



**Zonar Systems, LLC**

**V3R**

**FCC 15.247:2013**

**Report #: ZONA0044.1**



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – [www.nwemc.com](http://www.nwemc.com)

California – Minnesota – Oregon – New York – Washington

# CERTIFICATE OF TEST

Last Date of Test: February 25, 2013  
**Zonar Systems, LLC**  
 Model: V3R

## Emissions

Test Description	Specification	Test Method	Pass/Fail
Radiated Channel Power	FCC 15.247:2013	ANSI C63.10:2009	Pass
Spurious Radiated Emissions	FCC 15.247:2013	ANSI C63.10:2009	Pass

## Deviations From Test Standards

None

## Approved By:



Tim O'Shea, Operations Manager



NVLAP Lab Code: 200676-0

## Test Facility

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

Northwest EMC, Inc.  
 41 Tesla Ave.  
 Irvine, CA 92618

Phone: (503) 844-4066      Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834B-1).

*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 HISTORY

Revision Number	Description	Date	Page Number
00	None		

### **Barometric Pressure**

The recorded barometric pressure has been normalized to sea level.

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## United States

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**FCC** - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

**NVLAP** - Each laboratory is accredited by NVLAP to ISO 17025

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## Canada

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**IC** - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

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## European Union

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**European Commission** – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

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## Australia/New Zealand

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**ACMA** - Recognized by ACMA as a CAB for the acceptance of test data.

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## Korea

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**KCC / RRA** - Recognized by KCC's RRA as a CAB for the acceptance of test data.

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## Japan

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**VCCI** - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

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## Taiwan

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**BSMI** – Recognized by BSMI as a CAB for the acceptance of test data.

**NCC** - Recognized by NCC as a CAB for the acceptance of test data.

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## Singapore

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**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

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## Hong Kong

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**OFTA** – Recognized by OFTA as a CAB for the acceptance of test data.

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## Vietnam

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**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

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## Russia

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**GOST** – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

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## SCOPE

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

<http://www.nwemc.com/accreditations/>

## 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. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty ( $K=2$ ) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-1 as applicable), and are available upon request.

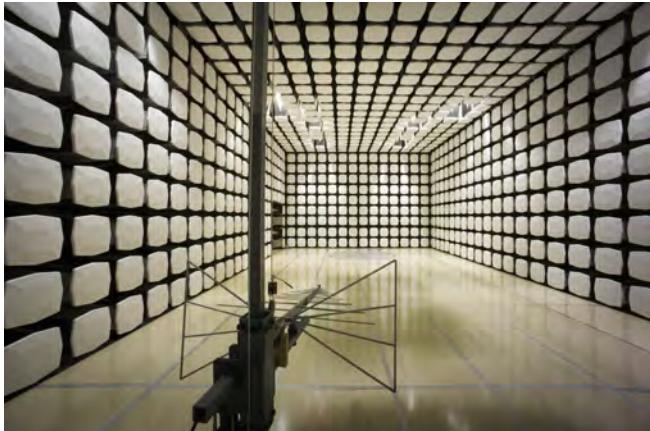
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.12	-0.01
Amplitude Accuracy (dB)	0.49	-0.49
Conducted Power (dB)	0.41	-0.41
Radiated Power via Substitution (dB)	0.69	-0.68
Temperature (degrees C)	0.81	-0.81
Humidity (% RH)	2.89	-2.89
Field Strength (dB)	3.80	-3.80
AC Powerline Conducted Emissions (dB)	2.94	-2.94

# LOCATIONS



<b>Oregon</b> Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	<b>California</b> Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	<b>New York</b> Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	<b>Minnesota</b> Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	<b>Washington</b> Labs NC01-05, SU02, SU07 19201 120 <sup>th</sup> Ave. NE Bothell, WA 98011 (425) 984-6600
<b>VCCI</b>				
A-0108	A-0029		A-0109	A-0110
<b>Industry Canada</b>				
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1
<b>NVLAP</b>				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0





# PRODUCT DESCRIPTION

## Client and Equipment Under Test (EUT) Information

<b>Company Name:</b>	Zonar Systems, LLC
<b>Address:</b>	18200 Cascade Ave. S Suite, 200
<b>City, State, Zip:</b>	Seattle, WA 98188
<b>Test Requested By:</b>	David Pascoe
<b>Model:</b>	V3R
<b>First Date of Test:</b>	February 11, 2013
<b>Last Date of Test:</b>	February 25, 2013
<b>Receipt Date of Samples:</b>	February 11, 2013
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No Damage

## Information Provided by the Party Requesting the Test

### Functional Description of the EUT (Equipment Under Test):

Vehicle mounted equipment that contains a cellular modem and ruggedized waterproof enclosure.

### Testing Objective:

Original enclosure is being replaced by a new ruggedized enclosure. Through a KDB inquiry, the FCC stated that this requires a new certification. The data in this report is intended to validate that change.

## Configuration ZONA0044- 1

EUT				
Description	Manufacturer	Model/Part Number	Serial Number	
Vehicle Base Module w/Ruggedized Waterproof Enclosure	Zonar Systems, LLC	V3R	40000000046	

Peripherals in test setup boundary				
Description	Manufacturer	Model/Part Number	Serial Number	
DC Power Supply	EZ Digital Co. Ltd.	DC Power Supply	01070029	

Remote Equipment Outside of Test Setup Boundary				
Description	Manufacturer	Model/Part Number	Serial Number	
Dell Laptop	Dell Corporation	RPO5L	8557805701	

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Cable	No	1.0m	No	Vehicle Base Module w/Ruggedized Waterproof Enclosure	DC Power Supply
Serial Cable (4pin)	No	3.0m	No	Vehicle Base Module w/Ruggedized Waterproof Enclosure	Dell Laptop
Serial Cable (8pin)	No	3.0m	No	Vehicle Base Module w/Ruggedized Waterproof Enclosure	Dell Laptop
AC Cable	No	1.8m	No	DC Power Supply	AC Mains
Cable Adapter	No	0.9m	No	Vehicle Base Module w/Ruggedized Waterproof Enclosure	Cables

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

## Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2/25/2013	Radiated Channel Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	2/25/2013	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

## RADIATED CHANNEL POWER

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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

### MODES OF OPERATION

Transmitting 802.11

### POWER SETTINGS INVESTIGATED

12 VDC

### CONFIGURATIONS INVESTIGATED

ZONA0044 - 1

### FREQUENCY RANGE INVESTIGATED

Start Frequency	2400 MHz	Stop Frequency	2483.5 MHz
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### 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
OC10 Cables	N/A	1-8GHz RE Cables	OCJ	10/10/2012	12 mo
Antenna, Horn	EMCO	3115	AHB	3/8/2011	24 mo
Spectrum Analyzer	Agilent	E4440A	AFG	5/16/2012	24 mo

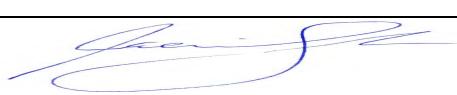
### MEASUREMENT BANDWIDTHS

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

### TEST DESCRIPTION

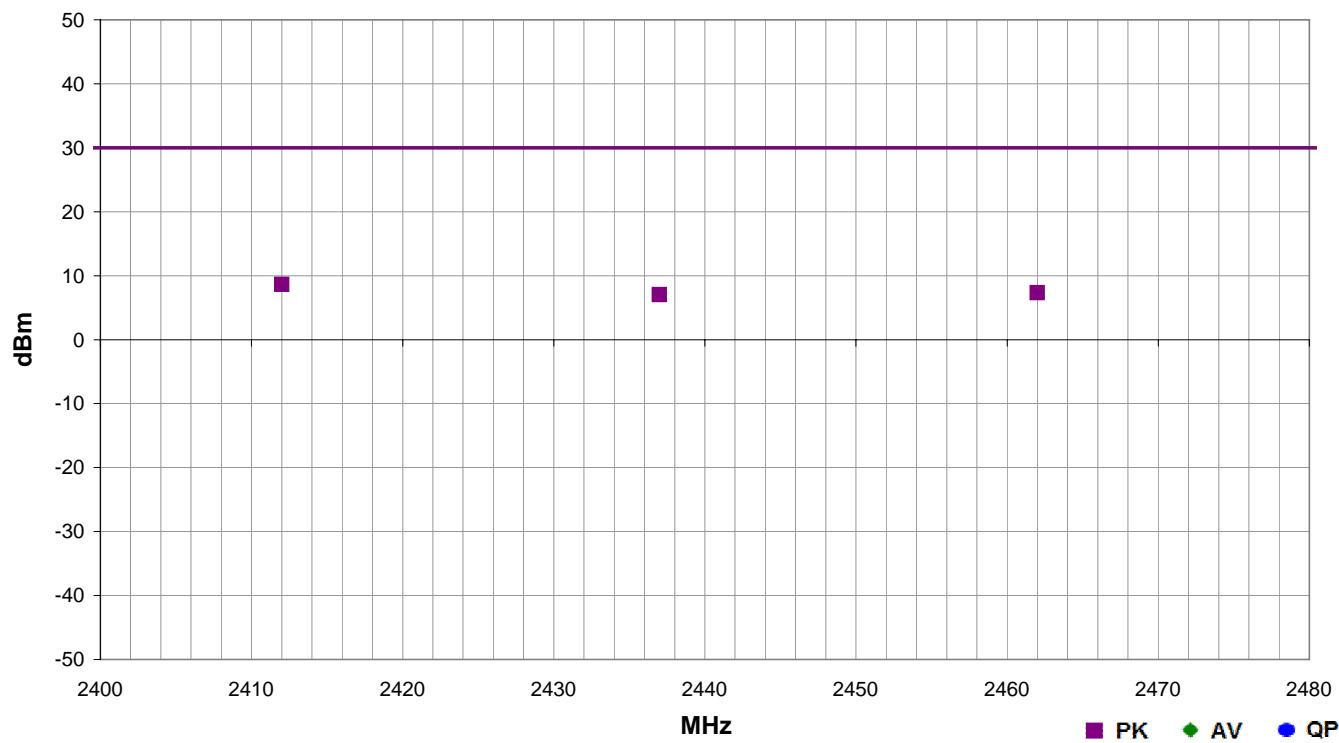
The EUT was tested in the low, mid and high channels in the mode which produced the highest power during antenna port conducted testing. The EUT was oriented in three orthogonal axis while turning the chamber turntable and maximizing the measurement antenna height. At the orientation and antenna polarity of the highest fundamental carrier emissions, the spectrum analyzer was configured for a channel power measurement consistent with the original test report to measure the peak channel power.

## RADIATED CHANNEL POWER

Work Order:	ZONA0044	Date:	02/25/13	 <b>Tested by:</b> Jaemi Suh	
Project:	None	Temperature:	22.15 °C		
Job Site:	OC02	Humidity:	31.51% RH		
Serial Number:	None	Barometric Pres.:	1013 mbar		
EUT:	V3R				
Configuration:	1				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	12 VDC				
Operating Mode:	Transmitting 802.11				
Deviations:	None				
Comments:	Worst Case Mode from Prescans: 1 Mbps, Worst Case Axis: Z-Axis				

Test Specifications	Test Method
FCC 15.247:2013	ANSI C63.10:2009

Run #	18	Test Distance (m)	3	Antenna Height(s)	1-4m	Results	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
2412.000	1.0	185.0	Vert	PK	7.32E-03	8.6	30.0	-21.4	Low Channel, EUT Z-Axis, Channel Power	
2462.000	1.6	19.0	Vert	PK	5.43E-03	7.3	30.0	-22.7	High Channel, EUT Z-Axis, Channel Power	
2437.000	1.0	183.0	Vert	PK	5.07E-03	7.0	30.0	-23.0	Mid Channel, EUT Z-Axis, Channel Power	

## SPURIOUS 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. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

### MODES OF OPERATION

Transmitting 802.11

### POWER SETTINGS INVESTIGATED

12 VDC

### CONFIGURATIONS INVESTIGATED

ZONA0044 - 1

### FREQUENCY RANGE INVESTIGATED

Start Frequency	1000 MHz	Stop Frequency	12400 MHz
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### 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	Mited	AMF-6F-08001200-30-10P	AOE	11/21/2012	12 mo
Antenna, Horn	ETS	3160-07	AHR	NCR	0 mo
OC 10 Cables	N/A	12-18GHz RE Cables	OCO	10/10/2012	12 mo
Pre-Amplifier	Miteq	AMF-4D-010120-30-10P-1	AOP	6/7/2012	12 mo
Antenna, Horn	EMCO	3115	AHB	3/8/2011	24 mo
OC10 Cables	N/A	1-8GHz RE Cables	OCJ	10/10/2012	12 mo
Spectrum Analyzer	Agilent	E4440A	AFG	5/16/2012	24 mo

### 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

### TEST DESCRIPTION

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. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

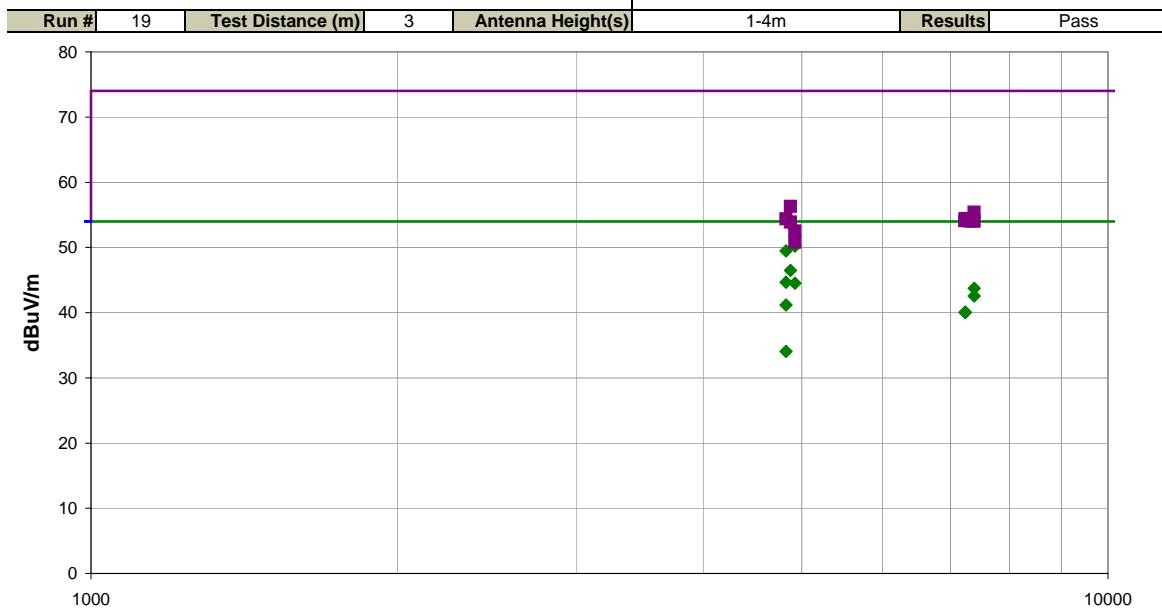


## SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2012.12.14  
PSA-ESCI Version 2011.12.21

Work Order:	ZONA0044	Date:	02/25/13	
Project:	None	Temperature:	22.15 °C	
Job Site:	OC02	Humidity:	31.51% RH	
Serial Number:	None	Barometric Pres.:	1013 mbar	Tested by: Jaemi Suh
EUT:	V3R			
Configuration:	1			
Customer:	Zonar Systems, LLC			
Attendees:	None			
EUT Power:	12 VDC			
Operating Mode:	Transmitting 802.11			
Deviations:	None			
Comments:	Worst Case Mode from Prescans: 1 Mbps, Worst Case Axis: Z-Axis			

Test Specifications	Test Method
FCC 15.247:2013	ANSI C63.10:2009



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4873.992	43.1	10.4	1.0	107.0	3.0	0.0	Horz	AV	0.0	53.5	54.0	-0.5	Mid Channel, 1 Mbps, EUT Z-Axis
4923.979	39.7	10.5	1.0	106.0	3.0	0.0	Horz	AV	0.0	50.2	54.0	-3.8	High Channel, 1 Mbps, EUT Z-Axis
4823.978	39.2	10.3	1.0	35.0	3.0	0.0	Vert	AV	0.0	49.5	54.0	-4.5	Low Channel, 1 Mbps, EUT Z-Axis
4873.961	36.1	10.4	1.0	25.0	3.0	0.0	Vert	AV	0.0	46.5	54.0	-7.5	Mid Channel, 1 Mbps, EUT Z-Axis
4823.968	34.4	10.3	1.0	101.0	3.0	0.0	Horz	AV	0.0	44.7	54.0	-9.3	Low Channel, 1 Mbps, EUT Z-Axis
4923.968	34.0	10.5	1.0	34.0	3.0	0.0	Vert	AV	0.0	44.5	54.0	-9.5	High Channel, 1 Mbps, EUT Z-Axis
7386.735	27.8	15.9	1.0	184.0	3.0	0.0	Horz	AV	0.0	43.7	54.0	-10.3	High Channel, 1 Mbps, EUT Z-Axis
7386.791	26.6	15.9	1.0	171.0	3.0	0.0	Vert	AV	0.0	42.5	54.0	-11.5	High Channel, 1 Mbps, EUT Z-Axis
4824.015	30.9	10.3	1.0	29.0	3.0	0.0	Vert	AV	0.0	41.2	54.0	-12.8	Low Channel, 1 Mbps, EUT Y-Axis
7237.362	24.6	15.5	1.0	194.0	3.0	0.0	Horz	AV	0.0	40.1	54.0	-13.9	Low Channel, 1 Mbps, EUT Z-Axis
7237.589	24.5	15.5	1.0	165.0	3.0	0.0	Vert	AV	0.0	40.0	54.0	-14.0	Low Channel, 1 Mbps, EUT Z-Axis
4874.014	45.9	10.4	1.0	107.0	3.0	0.0	Horz	PK	0.0	56.3	74.0	-17.7	Mid Channel, 1 Mbps, EUT Z-Axis
7386.317	39.5	15.9	1.0	184.0	3.0	0.0	Horz	PK	0.0	55.4	74.0	-18.6	High Channel, 1 Mbps, EUT Z-Axis
7237.419	38.9	15.5	1.0	194.0	3.0	0.0	Horz	PK	0.0	54.4	74.0	-19.6	Low Channel, 1 Mbps, EUT Z-Axis
4823.561	44.1	10.3	1.0	101.0	3.0	0.0	Horz	PK	0.0	54.4	74.0	-19.6	Low Channel, 1 Mbps, EUT Z-Axis
7235.784	38.6	15.5	1.0	165.0	3.0	0.0	Vert	PK	0.0	54.1	74.0	-19.9	Low Channel, 1 Mbps, EUT Z-Axis
4823.933	23.8	10.3	3.3	229.0	3.0	0.0	Horz	AV	0.0	34.1	54.0	-19.9	Low Channel, 1 Mbps, EUT X-Axis
7311.573	38.2	15.8	1.6	330.0	3.0	0.0	Vert	PK	0.0	54.0	74.0	-20.0	Mid Channel, 1 Mbps, EUT Z-Axis
7385.227	38.1	15.9	1.0	185.0	3.0	0.0	Vert	PK	0.0	54.0	74.0	-20.0	High Channel, 1 Mbps, EUT Z-Axis
7384.229	38.1	15.9	1.0	124.0	3.0	0.0	Vert	PK	0.0	54.0	74.0	-20.0	High Channel, 1 Mbps, EUT Z-Axis
4873.747	43.5	10.4	1.0	101.0	3.0	0.0	Horz	PK	0.0	53.9	74.0	-20.1	Mid Channel, 1 Mbps, EUT Z-Axis
4924.507	42.0	10.5	1.0	109.0	3.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5	High Channel, 1 Mbps, EUT Z-Axis
4923.853	40.3	10.5	1.0	169.0	3.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	High Channel, 1 Mbps, EUT Z-Axis