Electromagnetic Compatibility Test Report

Tests Performed on a Recognition Source, LLC

902-928 MHz Transceiver, WPR & WISI Configurations

Radiometrics Document RP-5149A

ACCREDITED
Certification # 1495.01

Product Detail:
FCC ID: PM7-IRL2001
Equipment type: 902 to 928 MHz Low Power Transceiver

Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2002
Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Class II permissive change.
FCC Part 15.247

Tests Performed For:	*Test Facility:*
Recognition Source, LLC 3820 Stern Avenue St. Charles, IL 60174	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772

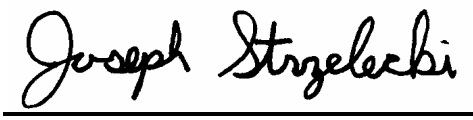
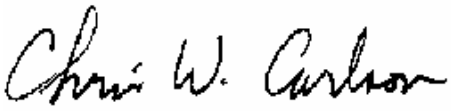
Test Date(s): (Month-Day-Year)
October 17 thru November 17, 2003

Document RP-5053 Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	November 21, 2003			

Table of Contents

1 ADMINISTRATIVE DATA

Equipment Under Test: A Recognition Source, LLC, 902-928 MHz Transceiver Model: MIRL Serial Number: None This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) 10/17/03	*Test Date(s): (Month-Day-Year)* October 17, 20, 24, and November 17, 2003
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* Dennis Johanson James F. Wiemeyer Recognition Source
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a 902-928 MHz Transceiver, Model MIRL, manufactured by Recognition Source, LLC. The detailed test results are presented in a separate section. The following is a summary of the test results.

Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section	Test Result
Spurious Radiated Emissions	30-9300 MHz	15.247 c	6.2.2 (o) (a)	Pass
Conducted Emissions, AC Mains	0.15-30 MHz	15.207	6.6	Pass

The tests at the antenna terminals were not repeated since the RF Transceiver board has not been modified.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a 902-928 MHz Transceiver, Model MIRL, manufactured by Recognition Source, LLC. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements

The EUT is professionally installed, so the antenna does not need unique antenna adaptors. The EUT will be marketed to businesses only.

3.2 Related Submittals

Recognition Source, LLC is also submitting a permissive change on a related product. Its FCC ID is PM7-DCMI2001.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

Test Setup Configuration List

Item	Description	Type*	Company	Model Number	Serial Number
1	WPR Transceiver	E	Recognition Source	MIRL	None
2	WISI Transceiver	E	Recognition Source	MIRL	None

The EUT was tested as a stand-alone device. Power was supplied with a new battery.

List of System Cables

QTY	Length (m)	Cable Description	Shielded?
1	1.7	Reader cable; Used on WISI only	Yes

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2002	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-1992	1992	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 5	2001	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment
FCC DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

The test procedures used are in accordance with the FCC DA 00-75, Industry Canada RSS-212 and ANSI document C63.4-1992, (July 17, 1992) "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics has been accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the "basic standards" listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la.org).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles in the located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	11/29/02
AMP-12	MITEQ	Pre-amplifier	AM-1431	530935	0.01-1000MHz	12 Mo.	12/28/02
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	11/25/02
ANT-03	Tensor	Biconical Antenna	4104	2231	20-200MHz	12 Mo.	08/07/03
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	12 Mo.	08/07/03
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	12 Mo.	09/30/02
ANT-28	Empire	Loop Antenna	LG-105	102	10-150kHz	12 Mo.	05/01/03
ANT-29	Empire	Loop Antenna	LP-105	656	0.15-30MHz	12 Mo.	05/01/03
ATT-02	KDI	Attenuator	A710N	RMC1	DC-10GHz	12 Mo.	12/31/02
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	12 Mo.	01/02/03
HPF-02	Microwave Cir.	High Pass Filter	H2G09G02	HPF-2	1.5-11 GHz	12 Mo.	05/01/03
LSN-01	Electrometrics	LISN	FCC/VDE 50/2	1001	0.01-30MHz	12 Mo.	1/10/03
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	06/07/03
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	12/23/02
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	12 Mo.	12/31/02

Note: All calibrated equipment is subject to periodic checks.
NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.

10 TEST SECTIONS

10.1 Spurious Radiated Emissions

Radiated emission measurements in the Restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz, an Anritsu Spectrum analyzer and a MITEQ AM-1431 amplifier with a 10 dB attenuator connected to the input were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 9.3 GHz, an HP8566A spectrum analyzer was used with a Celeritek uWave amplifier. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

The WPR was rotated through three orthogonal axis as per 13.1.4.1 of ANSI C63.4 during the prescans and during final radiated tests. This does not apply to the WISI since it wall mounted.

Radiated emission measurements are performed with linearly polarized broadband antennas. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. The entire frequency range from 30 to 9300 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

10.1.1 Radiated Emissions Field Strength Sample Calculation

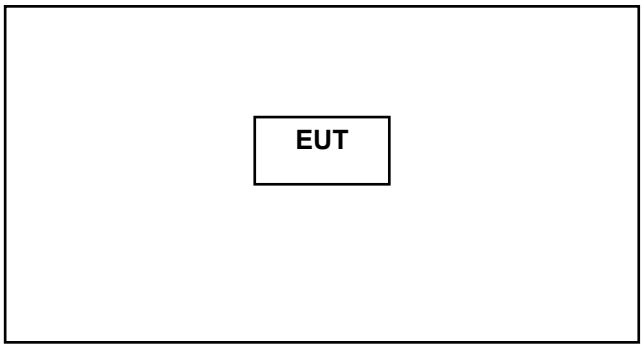
The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG + PKA

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
PKA = Peak to Average Factor (This is zero for non average measurements)

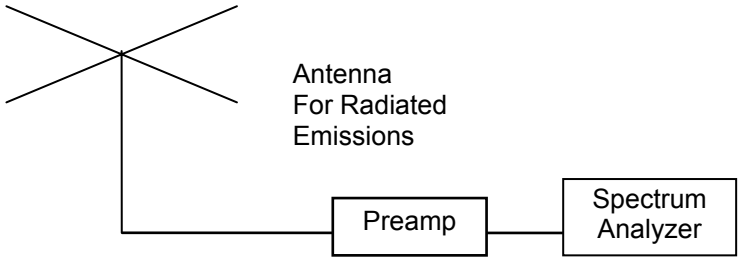
The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100).

Figure 1. Drawing of Radiated Emissions Setup



1x1.5m surface 80 cm above
Flush-mount Turntable

Notes:
- AC outlet with low-pass filter at the base of the turntable
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale



10.1.2 Spurious Radiated Emissions Test Results (Restricted Band)

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The duty cycle factor is 20 * Log(31/100) = -10.2 dB; The plot for this is in section 10.3. The peak emissions did not exceed the average by more than 20 dB.

Radiated Emissions Tests (Spurious and Harmonics above 1 GHz)

Test Distance	3 Meters	Test Date	October 24, 2003
Specification	FCC Part 15 Subpart C & RSS-210		
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain + High Pass Filter Loss		
Antennas Used	30 to 200 MHz Biconical (ANT-3); 200 to 1000 MHz Log-Periodic (ANT-6) 1 to 10 GHz Double Ridged Guide Horn (ANT-13)		

EUT Config	EUT Tx Freq	EUT Ornt	Freq (MHz)	Meter Reading (dBuV)	Ant Factor (dB/m)	Ant Pol.	Corr. Factors (dB)	Peak to Ave Factor (dB)	EUT Field Strength (dBuV/m)	Limit (dBuV/m)	Margin under Limit (dB)
WPR	903.5	X	2710.5	48.7	31.2	H	-20.2	-10.5	49.2	54.0	4.8
WPR	903.5	X	3614.4	43.7	33.4	H	-20.1	-10.5	46.5	54.0	7.5
WPR	903.5	X	4518.1	41.1	34.9	H	-21.7	-10.5	43.8	54.0	10.2
WPR	903.5	X	5422.0	42.0	36.2	H	-21.2	-10.5	46.5	54.0	7.5
WPR	903.5	X	8133.0	34.2	38.0	H	-20.4	-10.5	41.3	54.0	12.7
WPR	903.5	X	9031.9	30.5	40.1	H	-19.4	-10.5	40.7	54.0	13.3
WPR	903.5	X	2710.4	47.9	31.2	V	-20.2	-10.5	48.4	54.0	5.6
WPR	903.5	X	3614.5	43.8	33.4	V	-20.1	-10.5	46.6	54.0	7.4
WPR	903.5	X	4518.3	40.5	34.9	V	-21.7	-10.5	43.2	54.0	10.8
WPR	903.5	X	5422.1	39.7	36.2	V	-21.2	-10.5	44.2	54.0	9.8
WPR	903.5	X	8129.0	33.4	38.0	V	-20.4	-10.5	40.5	54.0	13.5
WPR	903.5	X	9037.0	30.6	40.1	V	-19.4	-10.5	40.8	54.0	13.2
WPR	915.0	X	2745.0	49.4	31.3	H	-20.2	-10.5	50.0	54.0	4.0
WPR	915.0	X	3660.1	42.1	33.6	H	-20.1	-10.5	45.1	54.0	8.9
WPR	915.0	X	4576.2	38.7	35.0	H	-21.7	-10.5	41.5	54.0	12.5
WPR	915.0	X	7318.2	36.4	37.8	H	-20.1	-10.5	43.6	54.0	10.4
WPR	915.0	X	8237.4	37.2	38.1	H	-20.5	-10.5	44.3	54.0	9.7
WPR	915.0	X	9147.7	32.8	39.8	H	-19.5	-10.5	42.6	54.0	11.4
WPR	915.0	X	2745.1	51.3	31.3	V	-20.2	-10.5	51.9	54.0	2.1
WPR	915.0	X	3660.1	41.9	33.6	V	-20.1	-10.5	44.9	54.0	9.1
WPR	915.0	X	4576.2	41.0	35.0	V	-21.7	-10.5	43.8	54.0	10.2
WPR	915.0	X	7322.8	34.0	37.8	V	-20.1	-10.5	41.2	54.0	12.8
WPR	915.0	X	8237.4	36.6	38.1	V	-20.5	-10.5	43.7	54.0	10.3
WPR	915.0	X	9147.5	35.0	39.8	V	-19.5	-10.5	44.8	54.0	9.2
WPR	925.7	X	2777.2	47.4	31.3	H	-20.1	-10.5	48.1	54.0	5.9
WPR	925.7	X	3702.9	45.6	33.8	H	-20.1	-10.5	48.8	54.0	5.2
WPR	925.7	X	4627.4	41.9	35.0	H	-21.6	-10.5	44.8	54.0	9.2
WPR	925.7	X	7403.7	34.8	37.9	H	-20.3	-10.5	41.9	54.0	12.1
WPR	925.7	X	8329.3	35.7	38.2	H	-20.4	-10.5	43.0	54.0	11.0
WPR	925.7	X	2777.2	50.9	31.3	V	-20.1	-10.5	51.6	54.0	2.4
WPR	925.7	X	3703.0	43.3	33.8	V	-20.1	-10.5	46.5	54.0	7.5
WPR	925.7	X	4629.7	39.3	35.0	V	-21.6	-10.5	42.2	54.0	11.8
WPR	925.7	X	7408.0	32.5	38.0	V	-20.3	-10.5	39.7	54.0	14.3
WPR	925.7	X	8329.3	35.8	38.2	V	-20.4	-10.5	43.1	54.0	10.9

EUT Config	EUT Tx Freq	EUT Ornt	Freq (MHz)	Meter Reading (dBuV)	Ant Factor (dB/m)	Ant Pol.	Corr. Factors (dB)	Peak to Ave Factor (dB)	EUT Field Strength (dBuV/m)	Limit (dBuV/m)	Margin under Limit (dB)
WPR	903.5	Y	2710.3	50.4	31.2	H	-20.2	-10.5	50.9	54.0	3.1
WPR	903.5	Y	3614.3	44.1	33.4	H	-20.1	-10.5	46.9	54.0	7.1
WPR	903.5	Y	4518.2	41.0	34.9	H	-21.7	-10.5	43.7	54.0	10.3
WPR	903.5	Y	5421.9	43.2	36.2	H	-21.2	-10.5	47.7	54.0	6.3
WPR	903.5	Y	8133.0	36.4	38.0	H	-20.4	-10.5	43.5	54.0	10.5
WPR	903.5	Y	9036.8	35.3	40.1	H	-19.4	-10.5	45.5	54.0	8.5
WPR	903.5	Y	2710.3	45.8	31.2	V	-20.2	-10.5	46.3	54.0	7.7
WPR	903.5	Y	3614.2	42.0	33.4	V	-20.1	-10.5	44.8	54.0	9.2
WPR	903.5	Y	4518.2	38.9	34.9	V	-21.7	-10.5	41.6	54.0	12.4
WPR	903.5	Y	5422.1	41.0	36.2	V	-21.2	-10.5	45.5	54.0	8.5
WPR	903.5	Y	8129.0	30.5	38.0	V	-20.4	-10.5	37.6	54.0	16.4
WPR	903.5	Y	9031.9	28.1	40.1	V	-19.4	-10.5	38.3	54.0	15.7
WPR	915.0	Y	2744.9	51.0	31.3	H	-20.2	-10.5	51.6	54.0	2.4
WPR	915.0	Y	3659.9	42.1	33.6	H	-20.1	-10.5	45.1	54.0	8.9
WPR	915.0	Y	4573.8	40.4	35.0	H	-21.7	-10.5	43.2	54.0	10.8
WPR	915.0	Y	7318.0	37.9	37.8	H	-20.1	-10.5	45.1	54.0	8.9
WPR	915.0	Y	8237.4	39.3	38.1	H	-20.5	-10.5	46.4	54.0	7.6
WPR	915.0	Y	9147.8	39.1	39.8	H	-19.5	-10.5	48.9	54.0	5.1
WPR	915.0	Y	2745.1	47.7	31.3	V	-20.2	-10.5	48.3	54.0	5.7
WPR	915.0	Y	3660.8	40.4	33.6	V	-20.1	-10.5	43.4	54.0	10.6
WPR	915.0	Y	4573.8	38.6	35.0	V	-21.7	-10.5	41.4	54.0	12.6
WPR	915.0	Y	7322.0	34.1	37.8	V	-20.1	-10.5	41.3	54.0	12.7
WPR	915.0	Y	8232.8	33.4	38.1	V	-20.5	-10.5	40.5	54.0	13.5
WPR	915.0	Y	9147.4	31.4	39.8	V	-19.5	-10.5	41.2	54.0	12.8
WPR	925.7	Y	2777.2	50.5	31.3	H	-20.1	-10.5	51.2	54.0	2.8
WPR	925.7	Y	3702.3	46.1	33.8	H	-20.1	-10.5	49.3	54.0	4.7
WPR	925.7	Y	4627.5	43.4	35.0	H	-21.6	-10.5	46.3	54.0	7.7
WPR	925.7	Y	7403.7	35.3	37.9	H	-20.3	-10.5	42.4	54.0	11.6
WPR	925.7	Y	8329.3	39.0	38.2	H	-20.4	-10.5	46.3	54.0	7.7
WPR	925.7	Y	2777.2	48.3	31.3	V	-20.1	-10.5	49.0	54.0	5.0
WPR	925.7	Y	3702.9	44.2	33.8	V	-20.1	-10.5	47.4	54.0	6.6
WPR	925.7	Y	4627.3	40.7	35.0	V	-21.6	-10.5	43.6	54.0	10.4
WPR	925.7	Y	7403.9	32.5	37.9	V	-20.3	-10.5	39.6	54.0	14.4
WPR	925.7	Y	8329.1	32.2	38.2	V	-20.4	-10.5	39.5	54.0	14.5
WPR	903.5	Z	2710.4	47.5	31.2	H	-20.2	-10.5	48.0	54.0	6.0
WPR	903.5	Z	3614.7	37.9	33.4	H	-20.1	-10.5	40.7	54.0	13.3
WPR	903.5	Z	4518.4	34.1	34.9	H	-21.7	-10.5	36.8	54.0	17.2
WPR	903.5	Z	5421.9	37.3	36.2	H	-21.2	-10.5	41.8	54.0	12.2
WPR	903.5	Z	8133.0	31.8	38.0	H	-20.4	-10.5	38.9	54.0	15.1
WPR	903.5	Z	9037.0	31.4	40.1	H	-19.4	-10.5	41.6	54.0	12.4
WPR	903.5	Z	2710.3	47.8	31.2	V	-20.2	-10.5	48.3	54.0	5.7
WPR	903.5	Z	3614.2	38.7	33.4	V	-20.1	-10.5	41.5	54.0	12.5
WPR	903.5	Z	4518.3	37.4	34.9	V	-21.7	-10.5	40.1	54.0	13.9
WPR	903.5	Z	5421.9	28.8	36.2	V	-21.2	-10.5	33.3	54.0	20.7

EUT Config	EUT Tx Freq	EUT Ornt	Freq (MHz)	Meter Reading (dBuV)	Ant Factor (dB/m)	Ant Pol.	Corr. Factors (dB)	Peak to Ave Factor (dB)	EUT Field Strength (dBuV/m)	Limit (dBuV/m)	Margin under Limit (dB)
WPR	903.5	Z	8133.2	28.5	38.0	V	-20.4	-10.5	35.6	54.0	18.4
WPR	903.5	Z	9036.9	28.2	40.1	V	-19.4	-10.5	38.4	54.0	15.6
WPR	915.0	Z	2745.0	47.1	31.3	H	-20.2	-10.5	47.7	54.0	6.3
WPR	915.0	Z	3660.9	36.3	33.6	H	-20.1	-10.5	39.3	54.0	14.7
WPR	915.0	Z	4576.2	34.6	35.0	H	-21.7	-10.5	37.4	54.0	16.6
WPR	915.0	Z	7318.0	31.2	37.8	H	-20.1	-10.5	38.4	54.0	15.6
WPR	915.0	Z	8237.4	32.7	38.1	H	-20.5	-10.5	39.8	54.0	14.2
WPR	915.0	Z	9147.6	30.5	39.8	H	-19.5	-10.5	40.3	54.0	13.7
WPR	915.0	Z	2744.9	44.5	31.3	V	-20.2	-10.5	45.1	54.0	8.9
WPR	915.0	Z	3660.7	39.1	33.6	V	-20.1	-10.5	42.1	54.0	11.9
WPR	915.0	Z	4573.8	37.0	35.0	V	-21.7	-10.5	39.8	54.0	14.2
WPR	915.0	Z	7318.1	34.0	37.8	V	-20.1	-10.5	41.2	54.0	12.8
WPR	915.0	Z	8232.7	32.1	38.1	V	-20.5	-10.5	39.2	54.0	14.8
WPR	915.0	Z	9147.6	32.7	39.8	V	-19.5	-10.5	42.5	54.0	11.5
WPR	925.7	Z	2777.3	44.6	31.3	H	-20.1	-10.5	45.3	54.0	8.7
WPR	925.7	Z	3701.9	39.2	33.8	H	-20.1	-10.5	42.4	54.0	11.6
WPR	925.7	Z	4629.8	35.2	35.0	H	-21.6	-10.5	38.1	54.0	15.9
WPR	925.7	Z	7403.8	29.4	37.9	H	-20.3	-10.5	36.5	54.0	17.5
WPR	925.7	Z	8329.2	30.3	38.2	H	-20.4	-10.5	37.6	54.0	16.4
WPR	925.7	Z	2710.4	47.9	31.2	V	-20.2	-10.5	48.4	54.0	5.6
WPR	925.7	Z	2777.1	40.7	31.3	V	-20.1	-10.5	41.4	54.0	12.6
WPR	925.7	Z	3702.2	40.5	33.8	V	-20.1	-10.5	43.7	54.0	10.3
WPR	925.7	Z	4629.9	39.2	35.0	V	-21.6	-10.5	42.1	54.0	11.9
WPR	925.7	Z	7403.8	33.8	37.9	V	-20.3	-10.5	40.9	54.0	13.1
WPR	925.7	Z	8329.5	33.8	38.2	V	-20.4	-10.5	41.1	54.0	12.9

EUT Config	EUT Tx Freq	EUT Ornt	Freq (MHz)	Meter Reading (dBuV)	Ant Factor (dB/m)	Ant Pol.	Corr. Factors (dB)	Peak to Ave Factor (dB)	EUT Field Strength (dBuV/m)	Limit (dBuV/m)	Margin under Limit (dB)
WISI	903.5	X	2710.4	46.4	31.2	H	-20.2	-10.5	46.9	54.0	7.1
WISI	903.5	X	3614.5	42.8	33.4	H	-20.1	-10.5	45.6	54.0	8.4
WISI	903.5	X	4516	40.7	34.9	H	-21.7	-10.5	43.4	54.0	10.6
WISI	903.5	X	5419.1	39.6	36.2	H	-21.2	-10.5	44.1	54.0	9.9
WISI	903.5	X	8129.6	39.6	38	H	-20.4	-10.5	46.7	54.0	7.3
WISI	903.5	X	9036.9	29.2	40.1	H	-19.4	-10.5	39.4	54.0	14.6
WISI	903.5	X	2710.5	49.3	31.2	V	-20.2	-10.5	49.8	54.0	4.2
WISI	903.5	X	3614.4	42.9	33.4	V	-20.1	-10.5	45.7	54.0	8.3
WISI	903.5	X	4516.1	36.6	34.9	V	-21.7	-10.5	39.3	54.0	14.7
WISI	903.5	X	5419.4	36.3	36.2	V	-21.2	-10.5	40.8	54.0	13.2
WISI	903.5	X	8133.3	33	38	V	-20.4	-10.5	40.1	54.0	13.9
WISI	903.5	X	9036.9	29.5	40.1	V	-19.4	-10.5	39.7	54.0	14.3
WISI	915.0	X	2744.9	47.5	31.3	H	-20.2	-10.5	48.1	54.0	5.9
WISI	915.0	X	3660.9	40.6	33.6	H	-20.1	-10.5	43.6	54.0	10.4

EUT Config	EUT Tx Freq	EUT Ornt	Freq (MHz)	Meter Reading (dBuV)	Ant Factor (dB/m)	Ant Pol.	Corr. Factors (dB)	Peak to Ave Factor (dB)	EUT Field Strength (dBuV/m)	Limit (dBuV/m)	Margin under Limit (dB)
WISI	915.0	X	4576.3	39.9	35	H	-21.7	-10.5	42.7	54.0	11.3
WISI	915.0	X	7318.2	39.1	37.8	H	-20.1	-10.5	46.3	54.0	7.7
WISI	915.0	X	8237.6	39.4	38.1	H	-20.5	-10.5	46.5	54.0	7.5
WISI	915.0	X	9152.9	36	39.8	H	-19.6	-10.5	45.7	54.0	8.3
WISI	915.0	X	2745	52	31.3	V	-20.2	-10.5	52.6	54.0	1.4
WISI	915.0	X	3660.9	42.7	33.6	V	-20.1	-10.5	45.7	54.0	8.3
WISI	915.0	X	4573.8	40.3	35	V	-21.7	-10.5	43.1	54.0	10.9
WISI	915.0	X	7322.3	37.7	37.8	V	-20.1	-10.5	44.9	54.0	9.1
WISI	915.0	X	8237.7	38.6	38.1	V	-20.5	-10.5	45.7	54.0	8.3
WISI	915.0	X	9152.8	37	39.8	V	-19.6	-10.5	46.7	54.0	7.3
WISI	925.7	X	2777.1	42.7	31.3	H	-20.1	-10.5	43.4	54.0	10.6
WISI	925.7	X	3703.4	44.1	33.8	H	-20.1	-10.5	47.3	54.0	6.7
WISI	925.7	X	4629.9	41	35	H	-21.6	-10.5	43.9	54.0	10.1
WISI	925.7	X	7404.1	33.2	37.9	H	-20.3	-10.5	40.3	54.0	13.7
WISI	925.7	X	8329.4	33.6	38.2	H	-20.4	-10.5	40.9	54.0	13.1
WISI	925.7	X	9254.9	28.8	39.5	H	-19.9	-10.5	37.9	54.0	16.1
WISI	925.7	X	2777.1	45.1	31.3	V	-20.1	-10.5	45.8	54.0	8.2
WISI	925.7	X	3703.4	44.8	33.8	V	-20.1	-10.5	48.0	54.0	6.0
WISI	925.7	X	4627.5	39.3	35	V	-21.6	-10.5	42.2	54.0	11.8
WISI	925.7	X	7407.9	33.6	38	V	-20.3	-10.5	40.8	54.0	13.2
WISI	925.7	X	8329.6	33.0	38.2	V	-20.4	-10.5	40.3	55.0	14.7

Judgment: Passed by 1.4 dB

Radiated Emissions Tests Below 1 GHz

Notes	Corr. Factors = cable loss - preamp gain The worst emissions are presented from the three operating frequencies
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical; LP = Log-Periodic; BL = Bilog; P = peak; Q = QP

EUT Config	Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
			Factor dB	Pol/ Type		EUT	Limit	
WPR	116.3	39.9 P	12.3	H/BC	-24.7	27.5	43.5	16.0
WPR	121.3	42.0 P	12.1	H/BC	-24.6	29.5	43.5	14.0
WPR	124.3	42.3 P	11.9	H/BC	-24.6	29.6	43.5	13.9
WPR	128.9	41.0 P	11.7	H/BC	-24.5	28.3	43.5	15.2
WPR	133.5	39.6 P	11.8	H/BC	-24.5	26.9	43.5	16.6
WPR	167.9	33.2 P	15.4	H/BC	-23.9	24.7	43.5	18.8
WPR	246.3	40.0 P	17.6	H/BC	-22.6	35.0	46.0	11.0
WPR	252.4	43.6 P	12.8	H/LP	-22.5	33.9	46.0	12.1
WPR	259.1	40.4 P	13.0	H/LP	-22.4	31.0	46.0	15.0

EUT Config	Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/ Type	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
WPR	38.0	34.1 P	10.6	V/BC	-25.9	18.8	40.0	21.2
WPR	112.8	38.9 P	12.8	V/BC	-24.7	27.0	43.5	16.5
WPR	116.3	39.3 P	13.2	V/BC	-24.7	27.8	43.5	15.7
WPR	120.0	41.9 P	12.9	V/BC	-24.6	30.2	43.5	13.3
WPR	125.0	44.8 P	12.9	V/BC	-24.5	33.2	43.5	10.3
WPR	131.4	44.9 P	12.9	V/BC	-24.5	33.4	43.5	10.1
WPR	132.1	42.7 P	12.8	V/BC	-24.5	31.0	43.5	12.5
WPR	253.3	38.2 P	12.8	V/LP	-22.5	28.5	46.0	17.5
WPR	261.2	36.9 P	13.0	V/LP	-22.3	27.6	46.0	18.4
WPR	271.4	36.5 P	13.5	V/LP	-22.1	28.0	46.0	18.0
WISI	120.3	50.1 P	12.2	H/BC	-24.6	37.7	43.5	5.8
WISI	121.8	51.8 P	12.1	H/BC	-24.6	39.2	43.5	4.3
WISI	130.0	51.8 Q	11.7	H/BC	-24.5	39.1	43.5	4.4
WISI	130.8	52.9 Q	11.7	H/BC	-24.5	40.1	43.5	3.4
WISI	132.1	52.8 Q	11.7	H/BC	-24.5	40.1	43.5	3.4
WISI	133.8	47.0 P	11.8	H/BC	-24.5	34.4	43.5	9.1
WISI	137.0	46.2 P	11.9	H/BC	-24.4	33.6	43.5	9.9
WISI	165.4	50.9 Q	15.1	H/BC	-24.0	42.0	43.5	1.5
WISI	240.8	45.3 Q	16.8	H/BC	-22.7	39.4	46.0	6.6
WISI	241.0	40.7 Q	16.8	H/BC	-22.7	34.8	46.0	11.2
WISI	241.6	46.4 P	16.9	H/BC	-22.7	40.6	46.0	5.4
WISI	243.0	44.8 P	17.1	H/BC	-22.6	39.3	46.0	6.7
WISI	248.3	39.5 P	17.9	H/BC	-22.6	34.9	46.0	11.1
WISI	255.6	47.2 P	12.9	H/LP	-22.4	37.7	46.0	8.3
WISI	257.6	39.6 P	12.9	H/LP	-22.4	30.1	46.0	15.9
WISI	111.6	50.3 P	12.6	V/BC	-24.7	38.2	43.5	5.3
WISI	114.4	50.9 P	13.2	V/BC	-24.7	39.4	43.5	4.1
WISI	115.4	50.3 P	13.3	V/BC	-24.7	39.0	43.5	4.5
WISI	124.0	51.3 P	12.9	V/BC	-24.6	39.7	43.5	3.8
WISI	128.0	52.8 Q	13.0	V/BC	-24.5	41.3	43.5	2.2
WISI	132.3	52.5 P	12.8	V/BC	-24.5	40.9	43.5	2.6
WISI	132.6	52.3 P	12.7	V/BC	-24.5	40.5	43.5	3.0
WISI	137.8	45.5 P	12.4	V/BC	-24.4	33.5	43.5	10.0
WISI	167.9	42.1 P	16.6	V/BC	-23.9	34.8	43.5	8.7
WISI	169.1	41.4 P	16.9	V/BC	-23.9	34.4	43.5	9.1
WISI	235.1	43.3 P	16.6	V/BC	-22.8	37.1	46.0	8.9
WISI	241.2	41.3 P	18.3	V/BC	-22.7	36.9	46.0	9.1
WISI	259.6	43.7 P	13.0	V/LP	-22.3	34.3	46.0	11.7
WISI	268.9	42.4 P	13.4	V/LP	-22.2	33.6	46.0	12.4
WISI	275.7	39.2 P	13.7	V/LP	-22.0	30.9	46.0	15.1
WISI	327.1	33.7 P	15.2	V/LP	-20.6	28.3	46.0	17.7

Judgment: Passed by 1.5 dB

10.2 Peak to Average Calculations

As required by FCC section 15.35 and RSS-210 section 6.5, the Peak to Average correction factor was calculated with the data supplied by the EUT designer.

The following is the peak to average calculation for all devices except for the WUSI.

The device will transmit RF-borne messages of 30.0ms duration or less. Its duty cycle averaged over 100ms will not exceed 30%. The WPR and WISI will transmit a maximum 31.0ms duration message, at a rate of not more than 1 message per 100ms.

20*Log (.31) = -10.46 dB Peak to average correction factor.