	1.2	3.0	0.0	H-Horn	AV	0.0	48.0	54.0	-6.0
4633.033	41.4	5.9	145.0	1.3	3.0	0.0	V-Horn	AV	0.0	47.3	54.0	-6.7
2779.830	45.1	1.7	272.0	1.5	3.0	0.0	V-Horn	AV	0.0	46.8	54.0	-7.2
5559.642	34.4	8.2	138.0	1.3	3.0	0.0	H-Horn	AV	0.0	42.6	54.0	-11.4
4633.025	36.1	5.9	144.0	1.9	3.0	0.0	H-Horn	AV	0.0	42.0	54.0	-12.0
3706.435	35.8	4.6	149.0	1.3	3.0	0.0	H-Horn	AV	0.0	40.4	54.0	-13.6
5559.630	31.7	8.2	131.0	1.2	3.0	0.0	H-Horn	AV	0.0	39.9	54.0	-14.1
6486.231	27.8	10.1	145.0	1.1	3.0	0.0	H-Horn	AV	0.0	37.9	54.0	-16.1
4633.052	45.5	5.9	183.0	1.3	3.0	0.0	V-Horn	PK	0.0	51.4	74.0	-22.6
2779.805	49.2	1.7	195.0	1.5	3.0	0.0	V-Horn	PK	0.0	50.9	74.0	-23.1
4632.999	44.8	5.9	145.0	1.3	3.0	0.0	V-Horn	PK	0.0	50.7	74.0	-23.3
2779.844	48.8	1.7	331.0	1.2	3.0	0.0	H-Horn	PK	0.0	50.5	74.0	-23.5
2779.814	48.3	1.7	169.0	1.2	3.0	0.0	H-Horn	PK	0.0	50.0	74.0	-24.0
5559.478	40.9	8.2	138.0	1.3	3.0	0.0	H-Horn	PK	0.0	49.1	74.0	-24.9
2779.875	47.4	1.7	272.0	1.5	3.0	0.0	V-Horn	PK	0.0	49.1	74.0	-24.9
5559.612	39.9	8.2	131.0	1.2	3.0	0.0	H-Horn	PK	0.0	48.1	74.0	-25.9
6486.215	37.8	10.1	145.0	1.1	3.0	0.0	H-Horn	PK	0.0	47.9	74.0	-26.1
4632.984	41.2	5.9	144.0	1.9	3.0	0.0	H-Horn	PK	0.0	47.1	74.0	-26.9

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)
3706.477	41.4	4.6	149.0	1.3	3.0	0.0	H-Horn	PK	0.0	46.0	74.0	-28.0


EMC
EMC
EMC
EMC
EMC
EMC
EMC
EMC


NORTHWEST
EMC
NORTHWEST
EMC


NORTHWEST
EMC
NORTHWEST
EMC