Zonar Systems, LLC

Pump Radio 80446A

EMC Test Report

Report No. ZONA0029

Report Prepared By

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

NORTHWEST EMC

22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Last Date of Test: October 20, 2011

Zonar Systems, LLC

Model: Pump Radio 80446A

Emissions			
Test Description	**Specification**	**Test Method**	**Pass/Fail**
Field Strength of Fundamental	FCC 15.249:2011	ANSI C63.10:2009	**Pass**
Field Strength of Harmonics	FCC 15.249:2011	ANSI C63.10:2009	**Pass**
AC Powerline Conducted Emissions	FCC 15.207:2011	ANSI C63.10:2009	**Pass**

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

Test Facility

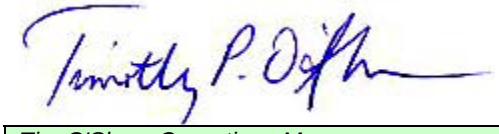
The measurement facility used to collect the data is located at:

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 (Site filing #2834D-2).

Approved By:



Tim O'Shea, Operations Manager

NVLAP Lab Code: 200630-0

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		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

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 accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. NVLAP is administered by the National Institute of Standards and Technology (NIST), an agency of the U.S. Commerce Department. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 2004/108/EC, and ANSI C63.4. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada.

Industry Canada

Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS-Gen, Issue 2 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. (*Site Filing Numbers - Hillsboro: 2834D-1, 2834D-2, Sultan: 2834C-1, Irvine: 2834B-1, 2834B-2, Brooklyn Park: 2834E-1)*

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.

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).

Accreditations and Authorizations

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, R-1025, G-84, C-2687, T-1658, and R-2318, Irvine: R-1943, G-85, C-2766, and T-1659, Sultan: R-871, G-83, C-3265, and T-1511, Brooklyn Park: R-3125, G-86, G-141, C-3464, and T-1634).*

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 (US0017).

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

KCC

Northwest EMC, Inc is a CAB designated by MRA partners and recognized by Korea. (*Assigned Lab Numbers: Hillsboro: US0017, Irvine: US0158, Sultan: US0157, Brooklyn Park: US0175)*

VIETNAM

Vietnam MIC has approved Northwest EMC as an accredited test lab. Per Decision No. 194/QD-QLCL (dated December 15, 2009), Northwest EMC test reports can be used for Vietnam approval submissions.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/

Northwest EMC Locations

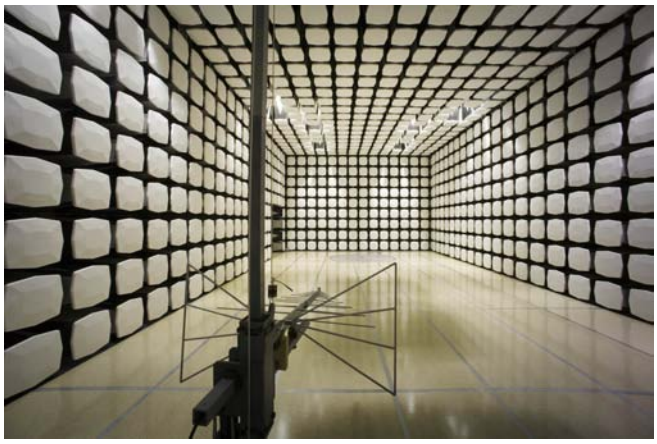
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

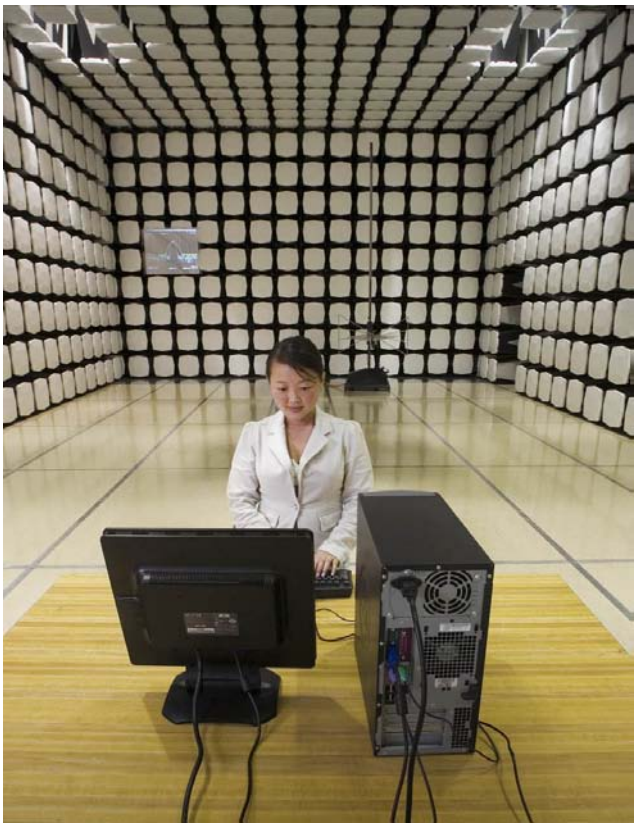
California
Labs OC01-OC13
41 Tesla
Irvine, CA 92618
(949) 861-8918

Minnesota
Labs MN01-MN08
9349 W Broadway Ave.
Brooklyn Park,
MN 55445
(763) 425-2281

Washington
Labs SU01-SU07
14128 339th Ave. SE
Sultan, WA 98294
(360) 793-8675

New York
Labs WA01-WA04
4939 Jordan Rd.
Elbridge, NY 13060
(315) 685-0796





Party Requesting the Test

Company Name:	Zonar Systems, LLC
Address:	18200 Cascade Ave. S Suite, 200
City, State, Zip:	Seattle, WA 98188
Test Requested By:	Ryan Schoelerman
Model:	Pump Radio 80446A
First Date of Test:	October 12, 2011
Last Date of Test:	October 20, 2011
Receipt Date of Samples:	October 10, 2011
Equipment Design Stage:	Preproduction
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
Pump Radio

Testing Objective:
To demonstrate compliance to FCC 15.249 specifications

CONFIGURATION 1 ZONA0029

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Pump Radio	Zonar	80446A	1001596
Antenna	Zonar	None	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Ti Programming Board	Chipcon	SmartRF04EB	0x64CB

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host PC	HP	QF938AT#ABA	CNU7390341

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.0m	No	Ti Programming Board	Host PC
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

CONFIGURATION 2 ZONA0029

Software/Firmware Running during test	
Description	**Version**
47e2 - CC2510	1.6.1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Pump Radio	Zonar	80446A	1001596
Antenna	Zonar	None	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Ti Programming Board	Chipcon	SmartRF04EB	0x64CB

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Host PC	HP	QF938AT#ABA	CNU7390341

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	4.5m	No	Ti Programming Board	Host PC
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

CONFIGURATION 4 ZONA0029

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Pump Radio	Zonar	80446A	1001596
Antenna	Zonar	None	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Ti Programming Board	Chipcon	SmartRF04EB	0x64CB
Host PC	HP	QF938AT#ABA	CNU7390341

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	1.0m	No	Ti Programming Board	Host PC
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	10/12/2011	Field Strength of Fundamental	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	10/17/2011	Field Strength of Harmonics	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.
3	10/20/2011	AC Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

Field Strength of Fundamental

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

Tx MSK modulation

FREQUENCY RANGE INVESTIGATED

Start Frequency	2400 MHz	Stop Frequency	2483.5 MHz

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
EV12 Cables	N/A	Double Ridge Horn Cables	EVT	10/6/2011	12
Antenna, Horn	ETS	3115	AIB	9/8/2010	24
Spectrum Analyzer	Agilent	E4440A	AAW	4/19/2011	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

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. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. The measurement uncertainty estimation is available upon request.

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting and while set at the lowest channel, a middle channel, and the highest channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT and EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009).

NORTHWEST **EMC**

Field Strength of Fundamental

PSA 2011.05.11
EMI 2008.1.9

EUT:	Pump Radio 80446A			**Work Order:**	ZONA0029
Serial Number:	1001596			**Date:**	10/12/11
Customer:	Zonar Systems, LLC			**Temperature:**	23°C
Attendees:	None			**Humidity:**	48%
Project:	None			**Barometric Pres.:**	1015.5
Tested by:	Ethan Schoonover	**Power:**	USB	**Job Site:**	EV12

TEST SPECIFICATIONS	Test Method
FCC 15.249:2011	ANSI C63.10:2009

TEST PARAMETERS

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

COMMENTS

None

EUT OPERATING MODES

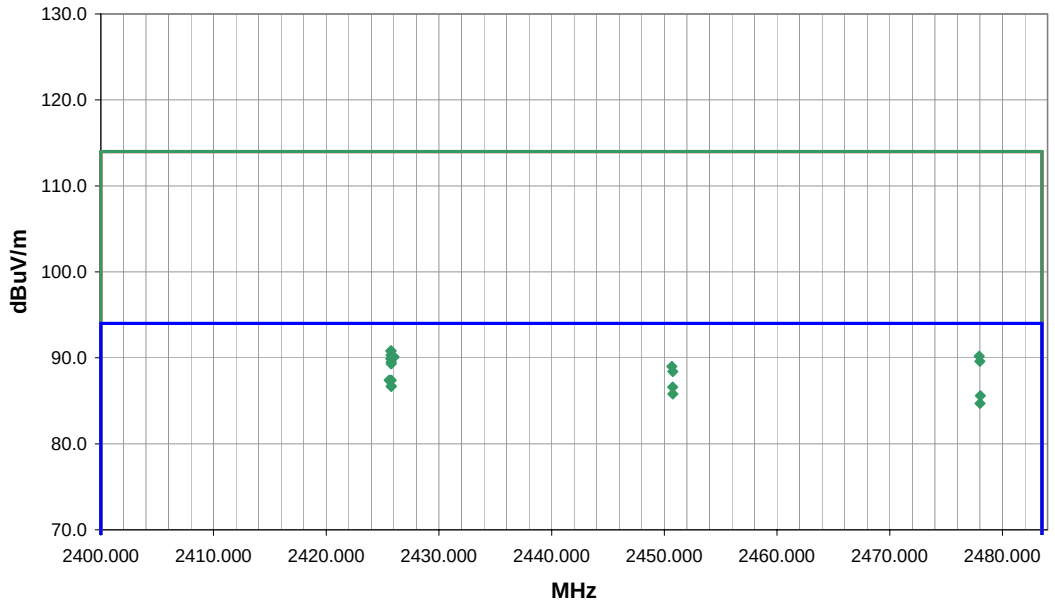
Tx MSK modulation

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)	Comments
2425.760	55.6	34.7	113.0	1.0	3.0	0.0	V-Horn	AV	0.0	90.3	94.0	-3.7	EUT Horz
2425.767	55.6	34.7	57.0	1.0	3.0	0.0	V-Horn	AV	0.0	90.3	94.0	-3.7	EUT Vert
2477.993	54.9	34.7	91.0	1.0	3.0	0.0	V-Horn	AV	0.0	89.6	94.0	-4.4	EUT Horz
2425.760	54.8	34.7	153.0	1.0	3.0	0.0	V-Horn	AV	0.0	89.5	94.0	-4.5	EUT On Side.
2425.760	54.6	34.7	359.0	1.0	3.0	0.0	H-Horn	AV	0.0	89.3	94.0	-4.7	EUT On Side.
2450.753	53.6	34.8	94.0	1.0	3.0	0.0	V-Horn	AV	0.0	88.4	94.0	-5.6	EUT Horz
2425.760	52.0	34.7	27.0	2.0	3.0	0.0	H-Horn	AV	0.0	86.7	94.0	-7.3	EUT Vert
2425.767	52.0	34.7	117.0	1.0	3.0	0.0	H-Horn	AV	0.0	86.7	94.0	-7.3	EUT Horz
2450.753	51.0	34.8	315.0	1.0	3.0	0.0	H-Horn	AV	0.0	85.8	94.0	-8.2	EUT Horz
2478.003	50.0	34.7	256.0	1.0	3.0	0.0	H-Horn	AV	0.0	84.7	94.0	-9.3	EUT Horz
2425.743	56.1	34.7	57.0	1.0	3.0	0.0	V-Horn	PK	0.0	90.8	114.0	-23.2	EUT Vert
2425.757	56.1	34.7	113.0	1.0	3.0	0.0	V-Horn	PK	0.0	90.8	114.0	-23.2	EUT Horz
2477.933	55.5	34.7	91.0	1.0	3.0	0.0	V-Horn	PK	0.0	90.2	114.0	-23.8	EUT Horz
2426.027	55.4	34.7	153.0	1.0	3.0	0.0	V-Horn	PK	0.0	90.1	114.0	-23.9	EUT On Side.
2425.723	55.2	34.7	359.0	1.0	3.0	0.0	H-Horn	PK	0.0	89.9	114.0	-24.1	EUT On Side.
2450.660	54.2	34.8	94.0	1.0	3.0	0.0	V-Horn	PK	0.0	89.0	114.0	-25.0	EUT Horz
2425.580	52.7	34.7	117.0	1.0	3.0	0.0	H-Horn	PK	0.0	87.4	114.0	-26.6	EUT Horz
2425.767	52.7	34.7	27.0	2.0	3.0	0.0	H-Horn	PK	0.0	87.4	114.0	-26.6	EUT Vert
2450.733	51.8	34.8	315.0	1.0	3.0	0.0	H-Horn	PK	0.0	86.6	114.0	-27.4	EUT Horz
2478.033	50.9	34.7	256.0	1.0	3.0	0.0	H-Horn	PK	0.0	85.6	114.0	-28.4	EUT Horz

Field Strength of Harmonics

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

Tx, MSK modulation

POWER SETTINGS INVESTIGATED

USB

FREQUENCY RANGE INVESTIGATED

Start Frequency	30MHz	Stop Frequency	26GHz

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
Cable	ESM Cable Corp.	KMKM-72	EVY	9/12/2011	12
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	9/12/2011	12
Antenna, Horn	ETS Lindgren	3160-09	AIV	NCR	0
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVI	7/5/2011	12
Antenna, Horn	ETS	3160-08	AIA	NCR	0
EV12 Cables	N/A	Standard Gain Horn Cables	EVU	6/20/2011	12
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVH	6/20/2011	12
Antenna, Horn	ETS	3160.07	AHZ	9/8/2010	24
High Pass Filter	Micro-Tronics	50111	HGE	7/14/2010	24
EV12 Cables	N/A	Double Ridge Horn Cables	EVT	10/6/2011	12
Pre-Amplifier	Miteq	AMF-3D00100800-32-13P	AVF	6/20/2011	12
Antenna, Horn	ETS	3115	AIB	9/8/2010	24
Spectrum Analyzer	Agilent	E4440A	AAW	4/19/2011	12
EV12 Cables	N/A	Bilog Cables	EVS	6/1/5403	12
Pre-Amplifier	Miteq	AM-1616-1000	AVM	6/20/2011	12
Antenna, Biconilog	EMCO	3141	AXG	3/15/2010	24

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

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. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4. The measurement uncertainty estimation is available upon request.

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting while set at the lowest channel, a middle channel, and the highest channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

NORTHWEST EMC

Field Strength of Harmonics

PSA 2011.05.11
EMI 2008.1.9

EUT:	Pump Radio 80446A	Work Order:	ZONA0029
Serial Number:	1001596	Date:	10/17/11
Customer:	Zonar Systems, LLC	Temperature:	20
Attendees:	None	Humidity:	46%
Project:	None	Barometric Pres.:	30.39
Tested by:	Jennifer Herrett	Power: USB	Job Site: EV12

TEST SPECIFICATIONS	Test Method
FCC 15.249:2011	ANSI C63.10:2009

TEST PARAMETERS			
Antenna Height(s) (m)	1.0-4.0	Test Distance (m)	3

COMMENTS

None

EUT OPERATING MODES

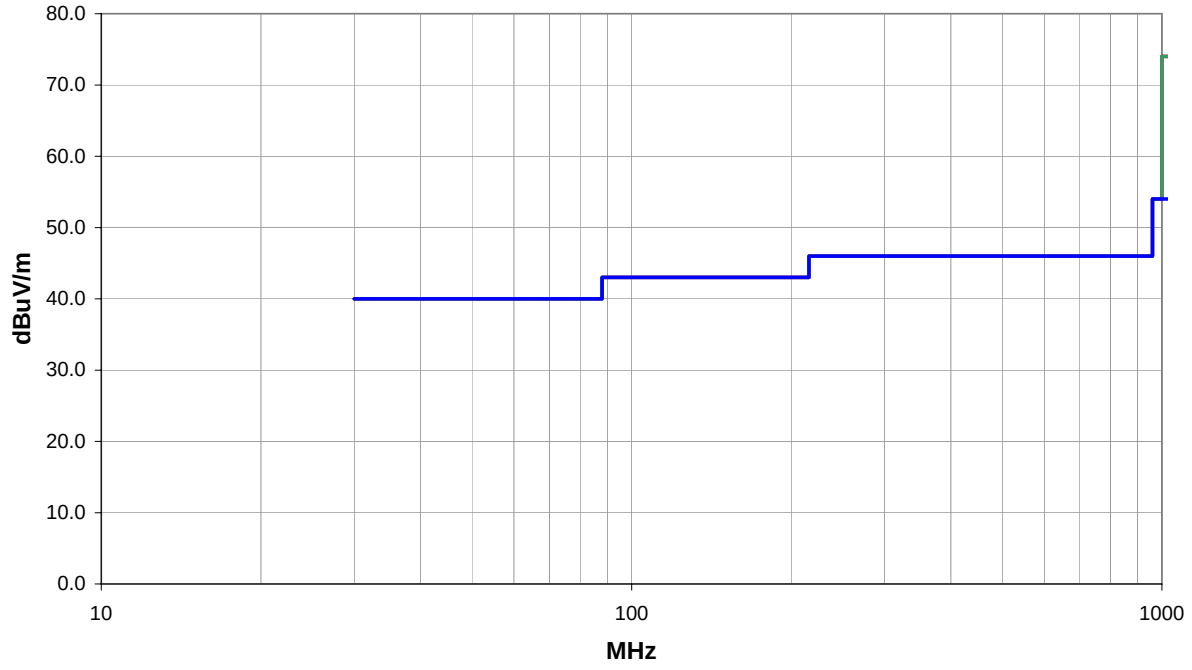
Tx, MSK modulation

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	5
Configuration #	2
Results	Pass

Signature: Jennifer Herrett



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted unknown units	Spec. Limit unknown units	Compared to Spec. (dB)

All emissions were greater than 10db below the limit.

NORTHWEST EMC

Field Strength of Harmonics

PSA 2011.05.11
EMI 2008.1.9

EUT:	Pump Radio 80446A	Work Order:	ZONA0029
Serial Number:	1001596	Date:	10/17/11
Customer:	Zonar Systems, LLC	Temperature:	20
Attendees:	None	Humidity:	46%
Project:	None	Barometric Pres.:	30.39
Tested by:	Jennifer Herrett	Power: USB	Job Site: EV12

TEST SPECIFICATIONS	Test Method
FCC 15.249:2011	ANSI C63.10:2009

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

COMMENTS

None

EUT OPERATING MODES

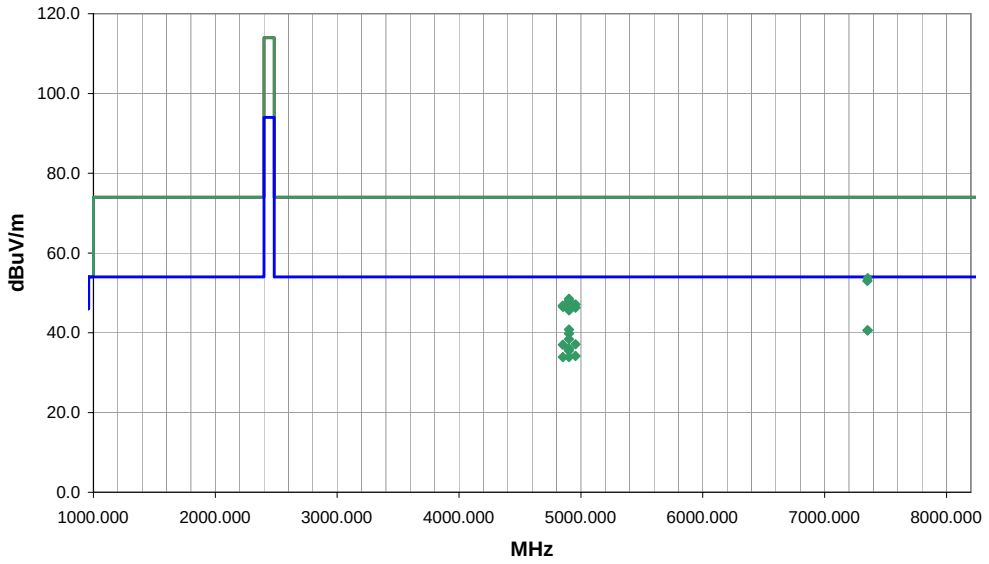
Tx, MSK modulation

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	4
Configuration #	2
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
4901.500	31.6	9.2	236.0	1.5	3.0	0.0	V-Horn	AV	0.0	40.8	54.0	-13.2	Mid Ch, EUT horizontal.
7352.442	24.5	16.1	303.0	1.0	3.0	0.0	H-Horn	AV	0.0	40.6	54.0	-13.4	Mid Ch, EUT on side.
7352.708	24.5	16.1	243.0	1.0	3.0	0.0	V-Horn	AV	0.0	40.6	54.0	-13.4	Mid Ch, EUT horizontal.
4901.492	30.6	9.2	240.0	1.4	3.0	0.0	V-Horn	AV	0.0	39.8	54.0	-14.2	Mid Ch, EUT vertical.
4901.450	29.2	9.2	186.0	2.2	3.0	0.0	H-Horn	AV	0.0	38.4	54.0	-15.6	Mid Ch, EUT on side.
4955.975	27.8	9.3	280.0	1.9	3.0	0.0	H-Horn	AV	0.0	37.1	54.0	-16.9	High Ch, EUT on side.
4851.508	28.0	9.0	202.0	1.7	3.0	0.0	H-Horn	AV	0.0	37.0	54.0	-17.0	Low Ch, EUT on side.
4901.517	26.8	9.2	206.0	1.0	3.0	0.0	H-Horn	AV	0.0	36.0	54.0	-18.0	Mid Ch, EUT vertical.
4901.425	26.3	9.2	259.0	1.5	3.0	0.0	V-Horn	AV	0.0	35.5	54.0	-18.5	Mid Ch, EUT on side.
4956.058	24.9	9.3	328.0	1.8	3.0	0.0	V-Horn	AV	0.0	34.2	54.0	-19.8	High Ch, EUT horizontal.
4901.583	24.7	9.2	179.0	2.2	3.0	0.0	H-Horn	AV	0.0	33.9	54.0	-20.1	Mid Ch, EUT horizontal.
4851.575	24.9	9.0	277.0	1.3	3.0	0.0	V-Horn	AV	0.0	33.9	54.0	-20.1	Low Ch, EUT horizontal.
7353.358	37.6	16.1	303.0	1.0	3.0	0.0	H-Horn	PK	0.0	53.7	74.0	-20.3	Mid Ch, EUT on side.
7350.700	36.9	16.1	243.0	1.0	3.0	0.0	V-Horn	PK	0.0	53.0	74.0	-21.0	Mid Ch, EUT horizontal.
4901.550	39.3	9.2	236.0	1.5	3.0	0.0	V-Horn	PK	0.0	48.5	74.0	-25.5	Mid Ch, EUT horizontal.
4901.475	38.8	9.2	240.0	1.4	3.0	0.0	V-Horn	PK	0.0	48.0	74.0	-26.0	Mid Ch, EUT vertical.
4901.350	38.6	9.2	186.0	2.2	3.0	0.0	H-Horn	PK	0.0	47.8	74.0	-26.2	Mid Ch, EUT on side.
4956.283	37.8	9.3	280.0	1.9	3.0	0.0	H-Horn	PK	0.0	47.1	74.0	-26.9	High Ch, EUT on side.
4851.275	37.8	9.0	202.0	1.7	3.0	0.0	H-Horn	PK	0.0	46.8	74.0	-27.2	Low Ch, EUT on side.
4901.758	37.6	9.2	206.0	1.0	3.0	0.0	H-Horn	PK	0.0	46.8	74.0	-27.2	Mid Ch, EUT vertical.
4902.167	37.6	9.2	259.0	1.5	3.0	0.0	V-Horn	PK	0.0	46.8	74.0	-27.2	Mid Ch, EUT on side.
4852.892	37.5	9.0	277.0	1.3	3.0	0.0	V-Horn	PK	0.0	46.5	74.0	-27.5	Low Ch, EUT horizontal.
4956.175	37.0	9.3	328.0	1.8	3.0	0.0	V-Horn	PK	0.0	46.3	74.0	-27.7	High Ch, EUT horizontal.
4902.817	36.4	9.2	179.0	2.2	3.0	0.0	H-Horn	PK	0.0	45.6	74.0	-28.4	Mid Ch, EUT horizontal.

NORTHWEST EMC

Field Strength of Harmonics

PSA 2011.05.11
EMI 2008.1.9

EUT:	Pump Radio 80446A	Work Order:	ZONA0029
Serial Number:	1001596	Date:	10/17/11
Customer:	Zonar Systems, LLC	Temperature:	20
Attendees:	None	Humidity:	46%
Project:	None	Barometric Pres.:	30.39
Tested by:	Jennifer Herrett	Power: USB	Job Site: EV12

TEST SPECIFICATIONS	Test Method
FCC 15.249:2011	ANSI C63.10:2009

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

COMMENTS

None

EUT OPERATING MODES

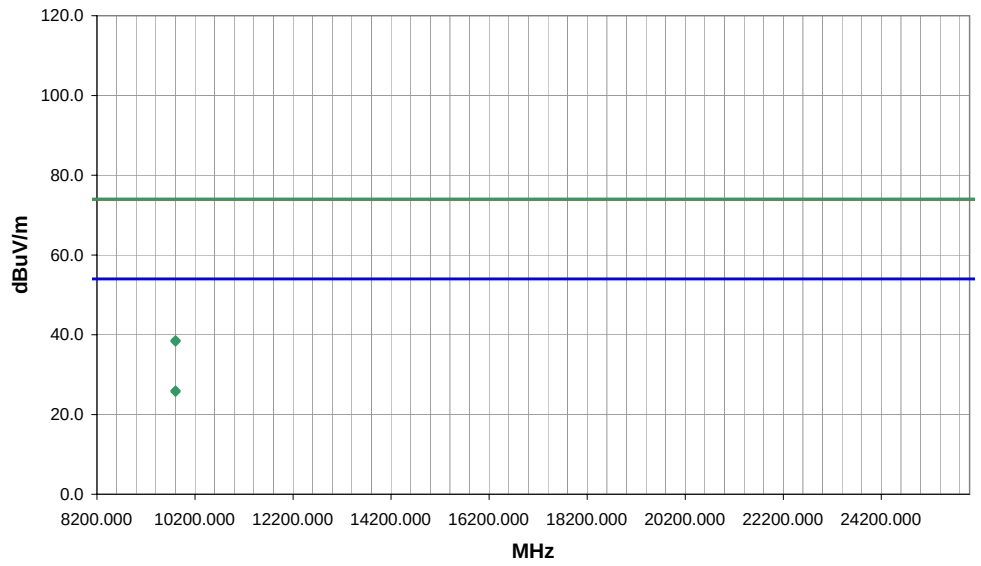
Tx, MSK modulation

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	5
Configuration #	2
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
9802.942	35.2	-9.2	229.0	1.0	3.0	0.0	H-Horn	AV	0.0	26.0	54.0	-28.0	Mid Ch, EUT on side.
9803.083	34.9	-9.2	186.0	1.0	3.0	0.0	V-Horn	AV	0.0	25.7	54.0	-28.3	Mid Ch, EUT horizontal.
9803.083	47.8	-9.2	186.0	1.0	3.0	0.0	V-Horn	PK	0.0	38.6	74.0	-35.4	Mid Ch, EUT horizontal.
9802.975	47.5	-9.2	229.0	1.0	3.0	0.0	H-Horn	PK	0.0	38.3	74.0	-35.7	Mid Ch, EUT on side.

EMC AC POWERLINE CONDUCTED 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
Tx High channel
Tx Mid channel
Tx Low channel

POWER SETTINGS INVESTIGATED
110VAC/60Hz

CONFIGURATIONS INVESTIGATED
ZONA0029 - 4

SAMPLE CALCULATIONS
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Attenuator, 20 dB, 'BNC'	SM Electronics	SA01B-20	REY	1/10/2011	12 mo
EV07 Cables	N/A	Conducted Cables	EVG	6/17/2011	12 mo
LISN	Solar	9252-50-R-24-BNC	LIR	2/17/2011	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HFX	2/9/2011	24 mo
Receiver	Rohde & Schwarz	ESCI	ARH	3/30/2011	12 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

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

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm.

NORTHWEST

EMC

AC POWERLINE CONDUCTED EMISSIONS

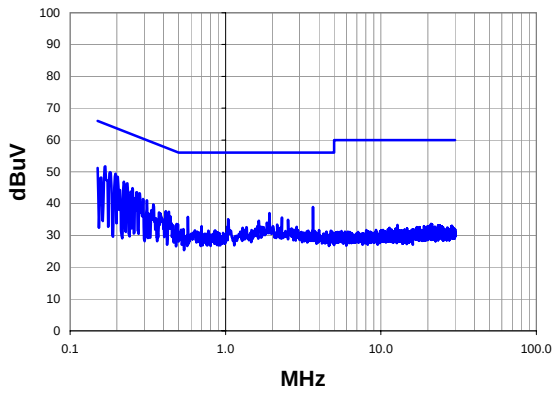
PSA-ESCI 2011.07.26
PSA-ESCI Version 2011.06.23

Work Order:	ZONA0029	**Date:**	10/20/11		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	EV07	**Humidity:**	41.3% RH		
Serial Number:	1001596	**Barometric Pres.:**	1019 mbar	**Tested by:**	Ethan Schoonover
EUT:	Pump Radio 80446A				
Configuration:	4				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx Low channel				
Deviations:	No deviations.				
Comments:	None				

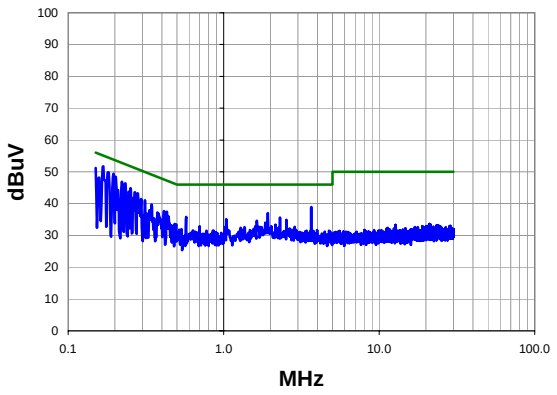
Test Specifications	**Test Method**
FCC 15.207:2011	ANSI C63.10:2009

Run #	1	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.169	31.6	20.1	51.7	65.0	-13.3
0.196	29.3	20.1	49.4	63.8	-14.4
0.181	29.8	20.1	49.9	64.5	-14.6
0.150	31.1	20.1	51.2	66.0	-14.8
0.201	28.4	20.1	48.5	63.6	-15.1
0.221	26.8	20.1	46.9	62.8	-15.9
0.233	26.3	20.1	46.4	62.3	-15.9
0.252	24.8	20.1	44.9	61.7	-16.8
3.656	18.7	20.2	38.9	56.0	-17.1
0.159	28.1	20.1	48.2	65.5	-17.3
0.279	23.2	20.1	43.3	60.8	-17.5
0.267	23.5	20.1	43.6	61.2	-17.6
0.245	23.7	20.1	43.8	61.9	-18.1
0.210	24.2	20.1	44.3	63.2	-18.9
0.312	20.9	20.1	41.0	59.9	-18.9
0.295	21.3	20.1	41.4	60.4	-19.0
1.920	16.9	20.1	37.0	56.0	-19.0
0.344	19.6	20.1	39.7	59.1	-19.4
0.262	21.7	20.1	41.8	61.4	-19.6
0.431	17.3	20.1	37.4	57.2	-19.8

Peak Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.169	31.6	20.1	51.7	55.0	-3.3
0.196	29.3	20.1	49.4	53.8	-4.4
0.181	29.8	20.1	49.9	54.5	-4.6
0.150	31.1	20.1	51.2	56.0	-4.8
0.201	28.4	20.1	48.5	53.6	-5.1
0.221	26.8	20.1	46.9	52.8	-5.9
0.233	26.3	20.1	46.4	52.3	-5.9
0.252	24.8	20.1	44.9	51.7	-6.8
3.656	18.7	20.2	38.9	46.0	-7.1
0.159	28.1	20.1	48.2	55.5	-7.3
0.279	23.2	20.1	43.3	50.8	-7.5
0.267	23.5	20.1	43.6	51.2	-7.6
0.245	23.7	20.1	43.8	51.9	-8.1
0.210	24.2	20.1	44.3	53.2	-8.9
0.312	20.9	20.1	41.0	49.9	-8.9
0.295	21.3	20.1	41.4	50.4	-9.0
1.920	16.9	20.1	37.0	46.0	-9.0
0.344	19.6	20.1	39.7	49.1	-9.4
0.262	21.7	20.1	41.8	51.4	-9.6
0.431	17.3	20.1	37.4	47.2	-9.8

NORTHWEST

EMC

AC POWERLINE CONDUCTED EMISSIONS

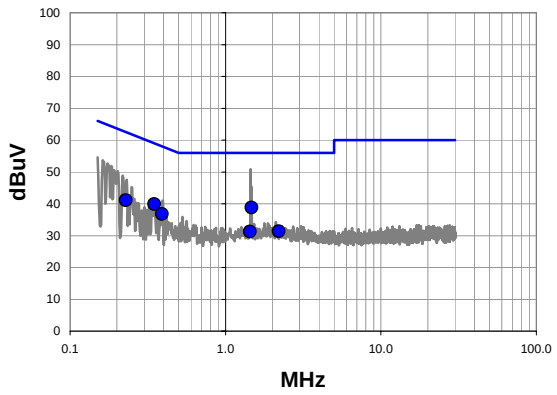
PSA-ESCI 2011.07.26
PSA-ESCI Version 2011.06.23

Work Order:	ZONA0029	**Date:**	10/20/11		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	EV07	**Humidity:**	41.3% RH		
Serial Number:	1001596	**Barometric Pres.:**	1019 mbar	**Tested by:**	Ethan Schoonover
EUT:	Pump Radio 80446A				
Configuration:	4				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx Low channel				
Deviations:	No deviations.				
Comments:	None				

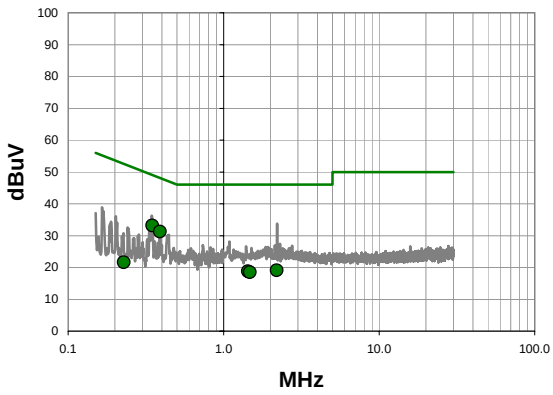
Test Specifications	**Test Method**
FCC 15.207:2011	ANSI C63.10:2009

Run #	2	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.472	18.7	20.1	38.8	56.0	-17.2
0.348	19.8	20.1	39.9	59.0	-19.1
0.390	16.7	20.1	36.8	58.1	-21.3
0.228	21.0	20.1	41.1	62.5	-21.4
2.200	11.3	20.1	31.4	56.0	-24.6
1.436	11.2	20.1	31.3	56.0	-24.7

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.348	13.1	20.1	33.2	49.0	-15.8
0.390	11.2	20.1	31.3	48.1	-16.8
2.200	-1.0	20.1	19.1	46.0	-26.9
1.436	-1.3	20.1	18.8	46.0	-27.2
1.472	-1.6	20.1	18.5	46.0	-27.5
0.228	1.5	20.1	21.6	52.5	-30.9

NORTHWEST

EMC

AC POWERLINE CONDUCTED EMISSIONS

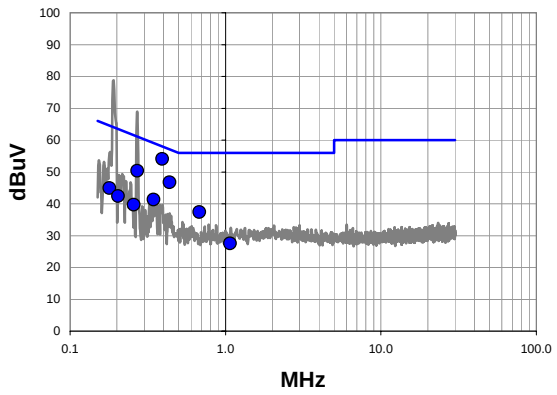
PSA-ESCI 2011.07.26
PSA-ESCI Version 2011.06.23

Work Order:	ZONA0029	**Date:**	10/20/11		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	EV07	**Humidity:**	41.3% RH		
Serial Number:	1001596	**Barometric Pres.:**	1019 mbar	**Tested by:**	Ethan Schoonover
EUT:	Pump Radio 80446A				
Configuration:	4				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx Mid channel				
Deviations:	No deviations.				
Comments:	None				

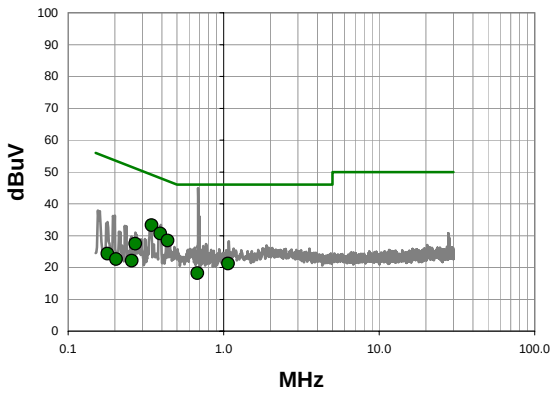
Test Specifications	**Test Method**
FCC 15.207:2011	ANSI C63.10:2009

Run #	3	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.391	34.0	20.1	54.1	58.0	-3.9
0.437	26.6	20.1	46.7	57.1	-10.4
0.271	30.3	20.1	50.4	61.1	-10.7
0.345	21.2	20.1	41.3	59.1	-17.8
0.678	17.3	20.1	37.4	56.0	-18.6
0.179	24.8	20.1	44.9	64.5	-19.6
0.204	22.3	20.1	42.4	63.4	-21.0
0.257	19.6	20.1	39.7	61.5	-21.8
1.068	7.4	20.1	27.5	56.0	-28.5

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.345	13.2	20.1	33.3	49.1	-15.8
0.391	10.6	20.1	30.7	48.0	-17.3
0.437	8.3	20.1	28.4	47.1	-18.7
0.271	7.3	20.1	27.4	51.1	-23.7
1.068	1.1	20.1	21.2	46.0	-24.8
0.678	-1.9	20.1	18.2	46.0	-27.8
0.257	2.0	20.1	22.1	51.5	-29.4
0.179	4.2	20.1	24.3	54.5	-30.2
0.204	2.5	20.1	22.6	53.4	-30.8

NORTHWEST
EMC

AC POWERLINE CONDUCTED EMISSIONS

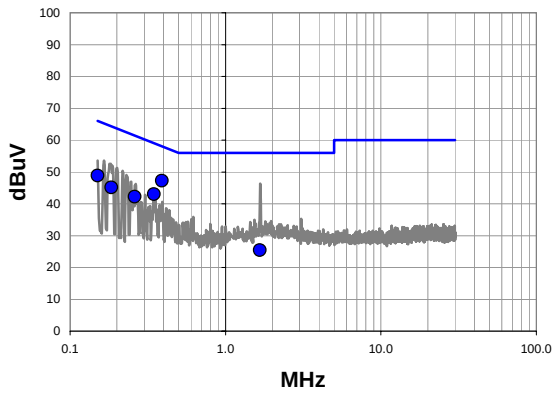
PSA-ESCI 2011.07.26
PSA-ESCI Version 2011.06.23

Work Order:	ZONA0029	**Date:**	10/20/11		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	EV07	**Humidity:**	41.3% RH		
Serial Number:	1001596	**Barometric Pres.:**	1019 mbar	**Tested by:**	Ethan Schoonover
EUT:	Pump Radio 80446A				
Configuration:	4				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx Mid channel				
Deviations:	No deviations.				
Comments:	None				

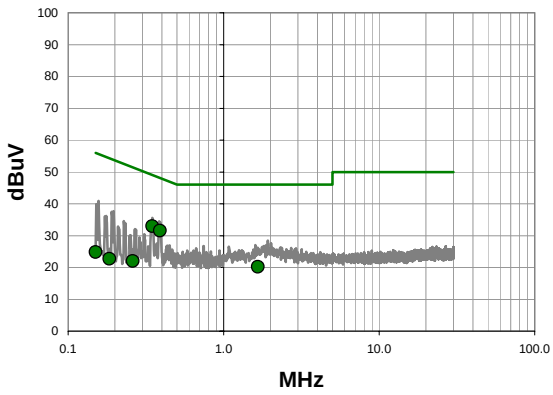
Test Specifications	**Test Method**
FCC 15.207:2011	ANSI C63.10:2009

Run #	4	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.389	27.1	20.1	47.2	58.1	-10.9
0.347	22.9	20.1	43.0	59.0	-16.0
0.150	28.7	20.1	48.8	66.0	-17.2
0.184	25.0	20.1	45.1	64.3	-19.2
0.260	22.1	20.1	42.2	61.4	-19.2
1.660	5.3	20.1	25.4	56.0	-30.6

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.347	12.9	20.1	33.0	49.0	-16.0
0.389	11.5	20.1	31.6	48.1	-16.5
1.660	0.1	20.1	20.2	46.0	-25.8
0.260	1.9	20.1	22.0	51.4	-29.4
0.150	4.7	20.1	24.8	56.0	-31.2
0.184	2.6	20.1	22.7	54.3	-31.6

NORTHWEST
EMC

AC POWERLINE CONDUCTED EMISSIONS

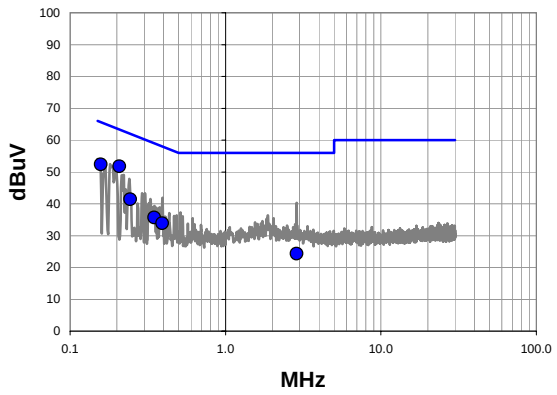
PSA-ESCI 2011.07.26
PSA-ESCI Version 2011.06.23

Work Order:	ZONA0029	**Date:**	10/20/11		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	EV07	**Humidity:**	41.3% RH		
Serial Number:	1001596	**Barometric Pres.:**	1019 mbar	**Tested by:**	Ethan Schoonover
EUT:	Pump Radio 80446A				
Configuration:	4				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx High channel				
Deviations:	No deviations.				
Comments:	None				

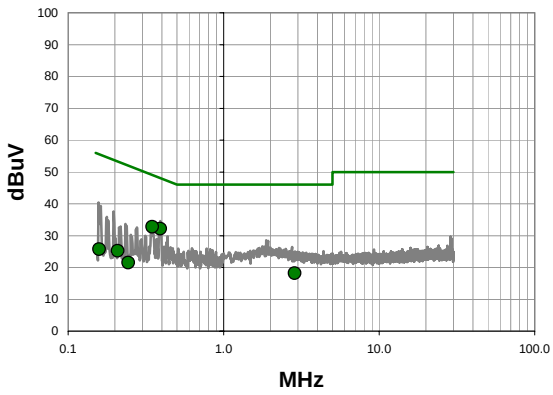
Test Specifications	**Test Method**
FCC 15.207:2011	ANSI C63.10:2009

Run #	5	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.208	31.7	20.1	51.8	63.3	-11.5
0.158	32.3	20.1	52.4	65.6	-13.2
0.244	21.3	20.1	41.4	62.0	-20.6
0.348	15.6	20.1	35.7	59.0	-23.3
0.391	13.8	20.1	33.9	58.0	-24.1
2.868	4.2	20.1	24.3	56.0	-31.7

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.391	12.1	20.1	32.2	48.0	-15.8
0.348	12.7	20.1	32.8	49.0	-16.2
2.868	-1.9	20.1	18.2	46.0	-27.8
0.208	5.1	20.1	25.2	53.3	-28.1
0.158	5.6	20.1	25.7	55.6	-29.9
0.244	1.4	20.1	21.5	52.0	-30.5

NORTHWEST

EMC

AC POWERLINE CONDUCTED EMISSIONS

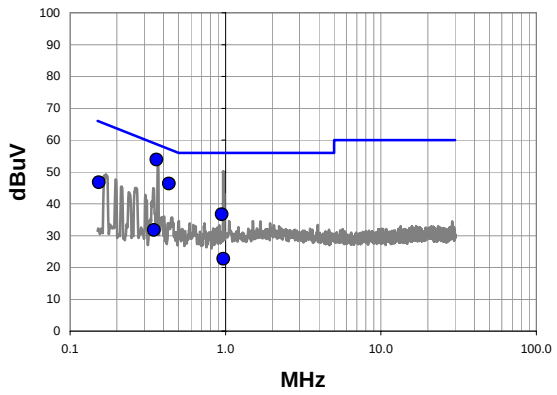
PSA-ESCI 2011.07.26
PSA-ESCI Version 2011.06.23

Work Order:	ZONA0029	**Date:**	10/20/11		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	EV07	**Humidity:**	41.3% RH		
Serial Number:	1001596	**Barometric Pres.:**	1019 mbar	**Tested by:**	Ethan Schoonover
EUT:	Pump Radio 80446A				
Configuration:	4				
Customer:	Zonar Systems, LLC				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Tx High channel				
Deviations:	No deviations.				
Comments:	None				

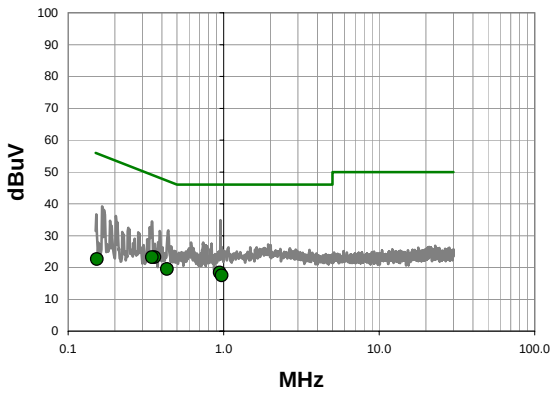
Test Specifications	**Test Method**
FCC 15.207:2011	ANSI C63.10:2009

Run #	6	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.360	33.8	20.1	53.9	58.7	-4.8
0.433	26.2	20.1	46.3	57.2	-10.9
0.153	26.6	20.1	46.7	65.8	-19.1
0.944	16.6	20.1	36.7	56.0	-19.3
0.346	11.7	20.1	31.8	59.1	-27.3
0.970	2.6	20.1	22.7	56.0	-33.3

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.360	3.1	20.1	23.2	48.7	-25.5
0.346	3.1	20.1	23.2	49.1	-25.9
0.944	-1.7	20.1	18.4	46.0	-27.6
0.433	-0.6	20.1	19.5	47.2	-27.7
0.970	-2.6	20.1	17.5	46.0	-28.5
0.153	2.5	20.1	22.6	55.8	-33.2