Home Comfort Zones, Inc.

418 MHz transmitter

EMC Test Report

Report No. HOCZ0020

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: November 17, 2010
Home Comfort Zones, Inc.
Model: 418 MHz transmitter

Emissions			
Test Description	**Specification**	**Test Method**	**Pass/Fail**
Occupied Bandwidth	FCC 15.231:2010	ANSI C63.10:2009	**Pass**
Field Strength of Fundamental	FCC 15.231:2010	ANSI C63.10:2009	**Pass**
Duty Cycle	FCC 15.231:2010	ANSI C63.10:2009	**Pass**
Spurious Radiated Emissions	FCC 15.231:2010	ANSI C63.10:2009	**Pass**

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

Test Facility

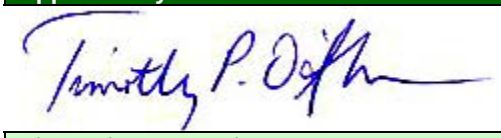
The measurement facility used to collect the data is located at:

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-1).

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.

NVLAP LAB CODE 200629-0
NVLAP LAB CODE 200630-0
NVLAP LAB CODE 200676-0
NVLAP LAB CODE 200761-0
NVLAP LAB CODE 200881-0

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-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.

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).

Accreditations and Authorizations

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, 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-1784, 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). 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

KCC

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

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

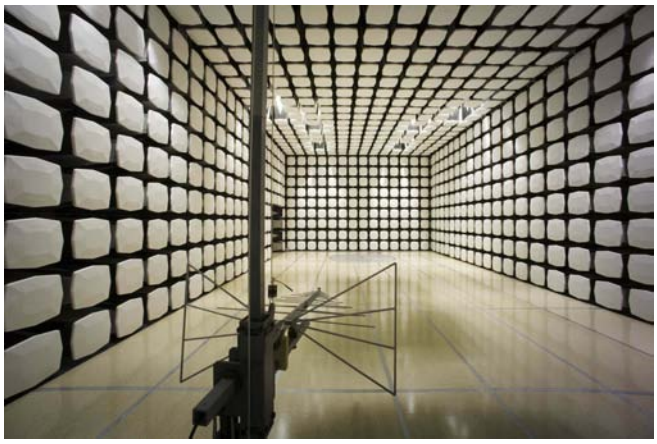
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

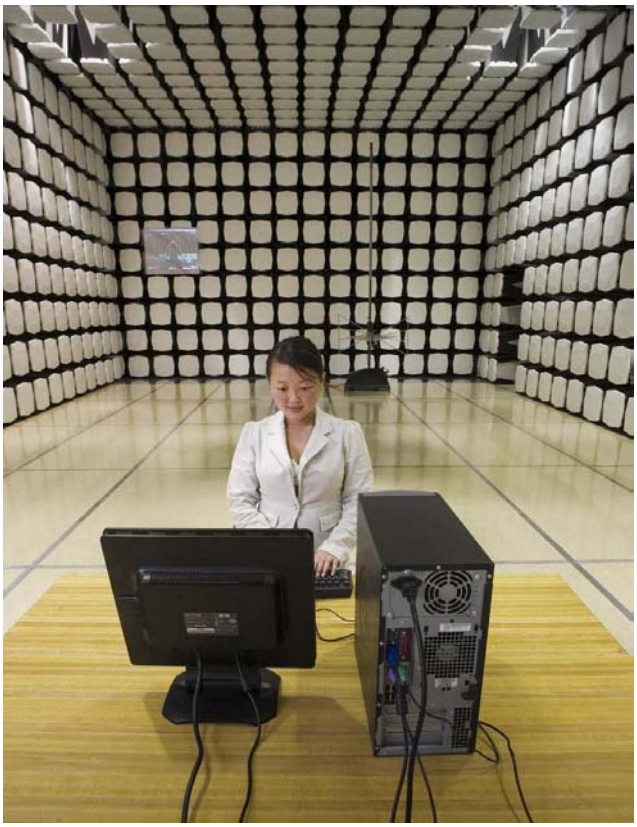
California
Labs OC01-OC13
41 Tesla
Irvine, CA 92618
(949) 861-8918

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:	Home Comfort Zones, Inc.
Address:	8239 Cirrus Drive
City, State, Zip:	Beaverton, OR 97008
Test Requested By:	Zac Wheeler
Model:	418 MHz transmitter
First Date of Test:	November 16, 2010
Last Date of Test:	November 17, 2010
Receipt Date of Samples:	November 16, 2010
Equipment Design Stage:	Preproduction
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):

Low power transmitter with a separate receiver operating at 418 MHz. The transmitter is installed in customer houses to periodically transmit temperature and command sequences from user input. It uses a PCB trace antenna (-6 dBi). Seeking TCB certification under 15.231(e). The receiver is installed on a wall and linked to the main control system via RS485. It uses a Dipole antenna. The receiver is DoC authorized.

Testing Objective:

To demonstrate compliance to FCC 15.231(e) specifications.

CONFIGURATION 1 HOCZ0020

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - CW mode	Home Comfort Zones, Inc.	Smart Sensor	1F00B0

CONFIGURATION 2 HOCZ0020

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Normal pulse train, short period	Home Comfort Zones, Inc.	Smart Sensor	1F00AF

CONFIGURATION 3 HOCZ0020

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
EUT - Normal pulse train, short period	Home Comfort Zones, Inc.	Smart Sensor	1F00AF
EUT - Normal operation	Home Comfort Zones, Inc.	Smart Sensor	1F009C

Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	11/16/2010	Duty Cycle	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	11/16/2010	Occupied Bandwidth	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	11/17/2010	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.
4	11/17/2010	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	6/1/2009	24
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Near Field Probe	EMCO	7405	IPD	NCR	0
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

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

The occupied bandwidth is required to be no wider that 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

The measurement was made using near field probe near the integral antenna of the EUT to the input of the spectrum analyzer. The EUT was transmitting at its maximum data rate.

NORTHWEST EMC

OCCUPIED BANDWIDTH

XMit 2010.11.03

EUT:	Smart Sensor			**Work Order:**	HOCZ0020
Serial Number:	1F00AF			**Date:**	11/16/10
Customer:	Home Comfort Zones, Inc.			**Temperature:**	20°C
Attendees:	Zach Wheeler			**Humidity:**	42%
Project:	None			**Barometric Pres.:**	29.83 in
Tested by:	Rod Peloquin	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.231:2010	ANSI C63.10:2009

COMMENTS

Transmitting with normal modulation

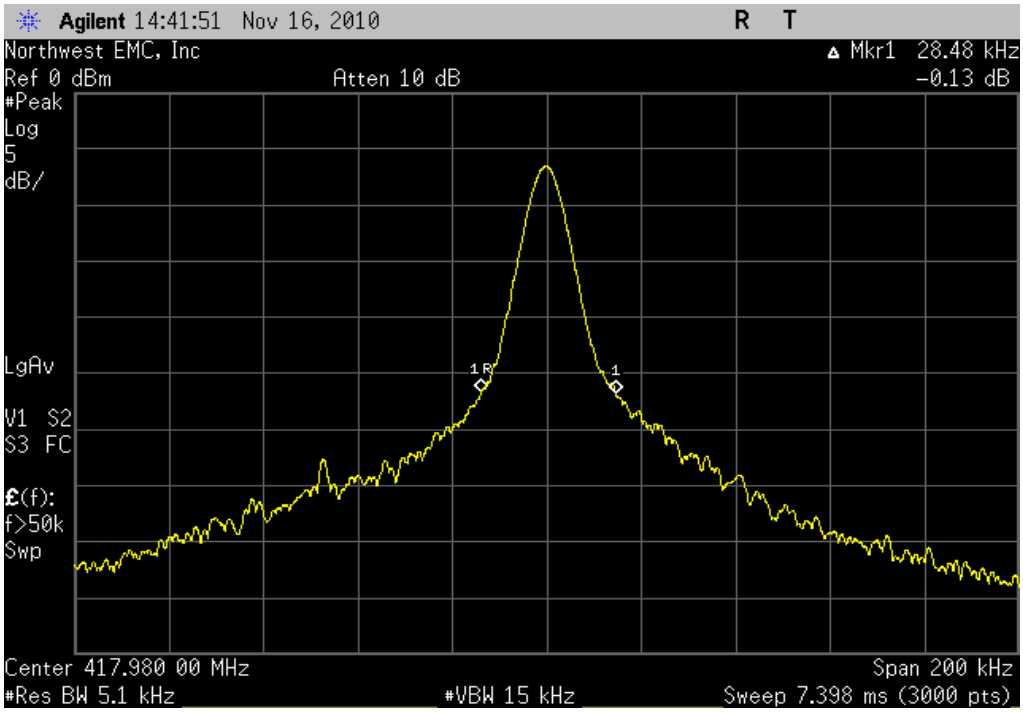
DEVIATIONS FROM TEST STANDARD

No Deviations

Configuration #	2	Signature

	Value	Limit	Results
20 dB OCCUPIED BANDWIDTH	28.5 kHz	1.045 MHz	Pass

20 dB OCCUPIED BANDWIDTH					
Result:	Pass	**Value:**	28.5 kHz	**Limit:**	1.045 MHz



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

CW Mode

POWER SETTINGS INVESTIGATED

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
Spectrum Analyzer	Agilent	E4446A	AAQ	1/6/2010	12
EV01 Cables	N/A	Bilog Cables	EVA	7/9/2010	13
Antenna, Biconilog	EMCO	3141	AXE	1/14/2010	13

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 configured for continuous unmodulated operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT in 3 orthogonal planes (per ANSI C63.10:2009).

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT’s pulse train are as follows:

Period = 18.67 mSec
Pulsewidth of Type 1 Pulse = 0.1567 mSec
Pulsewidth of Type 2 Pulse = 0.3067 mSec

Number of Type 1 Pulses = 34
Number of Type 2 Pulses = 9

Duty Cycle = 20 log [((34)(0.1567) + (9)(0.3067)/18.67] = -7.3 dB

The duty cycle correction factor of –7.3 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(e). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

NORTHWEST EMC

Field Strength of Fundamental

PSA 2008.07.21
EMI 2008.1.9

EUT:	418 MHz transmitter			Work Order:	HOCZ0020
Serial Number:	1F00B0			Date:	11/17/10
Customer:	Home Comfort Zones, Inc.			Temperature:	20
Attendees:	Zac Wheeler			Humidity:	42%
Project:	None			Barometric Pres.:	29.83
Tested by:	Travis Rychener	Power:	Battery	Job Site:	EV01

TEST SPECIFICATIONS	Test Method
FCC 15.231(e):2010	ANSI C63.10:2009

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

COMMENTS

No modulation

EUT OPERATING MODES

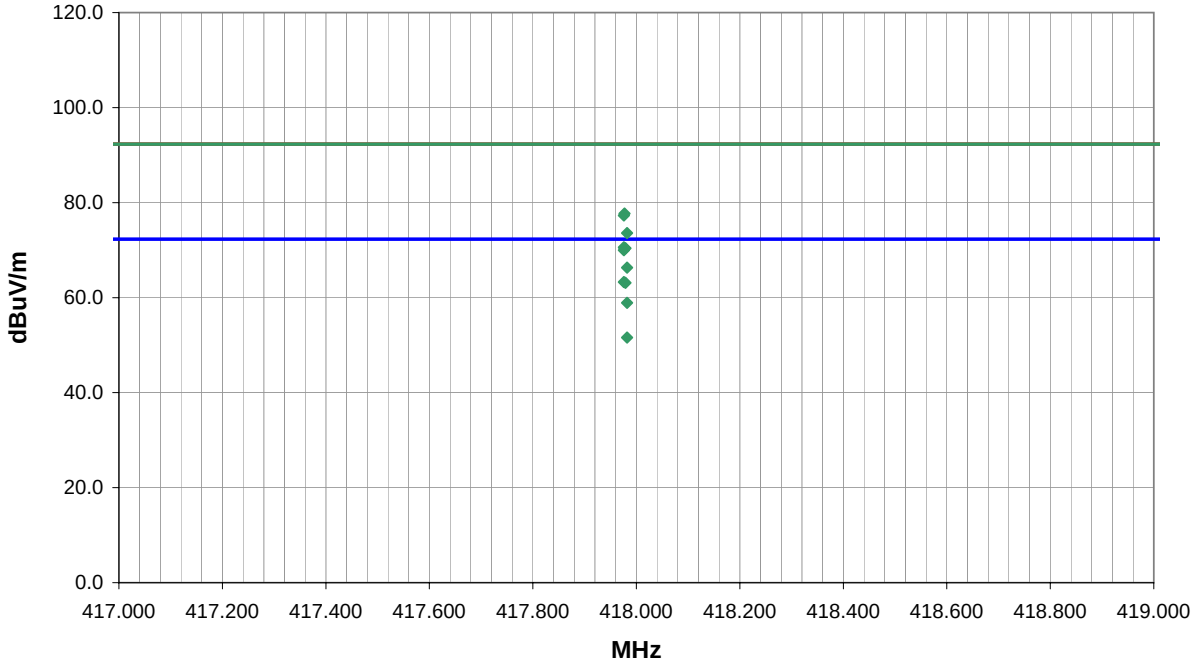
CW Mode

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	5
Configuration #	1
Results	Pass

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Duty Cycle Correction Factor	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
417.977	52.3	25.4	8.0	1.0	7.3	0.0	H-Bilog	AV	0.0	70.4	72.3	-1.9
417.976	51.9	25.4	259.0	1.3	7.3	0.0	V-Bilog	AV	0.0	70.0	72.3	-2.3
417.982	48.2	25.4	32.0	1.3	7.3	0.0	V-Bilog	AV	0.0	66.3	72.3	-6.0
417.976	45.2	25.4	360.0	1.6	7.3	0.0	H-Bilog	AV	0.0	63.3	72.3	-9.0
417.979	45.0	25.4	351.0	1.0	7.3	0.0	H-Bilog	AV	0.0	63.1	72.3	-9.2
417.977	52.3	25.4	8.0	1.0	0.0	0.0	H-Bilog	PK	0.0	77.7	92.3	-14.6
417.976	51.9	25.4	259.0	1.3	0.0	0.0	V-Bilog	PK	0.0	77.3	92.3	-15.0
417.982	48.2	25.4	32.0	1.3	0.0	0.0	V-Bilog	PK	0.0	73.6	92.3	-18.7
417.982	33.5	25.4	95.0	1.0	7.3	0.0	V-Bilog	AV	0.0	51.6	72.3	-20.7
417.976	45.2	25.4	360.0	1.6	0.0	0.0	H-Bilog	PK	0.0	70.6	92.3	-21.7
417.979	45.0	25.4	351.0	1.0	0.0	0.0	H-Bilog	PK	0.0	70.4	92.3	-21.9
417.982	33.5	25.4	95.0	1.0	0.0	0.0	V-Bilog	PK	0.0	58.9	92.3	-33.4

DUTY CYCLE

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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4440A	AFD	6/1/2009	24
40GHz DC Block	Miteq	DCB4000	AMD	8/5/2010	13
Near Field Probe	EMCO	7405	IPD	NCR	0
EV06 Direct Connect Cable	ESM Cable Corp.	TT	ECA	NCR	0

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

For software controlled or pre-programmed devices, the manufacturer shall declare the duty cycle class or classes for the equipment under test. For manually operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the device once triggered, follows a pre-programmed cycle, or whether the transmission is constant until the trigger is released or manually reset. The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the duty cycle and hence the duty class.

Where an acknowledgement is required, the additional transmitter on-time shall be included and declared by the manufacturer.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT’s pulse train are as follows:

Period = 18.67 mSec
Pulsewidth of Type 1 Pulse = 0.1567 mSec
Pulsewidth of Type 2 Pulse = 0.3067 mSec

Number of Type 1 Pulses = 34
Number of Type 2 Pulses = 9

Duty Cycle = 20 log [((34)(0.1567) + (9)(0.3067)/18.67] = -7.3 dB

The duty cycle correction factor of –7.3 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz.

The field strength of the fundamental (transmit) frequency meets the limits as defined in 47 CFR 15.231(e). It also meets the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions.

NORTHWEST EMC

DUTY CYCLE

XMit 2010.11.03

EUT:	418 MHz transmitter			**Work Order:**	HOCZ0020
Serial Number:	1F00AF & 1F009C			**Date:**	11/16/10
Customer:	Home Comfort Zones, Inc.			**Temperature:**	20°C
Attendees:	Zach Wheeler			**Humidity:**	42%
Project:	None			**Barometric Pres.:**	29.83 in
Tested by:	Rod Peloquin	**Power:**	Battery	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.231:2010	ANSI C63.10:2009

COMMENTS

Transmitting with a typical pulse train and periodicity

DEVIATIONS FROM TEST STANDARD

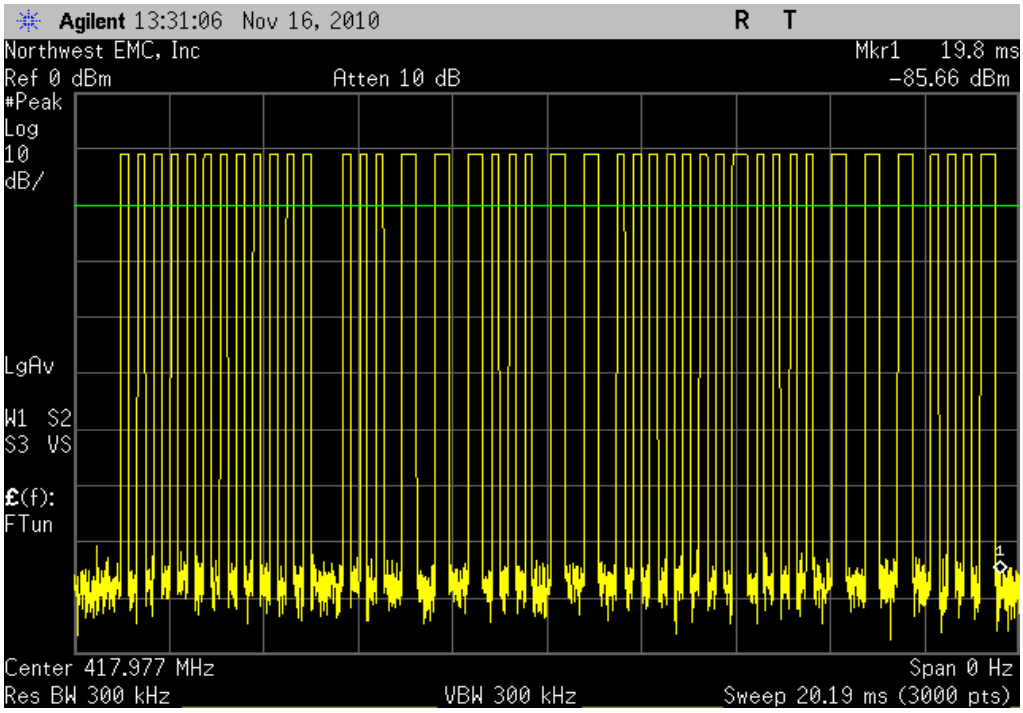
No Deviations

Configuration #	3	Signature

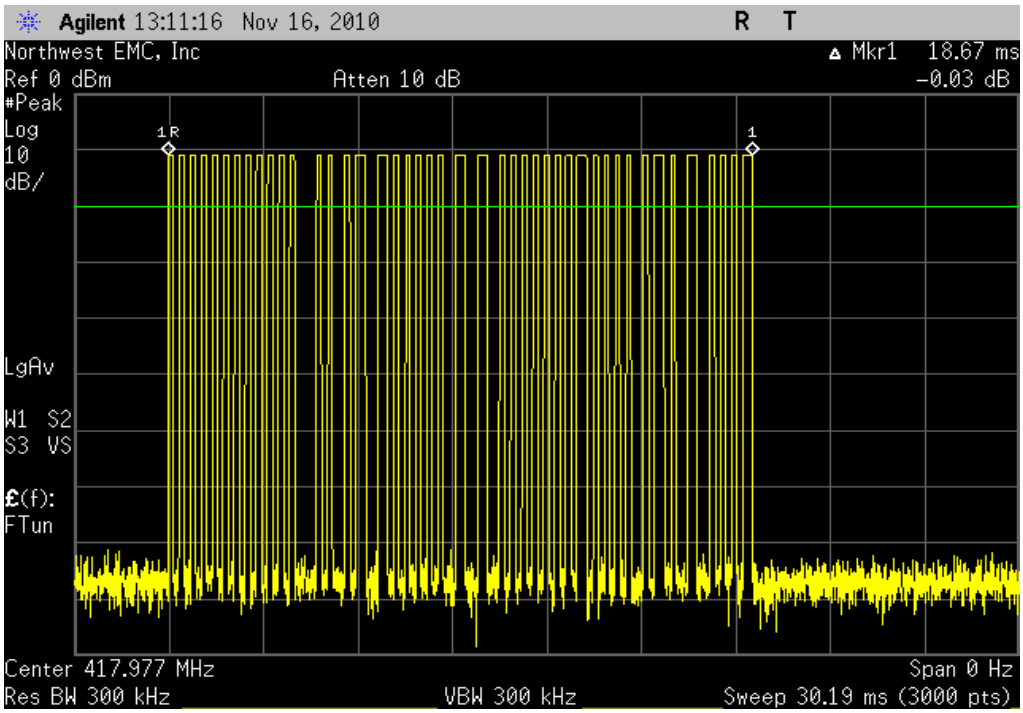
	Value	Limit	Results
Pulse Train	< 20 ms	≤ 100 ms	N/A
Duration	18.67 ms	≤ 100 ms	N/A
Pulse Segment 1	156.7µs	N/A	N/A
Pulse Segment 2	306.7µS	N/A	N/A
Pulse Segment 3	N/A	N/A	N/A
Pulse Segment 4	N/A	N/A	N/A
Off time	> 10 s	≥ 10 s	Pass

DUTY CYCLE

Pulse Train					
Result:	N/A	**Value:**	< 20 ms	**Limit:**	≤ 100 ms

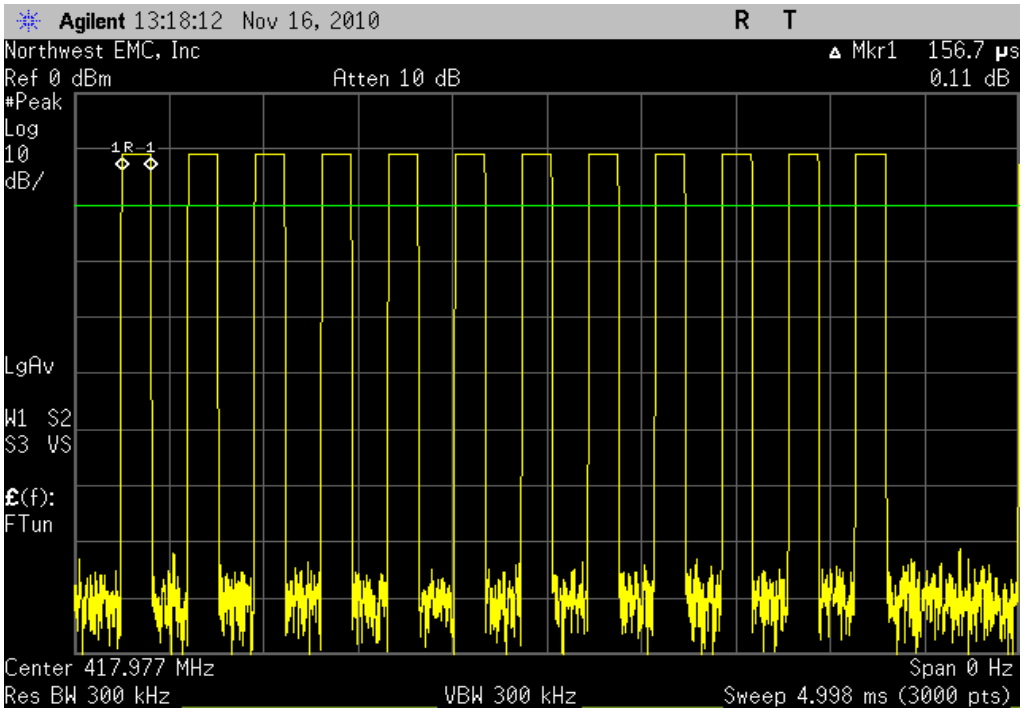


Duration					
Result:	N/A	**Value:**	18.67 ms	**Limit:**	≤ 100 ms

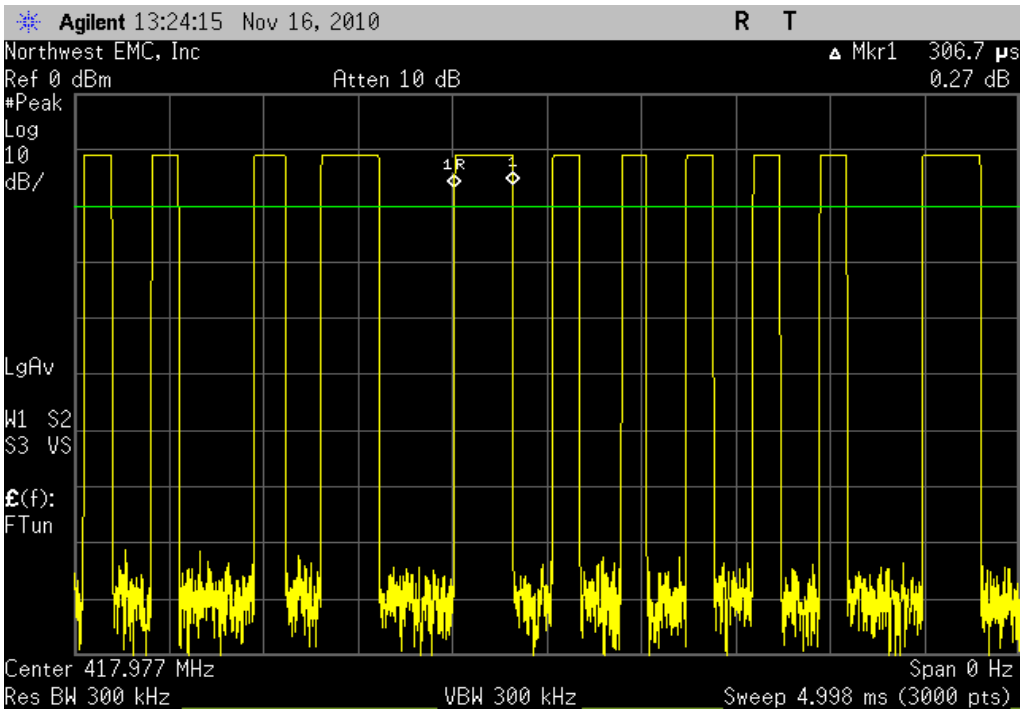


DUTY CYCLE

Pulse Segment 1					
Result:	N/A	**Value:**	156.7µs	**Limit:**	N/A

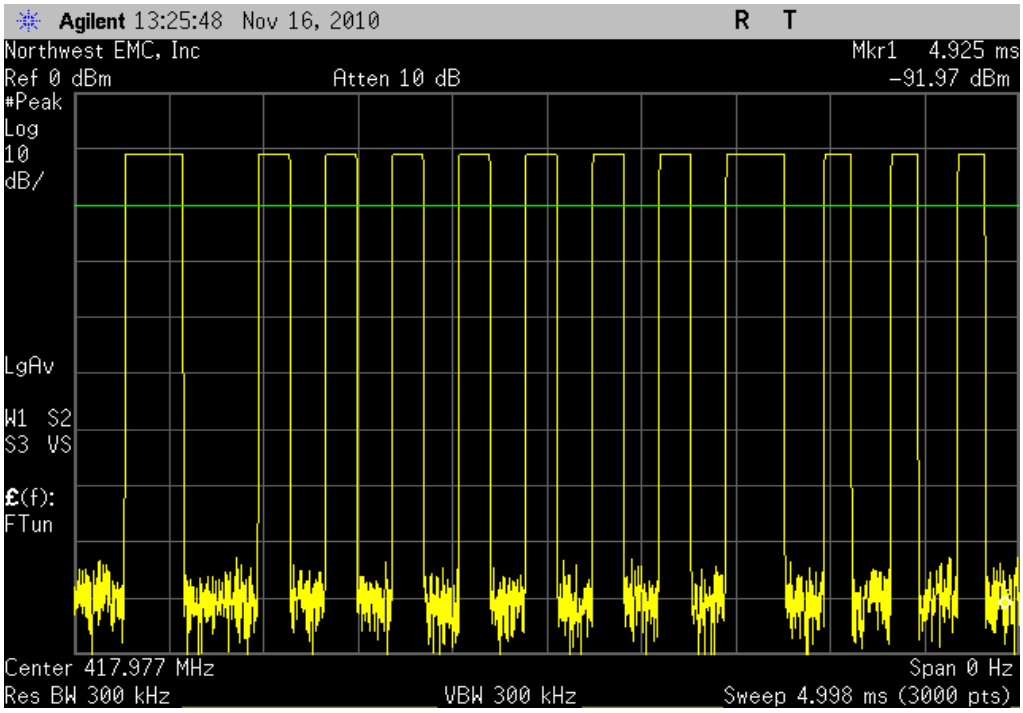


Pulse Segment 2					
Result:	N/A	**Value:**	306.7µS	**Limit:**	N/A

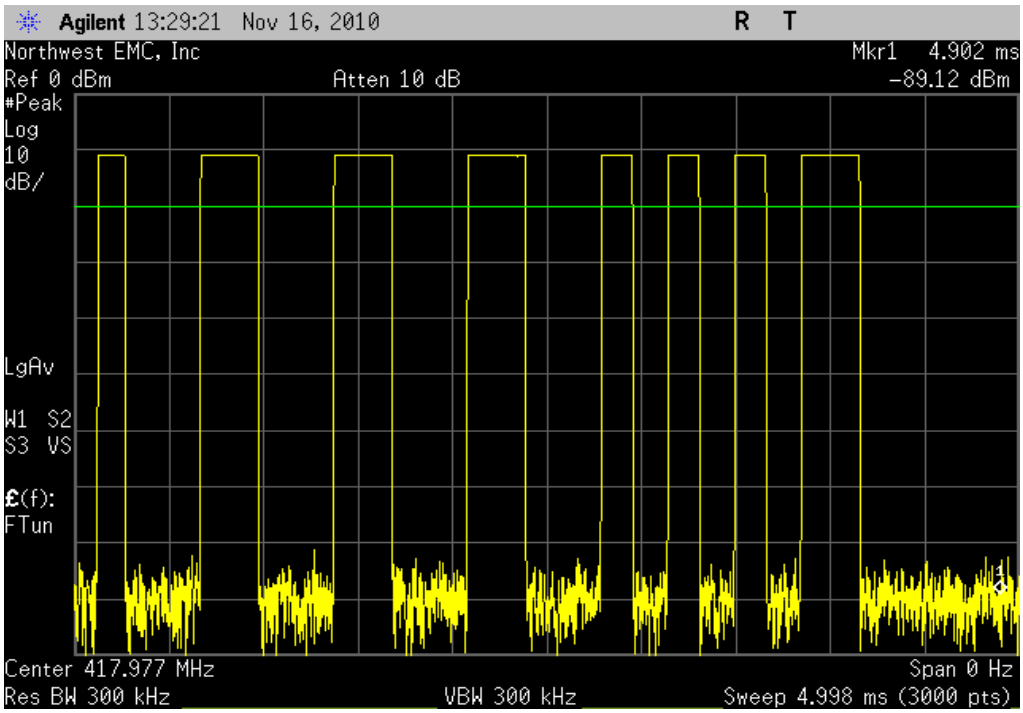


DUTY CYCLE

Pulse Segment 3					
Result:	N/A	**Value:**	N/A	**Limit:**	N/A

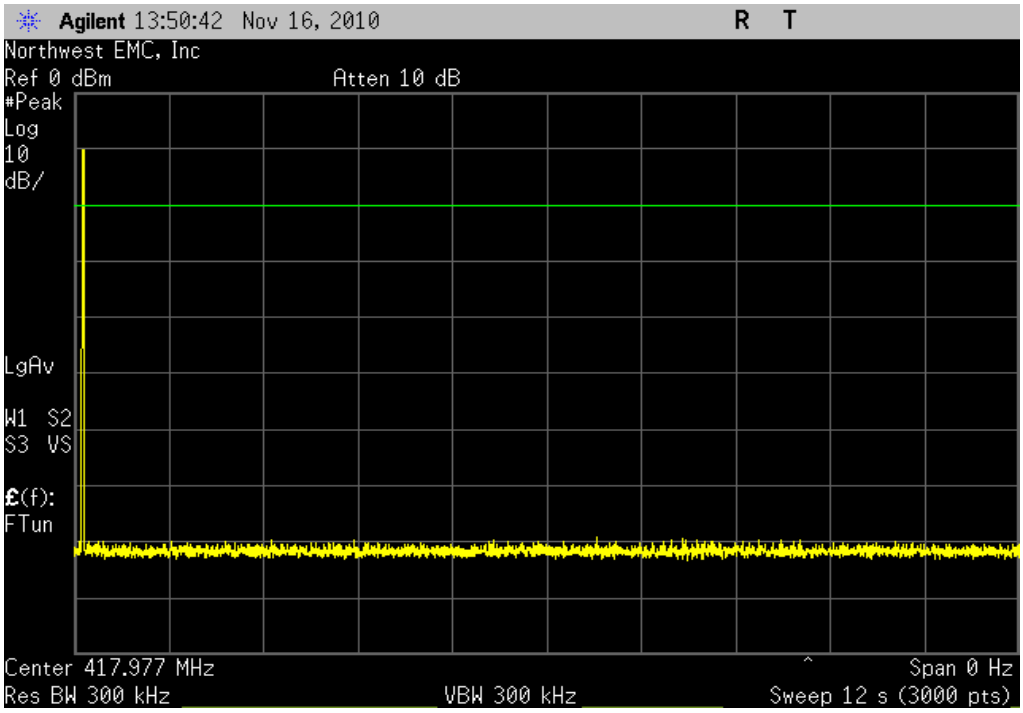


Pulse Segment 4					
Result:	N/A	**Value:**	N/A	**Limit:**	N/A



DUTY CYCLE

Off time					
Result:	Pass	**Value:**	> 10 s	**Limit:**	≥ 10 s



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.

MODES OF OPERATION

CW Mode

POWER SETTINGS INVESTIGATED

Battery

FREQUENCY RANGE INVESTIGATED

Start Frequency	30MHz	Stop Frequency	4200MHz

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
Spectrum Analyzer	Agilent	E4446A	AAQ	1/6/2010	12
Pre-Amplifier	Miteq	AMF-4D-010100-24-10P	APW	7/9/2010	13
EV01 Cables	N/A	Double Ridge Horn Cables	EVB	7/9/2010	13
High Pass Filter 1.2 - 18 GHz	Micro-Tronics	HPM50108	HFV	7/9/2010	13
Antenna, Horn	EMCO	3115	AHC	7/8/2010	24
EV01 Cables	N/A	Bilog Cables	EVA	7/9/2010	13
Pre-Amplifier	Miteq	AM-1616-1000	AOL	7/9/2010	13
Antenna, Biconilog	EMCO	3141	AXE	1/14/2010	13

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 single, integral antenna to be used with the EUT was tested. The EUT was configured for un-modulated, CW operation at its single transmit frequency. The field strength of the transmit frequency was maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT 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.

To derive average emission measurements, a duty cycle correction factor per 15.35(c) was utilized:

Duty Cycle = On time/100 milliseconds (or the period, whichever is less)

Where “On time” = N1L1 +N2L2 +….

Where N1 is the number of type 1 pulses, L1 is length of type 1 pulses, N2 is the number of type 2 pulses, L2 is the length of type 2 pulses, etc.

Therefore, Duty Cycle = (N1L1 +N2L2 +…)/100mS or T, whichever is less. Where T is the period of the pulse train.

The measured values for the EUT’s pulse train are as follows:

Period = 18.67 mSec
Pulsewidth of Type 1 Pulse = 0.1567 mSec
Pulsewidth of Type 2 Pulse = 0.3067 mSec

Number of Type 1 Pulses = 34
Number of Type 2 Pulses = 9

Duty Cycle = 20 log [((34)(0.1567) + (9)(0.3067)/18.67] = -7.3 dB

The duty cycle correction factor of –7.3 dB was added to the peak readings to mathematically derive the average levels. Peak measurements were made with a resolution bandwidth of 100kHz and a video bandwidth of 300kHz for measurements at or below 1GHz. Above 1GHz, a resolution bandwidth of 1MHz and a video bandwidth of 3MHz was used.

The field strength of the spurious emissions meet the limits as defined in 47 CFR 15.231(e). The spurious emissions also meet the provisions in 15.35 for averaging pulsed emissions and for limiting peak emissions. Further, spurious emissions meet the provisions of 15.205 using the measurement instrumentation specified in that section.

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS DATA SHEET

PSA 2008.07.21
EMI 2008.1.9

EUT:	418 MHz transmitter			**Work Order:**	HOCZ0020
Serial Number:	1F00B0			**Date:**	11/17/10
Customer:	Home Comfort Zones, Inc.			**Temperature:**	20
Attendees:	Zac Wheeler			**Humidity:**	42%
Project:	None			**Barometric Pres.:**	29.83
Tested by:	Travis Rychener	**Power:**	Battery	**Job Site:**	EV01

TEST SPECIFICATIONS	Test Method
FCC 15.231(e):2010	ANSI C63.10:2009

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

COMMENTS

No modulation

EUT OPERATING MODES

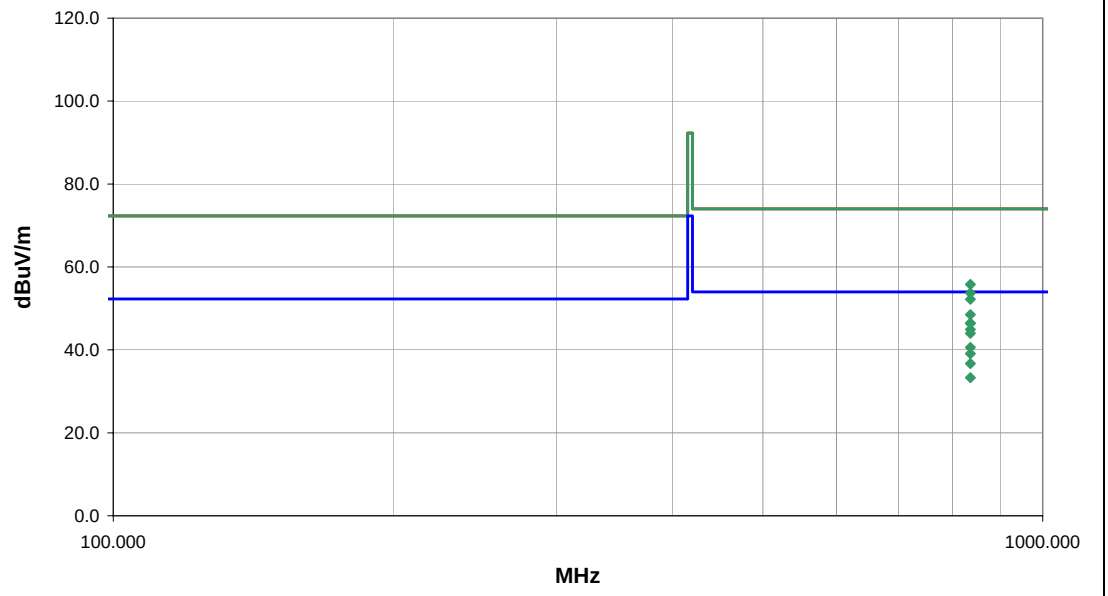
CW Mode

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	3
Configuration #	1
Results	Pass

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Duty Cycle Correction Factor	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
835.962	44.2	11.6	261.0	1.0	7.3	0.0	H-Bilog	AV	0.0	48.5	54.0	-5.5	EUT Horizontal
835.963	42.1	11.6	143.0	1.0	7.3	0.0	H-Bilog	AV	0.0	46.4	54.0	-7.6	EUT On Side
835.963	40.6	11.6	93.0	1.3	7.3	0.0	V-Bilog	AV	0.0	44.9	54.0	-9.1	EUT Vertical
835.965	34.8	11.6	105.0	2.0	7.3	0.0	V-Bilog	AV	0.0	39.1	54.0	-14.9	EUT On Side
835.963	32.4	11.6	105.0	1.0	7.3	0.0	V-Bilog	AV	0.0	36.7	54.0	-17.3	EUT Horizontal
835.962	44.2	11.6	261.0	1.0	0.0	0.0	H-Bilog	PK	0.0	55.8	74.0	-18.2	EUT Horizontal
835.963	42.1	11.6	143.0	1.0	0.0	0.0	H-Bilog	PK	0.0	53.7	74.0	-20.3	EUT On Side
835.969	29.0	11.6	279.0	1.0	7.3	0.0	H-Bilog	AV	0.0	33.3	54.0	-20.7	EUT Vertical
835.963	40.6	11.6	93.0	1.3	0.0	0.0	V-Bilog	PK	0.0	52.2	74.0	-21.8	EUT Vertical
835.965	34.8	11.6	105.0	2.0	0.0	0.0	V-Bilog	PK	0.0	46.4	74.0	-27.6	EUT On Side
835.963	32.4	11.6	105.0	1.0	0.0	0.0	V-Bilog	PK	0.0	44.0	74.0	-30.0	EUT Horizontal
835.969	29.0	11.6	279.0	1.0	0.0	0.0	H-Bilog	PK	0.0	40.6	74.0	-33.4	EUT Vertical

NORTHWEST EMC

SPURIOUS RADIATED EMISSIONS DATA SHEET

PSA 2008.07.21
EMI 2008.1.9

EUT:	418 MHz transmitter			**Work Order:**	HOCZ0020
Serial Number:	1F00B0			**Date:**	11/17/10
Customer:	Home Comfort Zones, Inc.			**Temperature:**	20
Attendees:	Zac Wheeler			**Humidity:**	42%
Project:	None			**Barometric Pres.:**	29.83
Tested by:	Travis Rychener	**Power:**	Battery	**Job Site:**	EV01

TEST SPECIFICATIONS	Test Method
FCC 15.231(e):2010	ANSI C63.10:2009

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

COMMENTS

No modulation

EUT OPERATING MODES

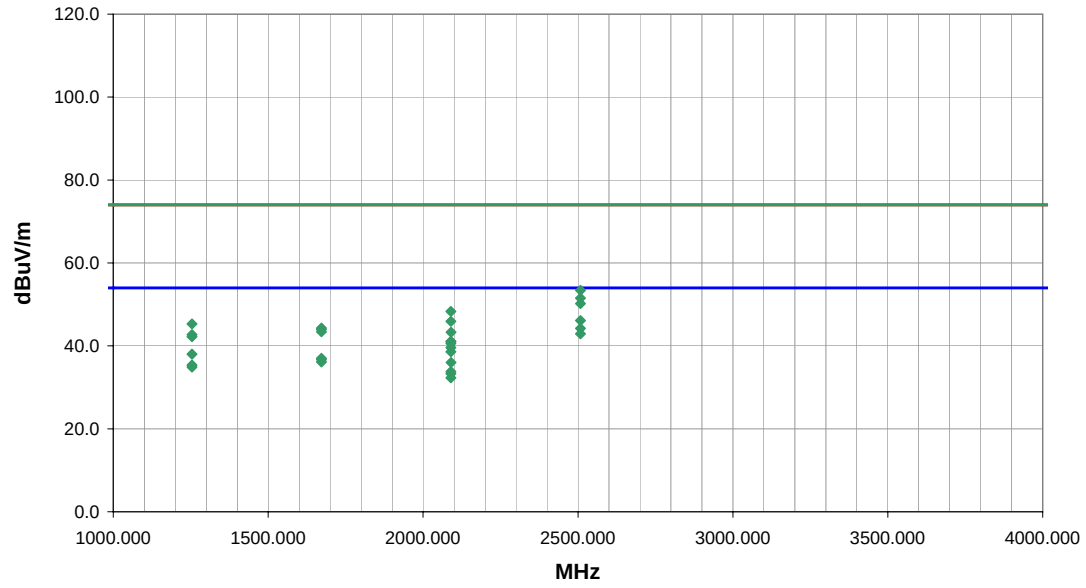
CW Mode

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	4
Configuration #	1
Results	Pass

Signature



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Duty Cycle Correction Factor	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
2507.859	51.1	2.3	214.0	1.0	7.3	0.0	H-Horn	AV	0.0	46.1	54.0	-7.9	EUT On Side
2507.926	49.2	2.3	210.0	1.1	7.3	0.0	V-Horn	AV	0.0	44.2	54.0	-9.8	EUT Vertical
2507.882	47.9	2.3	272.0	1.0	7.3	0.0	H-Horn	AV	0.0	42.9	54.0	-11.1	EUT Horizontal
2089.943	47.6	0.7	114.0	1.0	7.3	0.0	H-Horn	AV	0.0	41.0	54.0	-13.0	EUT Horizontal
2089.897	45.2	0.7	194.0	1.0	7.3	0.0	H-Horn	AV	0.0	38.6	54.0	-15.4	EUT On Side
1253.974	48.4	-3.1	240.0	1.2	7.3	0.0	H-Horn	AV	0.0	38.0	54.0	-16.0	EUT Horizontal
1671.890	45.6	-1.3	130.0	1.3	7.3	0.0	H-Horn	AV	0.0	37.0	54.0	-17.0	EUT Horizontal
1671.897	45.3	-1.3	40.0	1.0	7.3	0.0	V-Horn	AV	0.0	36.7	54.0	-17.3	EUT Vertical
1671.907	44.7	-1.3	217.0	1.3	7.3	0.0	H-Horn	AV	0.0	36.1	54.0	-17.9	EUT On Side
2090.047	42.6	0.7	105.0	2.6	7.3	0.0	V-Horn	AV	0.0	36.0	54.0	-18.0	EUT Vertical
1253.928	45.8	-3.1	200.0	1.3	7.3	0.0	H-Horn	AV	0.0	35.4	54.0	-18.6	EUT On Side
1254.021	45.3	-3.1	108.0	1.4	7.3	0.0	V-Horn	AV	0.0	34.9	54.0	-19.1	EUT Vertical
2089.850	40.4	0.7	58.0	2.5	7.3	0.0	V-Horn	AV	0.0	33.8	54.0	-20.2	EUT Horizontal
2507.859	51.1	2.3	214.0	1.0	0.0	0.0	H-Horn	PK	0.0	53.4	74.0	-20.6	EUT On Side
2089.907	39.9	0.7	298.0	2.6	7.3	0.0	V-Horn	AV	0.0	33.3	54.0	-20.7	EUT On Side
2089.767	38.9	0.7	152.0	1.0	7.3	0.0	H-Horn	AV	0.0	32.3	54.0	-21.7	EUT Vertical
2507.926	49.2	2.3	210.0	1.1	0.0	0.0	V-Horn	PK	0.0	51.5	74.0	-22.5	EUT Vertical
2507.882	47.9	2.3	272.0	1.0	0.0	0.0	H-Horn	PK	0.0	50.2	74.0	-23.8	EUT Horizontal
2089.943	47.6	0.7	114.0	1.0	0.0	0.0	H-Horn	PK	0.0	48.3	74.0	-25.7	EUT Horizontal
2089.897	45.2	0.7	194.0	1.0	0.0	0.0	H-Horn	PK	0.0	45.9	74.0	-28.1	EUT On Side