

NORTHWEST EMC

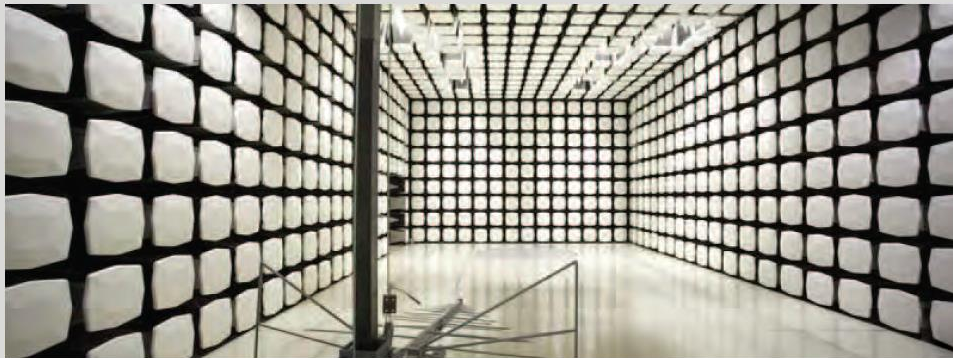
Holjeron

Wireless Multi-Protocol Receiver

FCC 15.207:2015

FCC 15.247:2015

Report # HOLE0018



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. This Report may only be duplicated in its entirety

CERTIFICATE OF TEST

Last Date of Test: July 22, 2015
Holjeron
Model: Wireless Multi-Protocol Receiver

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2015	ANSI C63.10:2009
FCC 15.247:2015	ANSI C63.10:2009

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
6.7	Band Edge Compliance	No	N/A	Not required for class 2 permissive change based on use and original grant.
6.7	Spurious Conducted Emissions	No	N/A	Not required for class 2 permissive change based on use and original grant.
6.9.1	Occupied Bandwidth	No	N/A	Not required for class 2 permissive change based on use and original grant.
6.10.2	Output Power	No	N/A	Not required for class 2 permissive change based on use and original grant.
6.11.2	Power Spectral Density	No	N/A	Not required for class 2 permissive change based on use and original grant.
7.5	Duty Cycle	No	N/A	Not required for class 2 permissive change based on use and original grant.

Deviations From Test Standards

None

Approved By:



Kyle Holgate, Operations Manager

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. 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. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

Revision Number		Description	Date	Page Number
00		None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

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 17065 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

Canada

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

European Union

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.

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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.

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

<http://www.nwemc.com/accreditations/>
<http://gsi.nist.gov/global/docs/cabs/designations.html>

MEASUREMENT UNCERTAINTY

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 16-4-2 as applicable), and are available upon request.

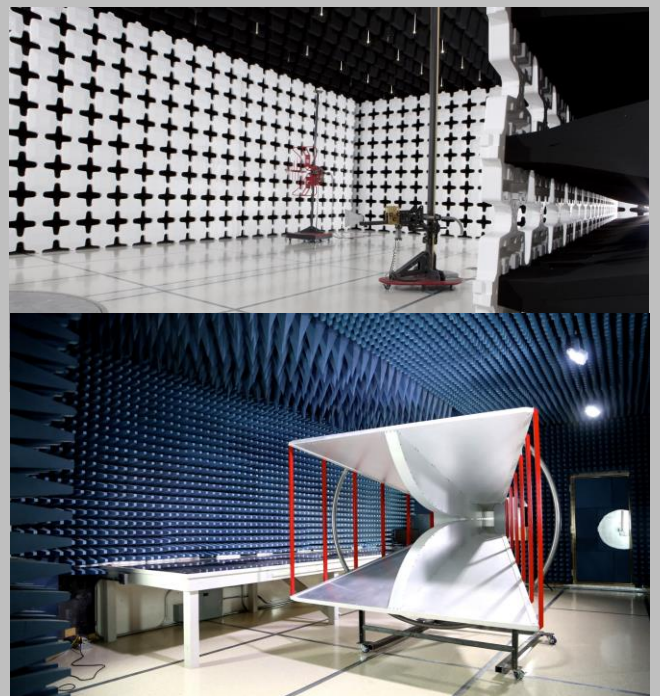
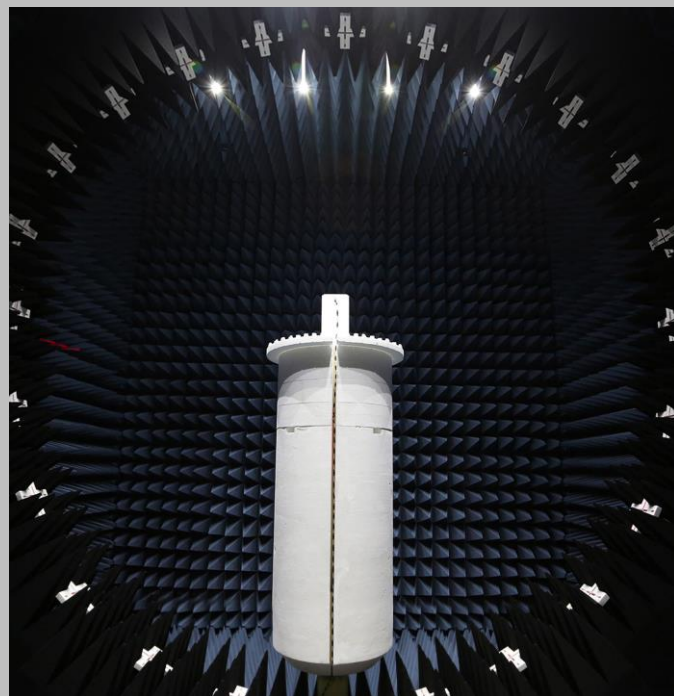
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

FACILITIES



California Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 9801 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Industry Canada					
2834B-1, 2834B-3	2834E-1	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Holjeron
Address:	9524 SW Tualatin-Sherwood Road
City, State, Zip:	Tualatin, OR 97062
Test Requested By:	Patrick Moore
Model:	WMPR
First Date of Test:	June 19, 2015
Last Date of Test:	July 22, 2015
Receipt Date of Samples:	June 19, 2015
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Wireless Multi-Protocol Receiver using Low Cost ISA 100 Radio Module
Testing Objective:
To demonstrate compliance of the 2.4 GHz ISM radio to FCC 15.247 requirements for a Class 2 Permissive change.

CONFIGURATIONS

Configuration HOLE0018- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Multiprotocol Receiver	Honeywell	WMPR	00:40:84:05:BF:F1 #4
Radio Module 2.4 GHz (High Channel)	Honeywell	WMPR	0033741
Radio Module 2.4 GHz (low Channel)	Honeywell	WMPR	0033754
Radio Module 2.4 GHz (Mid Channel)	Honeywell	WMPR	0033730

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC/DC Power Supply	IDEC	PS5R-SF24	913603D76935R

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Ethernet Switch	Netgear	Netgear FS108	3W614B5A01C0F

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	Unknown	1.4 m	No	AC/DC Power Supply	AC Main
CAT 6	Yes	15.24 m	2	Wireless Multiprotocol Receiver	Ethernet Switch
DC Lead	Unknown	2 m	No	Wireless Multiprotocol Receiver	AC/DC Power Supply

CONFIGURATIONS

Configuration HOLE0018- 2

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Multiprotocol Receiver	Honeywell	WMPR	00:40:84:05:BF:F1 #4
Radio Module 2.4 GHz (High Channel)	Honeywell	WMPR	0033741
Radio Module 2.4 GHz (low Channel)	Honeywell	WMPR	0033754
Radio Module 2.4 GHz (Mid Channel)	Honeywell	WMPR	0033730

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
DC Power Supply	BK Precision	Model 1715	272-00570

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Ethernet Switch	Netgear	Netgear FS108	3W614B5A01C0F

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	Unknown	1.4 m	No	AC/DC Power Supply	AC Main
CAT 6	Yes	15.24 m	2	Wireless Multiprotocol Receiver	Ethernet Switch
DC Lead	Unknown	2 m	No	Wireless Multiprotocol Receiver	AC/DC Power Supply

CONFIGURATIONS

Configuration HOLE0021- 1

Software/Firmware Running during test	
Description	Version
Continuous Transmit Software	1.8

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Multiprotocol Receiver	Honeywell	WMPR	00:40:84:05:BF:F1 #4
Radio Module 2.4 GHz (Low Channel)	Honeywell	WMPR	0033754
External Antenna (9dBi)	L-Com Global Connectivity	HG2409RD-RSP	None

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC/DC Power Supply	IDEC	PS5R-SF24	None
Ethernet Switch	Netgear	Netgear FS108	3W614B5A01C0F
DC Power Supply	BK Precision	Model 1715	272-00570

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	No	1.4 m	No	AC/DC Power Supply	AC Main
CAT 6	Yes	15.24 m	No	Wireless Multiprotocol Receiver	Ethernet Switch
DC Lead	No	2.0 m	No	Wireless Multiprotocol Receiver	AC/DC Power Supply

CONFIGURATIONS

Configuration HOLE0021- 2

Software/Firmware Running during test	
Description	Version
Continuous Transmit Software	1.8

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Multiprotocol Receiver	Honeywell	WMPR	00:40:84:05:BF:F1 #4
Radio Module 2.4 GHz (Mid Channel)	Honeywell	WMPR	0033730
External Antenna (9dBi)	L-Com Global Connectivity	HG2409RD-RSP	None

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC/DC Power Supply	IDEC	PS5R-SF24	None
Ethernet Switch	Netgear	Netgear FS108	3W614B5A01C0F
DC Power Supply	BK Precision	Model 1715	272-00570

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	No	1.4 m	No	AC/DC Power Supply	AC Main
CAT 6	Yes	15.24 m	No	Wireless Multiprotocol Receiver	Ethernet Switch
DC Lead	No	2.0 m	No	Wireless Multiprotocol Receiver	AC/DC Power Supply

CONFIGURATIONS

Configuration HOLE0021- 3

Software/Firmware Running during test	
Description	Version
Continuous Transmit Software	1.8

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Wireless Multiprotocol Receiver	Honeywell	WMPR	00:40:84:05:BF:F1 #4
Radio Module 2.4 GHz (High Channel)	Honeywell	WMPR	0033741
External Antenna (9dBi)	L-Com Global Connectivity	HG2409RD-RSP	None

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
AC/DC Power Supply	IDEC	PS5R-SF24	None
Ethernet Switch	Netgear	Netgear FS108	3W614B5A01C0F
DC Power Supply	BK Precision	Model 1715	272-00570

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Power Cable	No	1.4 m	No	AC/DC Power Supply	AC Main
CAT 6	Yes	15.24 m	No	Wireless Multiprotocol Receiver	Ethernet Switch
DC Lead	No	2.0 m	No	Wireless Multiprotocol Receiver	AC/DC Power Supply

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	6/19/2015	Powerline Conducted Emissions	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	7/22/2015	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

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 50 Ω measuring port is terminated by a 50 Ω EMI meter or a 50 Ω resistive load. All 50 Ω measuring ports of the LISN are terminated by 50 Ω .

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESCI	ARH	3/11/2015	03/11/2016
High Pass Filter	TTE	H97-100K-50-720B	HHD	1/5/2015	01/05/2016
Attenuator, BNC 10 Watt	Fairview Microwave	SA6B10W-20	TQQ	11/20/2014	11/20/2015
Cable, Standard LISN	None	Conducted Emissions	EVGA	5/12/2015	05/12/2016
LISN	Solar Electronics	9252-50-R-24-BNC	LIR	10/7/2014	10/07/2015

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

HOLE0018-2

MODES INVESTIGATED

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.	High Ch. 2475 MHz
IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.	Low Ch. 2405 MHz
IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.	Mid Ch. 2440 MHz

POWERLINE CONDUCTED EMISSIONS

EUT:	Wireless Multi-Protocol Receiver	Work Order:	HOLE0018
Serial Number:	00:40:84:05:BF:F1 #4	Date:	06/19/2015
Customer:	Holjeron	Temperature:	24.4°C
Attendees:	Patrick Moore	Relative Humidity:	41.9%
Customer Project:	WMPR	Bar. Pressure:	1019.5 mb
Tested By:	Jared Ison	Job Site:	EV07
Power:	110VAC/60Hz	Configuration:	HOLE0018-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	4	Line:	Neutral	Ext. Attenuation (dB):	0
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COMMENTS

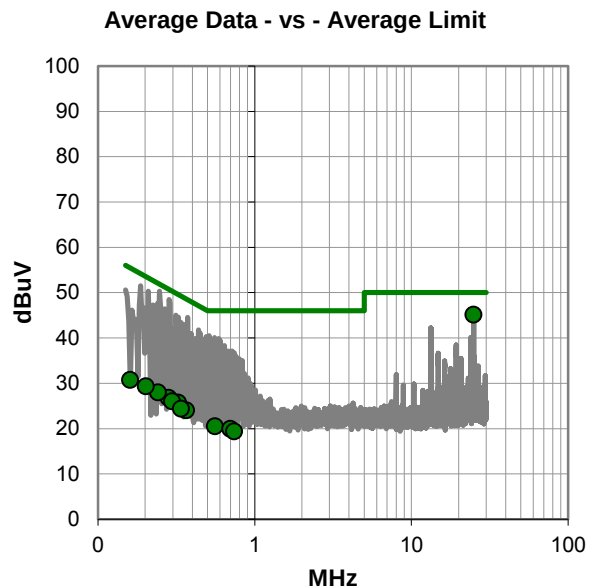
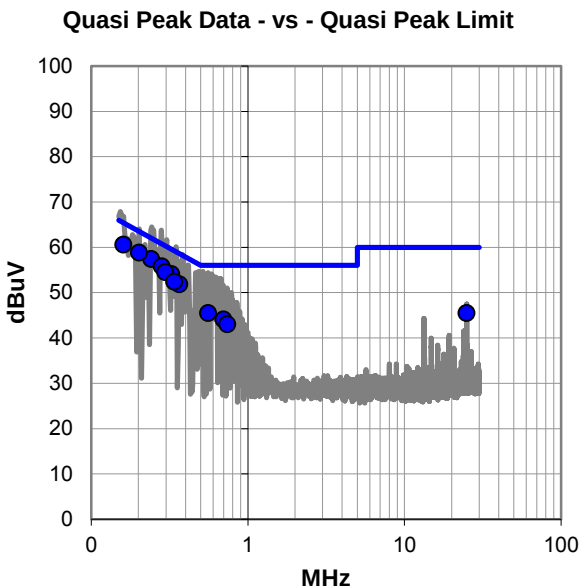
None

EUT OPERATING MODES

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps. Low Ch. 2405 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

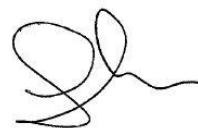
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.241	37.4	20.0	57.4	62.1	-4.7
0.202	38.8	20.0	58.8	63.5	-4.7
0.160	40.5	20.0	60.5	65.5	-4.9
0.283	35.9	19.9	55.8	60.7	-4.9
0.325	34.2	19.9	54.1	59.6	-5.5
0.297	34.6	19.9	54.5	60.3	-5.8
0.366	31.9	19.9	51.8	58.6	-6.8
0.340	32.5	19.9	52.4	59.2	-6.8
0.557	25.6	19.9	45.5	56.0	-10.5
0.698	24.2	19.9	44.1	56.0	-11.9
0.741	23.1	19.9	43.0	56.0	-13.0
25.000	24.2	21.3	45.5	60.0	-14.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
25.000	23.8	21.3	45.1	50.0	-4.9
0.325	5.8	19.9	25.7	49.6	-23.9
0.283	6.9	19.9	26.8	50.7	-23.9
0.241	8.0	20.0	28.0	52.1	-24.1
0.202	9.3	20.0	29.3	53.5	-24.2
0.297	6.1	19.9	26.0	50.3	-24.3
0.366	4.1	19.9	24.0	48.6	-24.6
0.160	10.7	20.0	30.7	55.5	-24.7
0.340	4.5	19.9	24.4	49.2	-24.8
0.557	0.6	19.9	20.5	46.0	-25.5
0.698	0.0	19.9	19.9	46.0	-26.1
0.741	-0.5	19.9	19.4	46.0	-26.6

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Wireless Multi-Protocol Receiver	Work Order:	HOLE0018
Serial Number:	00:40:84:05:BF:F1 #4	Date:	06/19/2015
Customer:	Holjeron	Temperature:	24.4°C
Attendees:	Patrick Moore	Relative Humidity:	41.9%
Customer Project:	WMPR	Bar. Pressure:	1019.5 mb
Tested By:	Jared Ison	Job Site:	EV07
Power:	110VAC/60Hz	Configuration:	HOLE0018-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	5	Line:	High Line	Ext. Attenuation (dB):	0
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COMMENTS

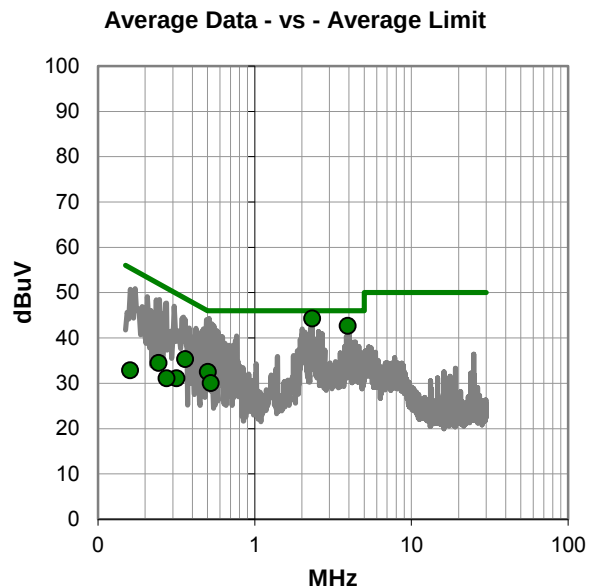
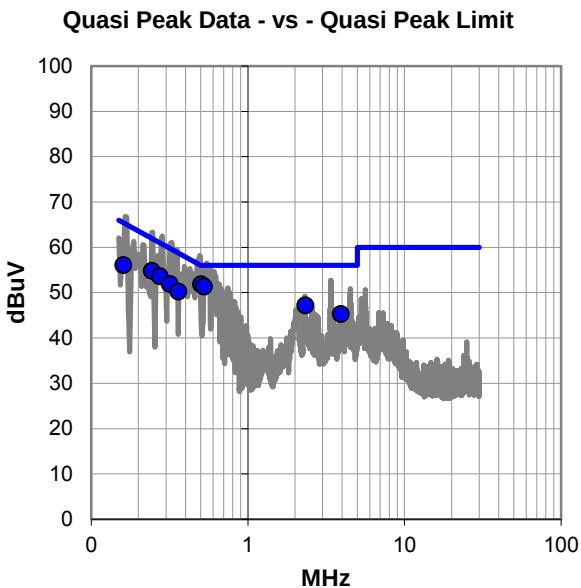
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EUT OPERATING MODES

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps. Low Ch. 2405 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #5

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.503	31.9	19.9	51.8	56.0	-4.2
0.525	31.4	19.9	51.3	56.0	-4.7
0.244	34.8	20.0	54.8	61.9	-7.2
0.274	33.7	19.9	53.6	61.0	-7.4
0.317	32.0	19.9	51.9	59.8	-7.9
0.361	30.3	19.9	50.2	58.7	-8.5
2.329	27.1	20.1	47.2	56.0	-8.8
0.161	36.0	20.0	56.0	65.4	-9.4
3.921	25.1	20.2	45.3	56.0	-10.7

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
2.329	24.2	20.1	44.3	46.0	-1.7
3.921	22.5	20.2	42.7	46.0	-3.3
0.361	15.4	19.9	35.3	48.7	-13.4
0.503	12.6	19.9	32.5	46.0	-13.5
0.525	10.1	19.9	30.0	46.0	-16.0
0.244	14.5	20.0	34.5	51.9	-17.5
0.317	11.2	19.9	31.1	49.8	-18.7
0.274	11.2	19.9	31.1	51.0	-19.9
0.161	12.8	20.0	32.8	55.4	-22.6

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Wireless Multi-Protocol Receiver	Work Order:	HOLE0018
Serial Number:	00:40:84:05:BF:F1 #4	Date:	06/19/2015
Customer:	Holjeron	Temperature:	24.4°C
Attendees:	Patrick Moore	Relative Humidity:	41.9%
Customer Project:	WMPR	Bar. Pressure:	1019.5 mb
Tested By:	Jared Ison	Job Site:	EV07
Power:	110VAC/60Hz	Configuration:	HOLE0018-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	6	Line:	High Line	Ext. Attenuation (dB):	0
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COMMENTS

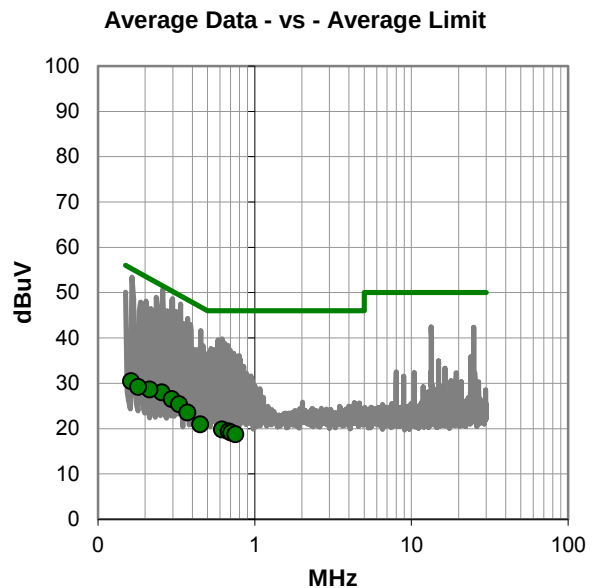
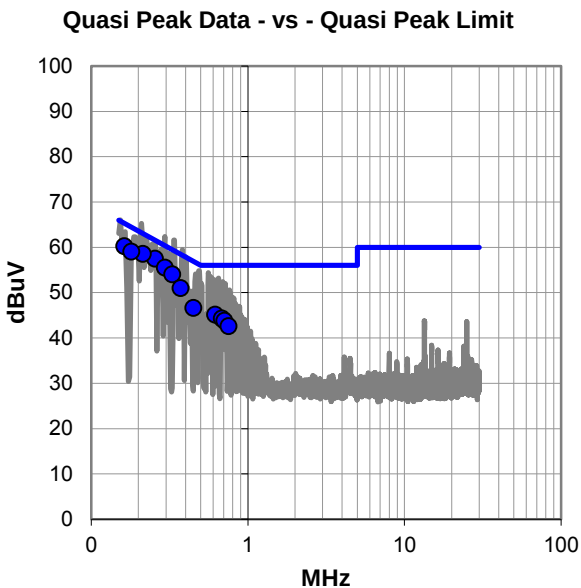
None

EUT OPERATING MODES

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps. Mid Ch. 2440 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #6

Quasi Peak Data - vs - Quasi Peak Limit

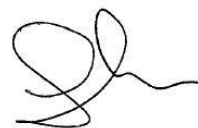
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.256	37.5	19.9	57.4	61.6	-4.1
0.214	38.5	20.0	58.5	63.1	-4.6
0.295	35.6	19.9	55.5	60.4	-4.9
0.163	40.2	20.0	60.2	65.3	-5.1
0.180	39.0	20.0	59.0	64.5	-5.5
0.329	34.1	19.9	54.0	59.5	-5.5
0.373	31.1	19.9	51.0	58.4	-7.4
0.449	26.7	19.9	46.6	56.9	-10.3
0.618	25.2	19.9	45.1	56.0	-10.9
0.684	24.4	19.9	44.3	56.0	-11.7
0.711	23.9	19.9	43.8	56.0	-12.2
0.753	22.7	19.9	42.6	56.0	-13.4

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.256	8.0	19.9	27.9	51.6	-23.6
0.295	6.6	19.9	26.5	50.4	-23.9
0.329	5.5	19.9	25.4	49.5	-24.1
0.214	8.6	20.0	28.6	53.1	-24.5
0.163	10.4	20.0	30.4	55.3	-24.9
0.373	3.6	19.9	23.5	48.4	-24.9
0.180	9.2	20.0	29.2	54.5	-25.3
0.449	1.0	19.9	20.9	46.9	-26.0
0.618	-0.1	19.9	19.8	46.0	-26.2
0.684	-0.5	19.9	19.4	46.0	-26.6
0.711	-0.8	19.9	19.1	46.0	-26.9
0.753	-1.2	19.9	18.7	46.0	-27.3

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Wireless Multi-Protocol Receiver	Work Order:	HOLE0018
Serial Number:	00:40:84:05:BF:F1 #4	Date:	06/19/2015
Customer:	Holjeron	Temperature:	24.4°C
Attendees:	Patrick Moore	Relative Humidity:	41.9%
Customer Project:	WMPR	Bar. Pressure:	1019.5 mb
Tested By:	Jared Ison	Job Site:	EV07
Power:	110VAC/60Hz	Configuration:	HOLE0018-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	7	Line:	Neutral	Ext. Attenuation (dB):	0
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COMMENTS

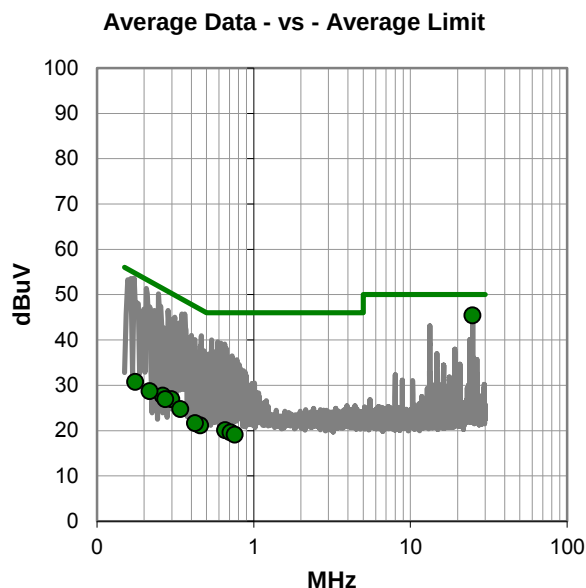
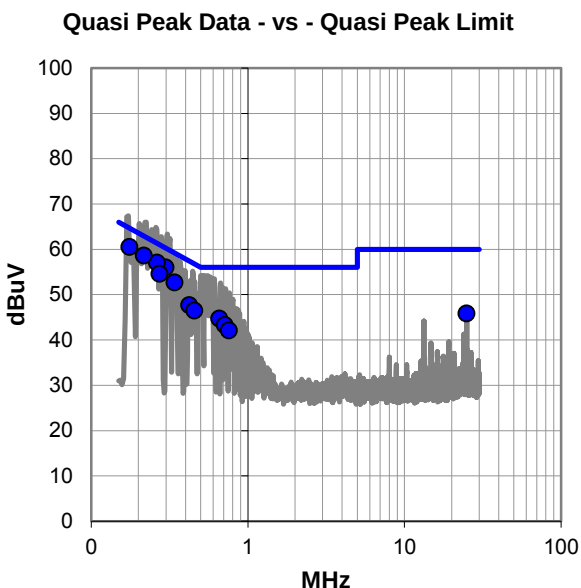
None

EUT OPERATING MODES

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps. Mid Ch. 2440 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #7

Quasi Peak Data - vs - Quasi Peak Limit

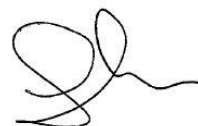
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.176	40.5	20.0	60.5	64.7	-4.2
0.299	36.1	19.9	56.0	60.3	-4.3
0.263	37.1	19.9	57.0	61.3	-4.3
0.217	38.6	20.0	58.6	62.9	-4.3
0.273	34.7	19.9	54.6	61.0	-6.4
0.341	32.8	19.9	52.7	59.2	-6.5
0.424	27.8	19.9	47.7	57.4	-9.7
0.456	26.6	19.9	46.5	56.8	-10.3
0.659	24.8	19.9	44.7	56.0	-11.3
0.712	23.4	19.9	43.3	56.0	-12.7
0.758	22.2	19.9	42.1	56.0	-13.9
25.000	24.5	21.3	45.8	60.0	-14.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
25.000	24.1	21.3	45.4	50.0	-4.6
0.299	7.0	19.9	26.9	50.3	-23.4
0.263	7.8	19.9	27.7	51.3	-23.6
0.176	10.7	20.0	30.7	54.7	-24.0
0.273	7.0	19.9	26.9	51.0	-24.1
0.217	8.7	20.0	28.7	52.9	-24.2
0.341	4.8	19.9	24.7	49.2	-24.5
0.456	1.2	19.9	21.1	46.8	-25.7
0.424	1.7	19.9	21.6	47.4	-25.8
0.659	0.2	19.9	20.1	46.0	-25.9
0.712	-0.3	19.9	19.6	46.0	-26.4
0.758	-0.8	19.9	19.1	46.0	-26.9

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Wireless Multi-Protocol Receiver	Work Order:	HOLE0018
Serial Number:	00:40:84:05:BF:F1 #4	Date:	06/19/2015
Customer:	Holjeron	Temperature:	24.4°C
Attendees:	Patrick Moore	Relative Humidity:	41.9%
Customer Project:	WMPR	Bar. Pressure:	1019.5 mb
Tested By:	Jared Ison	Job Site:	EV07
Power:	110VAC/60Hz	Configuration:	HOLE0018-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	8	Line:	High Line	Ext. Attenuation (dB):	0
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COMMENTS

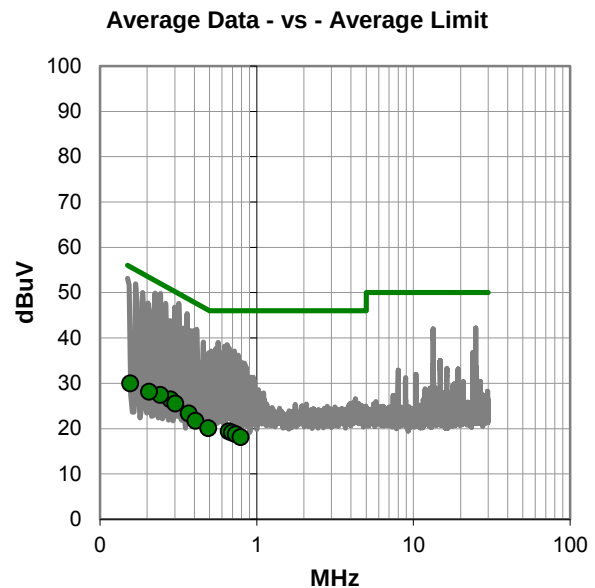
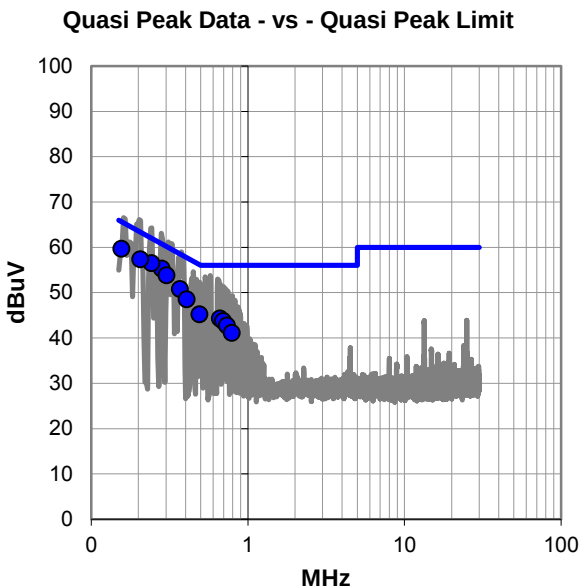
None

EUT OPERATING MODES

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps. High Ch. 2475 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #8

Quasi Peak Data - vs - Quasi Peak Limit

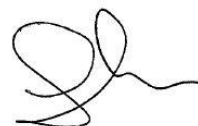
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.282	35.4	19.9	55.3	60.8	-5.5
0.243	36.5	20.0	56.5	62.0	-5.5
0.156	39.6	20.1	59.7	65.7	-6.0
0.206	37.3	20.0	57.3	63.4	-6.1
0.303	33.9	19.9	53.8	60.2	-6.4
0.369	30.9	19.9	50.8	58.5	-7.7
0.407	28.6	19.9	48.5	57.7	-9.2
0.491	25.3	19.9	45.2	56.2	-11.0
0.663	24.4	19.9	44.3	56.0	-11.7
0.696	23.8	19.9	43.7	56.0	-12.3
0.735	22.8	19.9	42.7	56.0	-13.3
0.791	21.2	19.9	41.1	56.0	-14.9

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.282	6.5	19.9	26.4	50.8	-24.4
0.243	7.4	20.0	27.4	52.0	-24.6
0.303	5.6	19.9	25.5	50.2	-24.7
0.369	3.4	19.9	23.3	48.5	-25.2
0.206	8.1	20.0	28.1	53.4	-25.3
0.156	9.9	20.1	30.0	55.7	-25.7
0.407	1.8	19.9	21.7	47.7	-26.0
0.491	0.2	19.9	20.1	46.2	-26.1
0.663	-0.5	19.9	19.4	46.0	-26.6
0.696	-0.8	19.9	19.1	46.0	-26.9
0.735	-1.2	19.9	18.7	46.0	-27.3
0.791	-1.8	19.9	18.1	46.0	-27.9

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Wireless Multi-Protocol Receiver	Work Order:	HOLE0018
Serial Number:	00:40:84:05:BF:F1 #4	Date:	06/19/2015
Customer:	Holjeron	Temperature:	24.4°C
Attendees:	Patrick Moore	Relative Humidity:	41.9%
Customer Project:	WMPR	Bar. Pressure:	1019.5 mb
Tested By:	Jared Ison	Job Site:	EV07
Power:	110VAC/60Hz	Configuration:	HOLE0018-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2015	ANSI C63.10:2009

TEST PARAMETERS

Run #:	9	Line:	Neutral	Ext. Attenuation (dB):	0
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COMMENTS

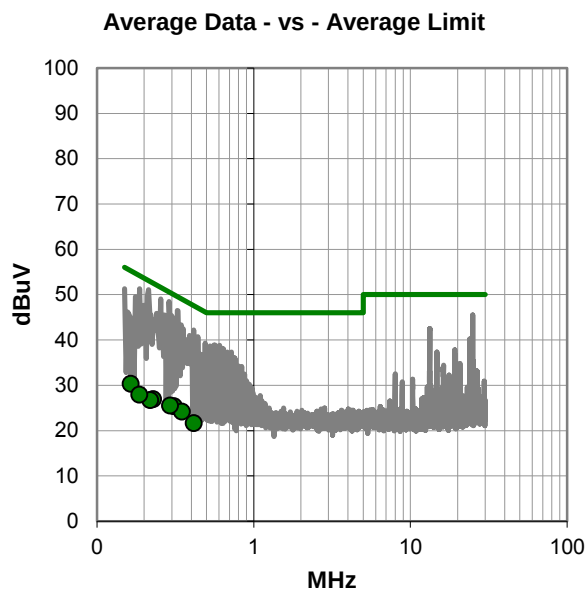
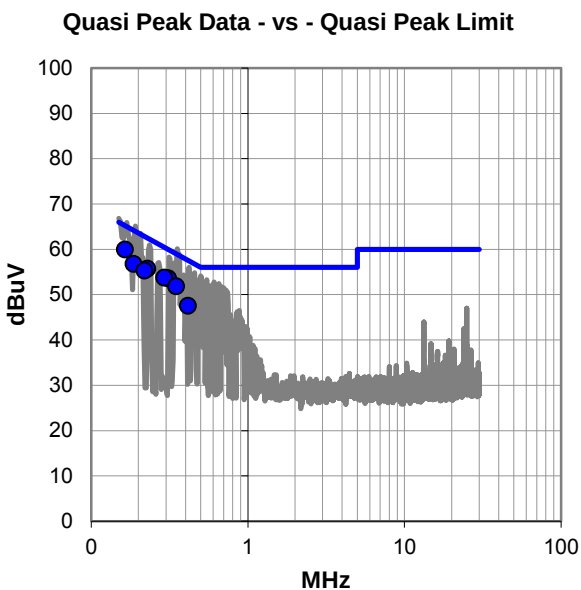
None

EUT OPERATING MODES

IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps. High Ch. 2475 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #9

Quasi Peak Data - vs - Quasi Peak Limit

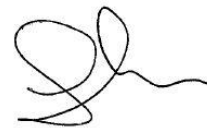
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.164	39.9	20.0	59.9	65.2	-5.3
0.310	33.7	19.9	53.6	60.0	-6.4
0.293	33.8	19.9	53.7	60.4	-6.7
0.228	35.7	20.0	55.7	62.5	-6.8
0.349	31.9	19.9	51.8	59.0	-7.2
0.187	36.8	20.0	56.8	64.2	-7.4
0.219	35.3	20.0	55.3	62.8	-7.5
0.414	27.6	19.9	47.5	57.6	-10.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.310	5.5	19.9	25.4	50.0	-24.6
0.349	4.3	19.9	24.2	49.0	-24.8
0.164	10.3	20.0	30.3	55.2	-24.9
0.293	5.6	19.9	25.5	50.4	-24.9
0.228	6.9	20.0	26.9	52.5	-25.6
0.414	1.7	19.9	21.6	47.6	-26.0
0.219	6.7	20.0	26.7	52.8	-26.1
0.187	7.9	20.0	27.9	54.2	-26.3

CONCLUSION

Pass



Tested By

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

Low Channel 2405 MHz, 250 Kbps.

Mid Channel 2440 MHz, 250 Kbps.

High Channel 2475 MHz, 250 Kbps.

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

HOLE0018 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26000 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
Cable	ESM Cable Corp.	KMKM-72	EVY	11/9/2014	12 mo
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	11/9/2014	12 mo
Antenna, Horn	ETS Lindgren	3160-09	AIV	NCR	0 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	4/16/2015	12 mo
Antenna, Horn	ETS Lindgren	3160-08	AHV	NCR	0 mo
Cable	None	Standard Gain Horns Cable	EVF	4/20/2015	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	4/20/2015	12 mo
Antenna, Horn	ETS Lindgren	3160-07	AHU	NCR	0 mo
High Pass Filter, 2.8 - 18 GHz	Micro-Tronics	HPM50111	HFO	3/31/2015	12 mo
Cable	N/A	Double Ridge Horn Cables	EVB	4/16/2015	12 mo
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	4/16/2015	12 mo
Antenna, Horn	ETS Lindgren	3115	AIZ	1/27/2014	24 mo
Low Pass Filter, 0 - 1000 MHz	Micro-Tronics	LPM50004	LFD	5/24/2015	12 mo
Cable	N/A	Bilog Cables	EVA	2/10/2015	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOL	2/10/2015	12 mo
Antenna, Biconilog	EMCO	3141	AXE	8/29/2014	24 mo
Spectrum Analyzer	Keysight	N9010A	AFN	2/10/2015	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

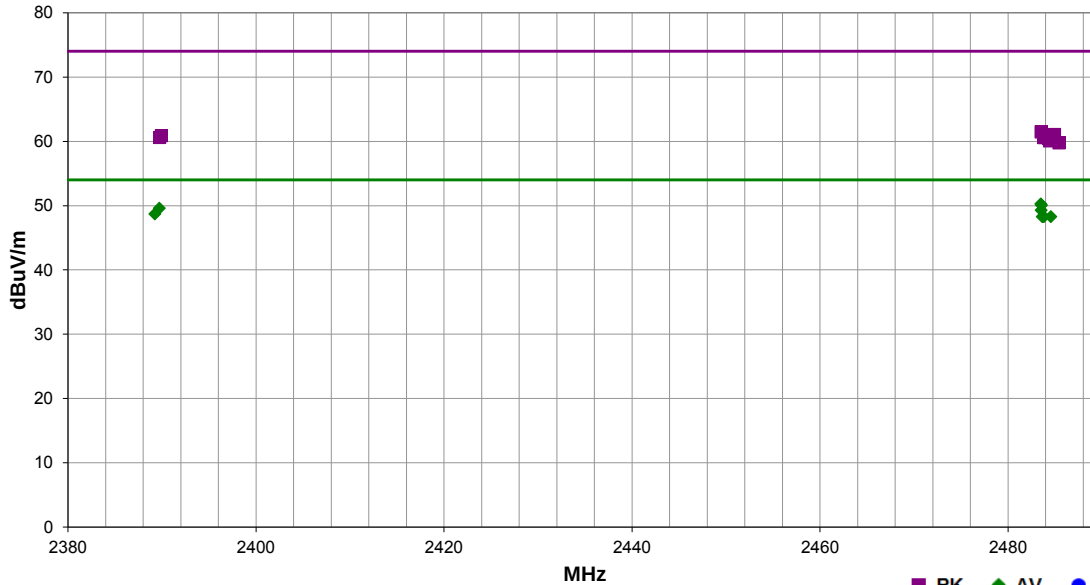
TEST DESCRIPTION

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 EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10:2009). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

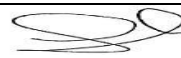
Work Order:	HOLE0018	Date:	06/19/15	
Project:	WMPR	Temperature:	23.6 °C	
Job Site:	EV01	Humidity:	40.3% RH	
Serial Number:	00:40:84:05:BF:F1 #4	Barometric Pres.:	1020.6 mbar	
EUT: Wireless Multi-Protocol Receiver				
Configuration:	1			
Customer:	Holjeron			
Attendees:	Patrick Moore			
EUT Power:	110VAC/60Hz			
Operating Mode:	IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.			
Deviations:	None			
Comments:	Reference data comments for EUT channel and orientation. 2.1dBi Antenna			

Test Specifications	Test Method
FCC 15.247:2015	ANSI C63.10:2009

Run #	17	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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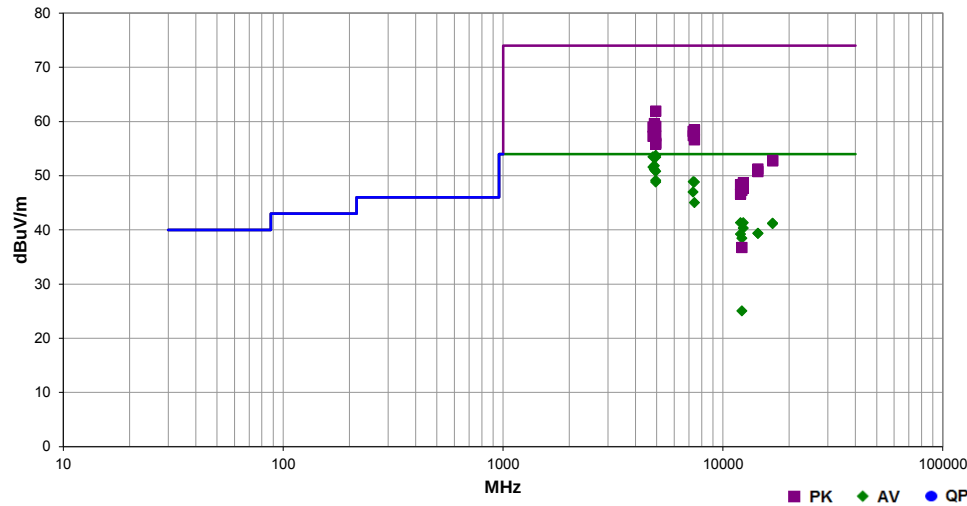


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.510	33.3	-3.0	1.1	281.0	3.0	20.0	Horz	AV	0.0	50.3	54.0	-3.7	High Ch. 2475 MHz, EUT Horz
2483.577	33.1	-3.0	1.0	324.0	3.0	20.0	Vert	AV	0.0	50.1	54.0	-3.9	High Ch. 2475 MHz, EUT Vert
2389.733	32.9	-3.3	1.0	289.0	3.0	20.0	Vert	AV	0.0	49.6	54.0	-4.4	Low Ch. 2405 MHz, EUT Vert
2483.543	32.3	-3.0	1.0	56.0	3.0	20.0	Horz	AV	0.0	49.3	54.0	-4.7	High Ch. 2475 MHz, EUT On Side
2389.257	32.0	-3.3	1.0	330.0	3.0	20.0	Horz	AV	0.0	48.7	54.0	-5.3	Low Ch. 2405 MHz, EUT Horz
2484.570	31.3	-3.0	1.0	120.0	3.0	20.0	Vert	AV	0.0	48.3	54.0	-5.7	High Ch. 2475 MHz, EUT Horz
2483.817	31.3	-3.0	1.0	230.0	3.0	20.0	Horz	AV	0.0	48.3	54.0	-5.7	High Ch. 2475 MHz, EUT Vert
2483.650	31.3	-3.0	1.0	33.0	3.0	20.0	Vert	AV	0.0	48.3	54.0	-5.7	High Ch. 2475 MHz, EUT On Side
2483.520	44.5	-3.0	1.1	281.0	3.0	20.0	Horz	PK	0.0	61.5	74.0	-12.5	High Ch. 2475 MHz, EUT Horz
2484.947	44.1	-3.0	1.0	324.0	3.0	20.0	Vert	PK	0.0	61.1	74.0	-12.9	High Ch. 2475 MHz, EUT Vert
2389.930	44.2	-3.3	1.0	289.0	3.0	20.0	Vert	PK	0.0	60.9	74.0	-13.1	Low Ch. 2405 MHz, EUT Vert
2389.737	43.9	-3.3	1.0	330.0	3.0	20.0	Horz	PK	0.0	60.6	74.0	-13.4	Low Ch. 2405 MHz, EUT Horz
2483.830	43.6	-3.0	1.0	56.0	3.0	20.0	Horz	PK	0.0	60.6	74.0	-13.4	High Ch. 2475 MHz, EUT On Side
2484.293	43.5	-3.0	1.0	120.0	3.0	20.0	Vert	PK	0.0	60.5	74.0	-13.5	High Ch. 2475 MHz, EUT Horz
2484.417	43.1	-3.0	1.0	33.0	3.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9	High Ch. 2475 MHz, EUT On Side
2485.423	42.8	-3.0	1.0	230.0	3.0	20.0	Horz	PK	0.0	59.8	74.0	-14.2	High Ch. 2475 MHz, EUT Vert

Work Order:	HOLE0018	Date:	06/19/15		
Project:	WMPR	Temperature:	23.6 °C		
Job Site:	EV01	Humidity:	40.3% RH		
Serial Number:	00:40:84:05:BF:F1 #4	Barometric Pres.:	1020.6 mbar	Tested by:	Jared Ison
EUT:	Wireless Multi-Protocol Receiver				
Configuration:	1				
Customer:	Holjeron				
Attendees:	Patrick Moore				
EUT Power:	110VAC/60Hz				
Operating Mode:	IEEE802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.				
Deviations:	None				
Comments:	Reference data comments for EUT channel and orientation. 2.1dBi Antenna				

Test Specifications	Test Method
FCC 15.247:2015	ANSI C63.10:2009

Run #	8	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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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
4948.917	46.2	7.5	3.1	241.0	3.0	0.0	Horz	AV	0.0	53.7	54.0	-0.3	High Ch. 2475 MHz, EUT Vert_10 Hz Av
4808.958	46.1	7.4	2.0	335.0	3.0	0.0	Vert	AV	0.0	53.5	54.0	-0.5	Low Ch. 2405 MHz, EUT Horz
4948.958	45.9	7.5	2.4	320.0	3.0	0.0	Vert	AV	0.0	53.4	54.0	-0.6	High Ch. 2475 MHz, EUT Horz
4878.967	44.4	7.4	2.0	331.0	3.0	0.0	Vert	AV	0.0	51.8	54.0	-2.2	Mid Ch. 2440 MHz, EUT Horz_10 Hz
4808.917	44.2	7.4	1.3	162.0	3.0	0.0	Horz	AV	0.0	51.6	54.0	-2.4	Low Ch. 2405 MHz, EUT Vert
4878.950	43.7	7.4	1.4	156.0	3.0	0.0	Horz	AV	0.0	51.1	54.0	-2.9	Mid Ch. 2440 MHz, EUT Vert
4948.958	43.3	7.5	2.9	339.0	3.0	0.0	Horz	AV	0.0	50.8	54.0	-3.2	High Ch. 2475 MHz, EUT On Side
4948.917	41.6	7.5	1.0	149.0	3.0	0.0	Vert	AV	0.0	49.1	54.0	-4.9	High Ch. 2475 MHz, EUT Vert
7321.283	33.7	15.2	1.9	162.0	3.0	0.0	Vert	AV	0.0	48.9	54.0	-5.1	Mid Ch. 2440 MHz, EUT Horz
7423.508	33.4	15.4	2.2	155.0	3.0	0.0	Vert	AV	0.0	48.8	54.0	-5.2	High Ch. 2475 MHz, EUT Horz
4949.000	41.3	7.5	2.3	206.0	3.0	0.0	Horz	AV	0.0	48.8	54.0	-5.2	High Ch. 2475 MHz, EUT Horz
7318.425	31.8	15.2	1.0	151.0	3.0	0.0	Horz	AV	0.0	47.0	54.0	-7.0	Mid Ch. 2440 MHz, EUT Vert
7423.475	29.6	15.4	1.0	259.0	3.0	0.0	Horz	AV	0.0	45.0	54.0	-9.0	High Ch. 2475 MHz, EUT Vert
4948.950	54.4	7.5	3.1	241.0	3.0	0.0	Horz	PK	0.0	61.9	74.0	-12.1	High Ch. 2475 MHz, EUT Vert
12027.370	41.1	0.2	1.9	53.0	3.0	0.0	Vert	AV	0.0	41.3	54.0	-12.7	Low Ch. 2405 MHz, EUT Horz
12377.270	39.5	1.8	2.2	186.0	3.0	0.0	Horz	AV	0.0	41.3	54.0	-12.7	High Ch. 2475 MHz, EUT Vert
16833.240	25.5	15.7	2.2	263.0	3.0	0.0	Horz	AV	0.0	41.2	54.0	-12.8	Low Ch. 2405 MHz, EUT Vert
16837.240	25.4	15.7	1.0	360.0	3.0	0.0	Vert	AV	0.0	41.1	54.0	-12.9	Low Ch. 2405 MHz, EUT Horz
12377.290	38.5	1.8	1.2	307.0	3.0	0.0	Vert	AV	0.0	40.3	54.0	-13.7	High Ch. 2475 MHz, EUT Horz
4878.892	52.2	7.4	2.0	331.0	3.0	0.0	Vert	PK	0.0	59.6	74.0	-14.4	Mid Ch. 2440 MHz, EUT Horz
14431.720	25.9	13.4	1.0	333.0	3.0	0.0	Vert	AV	0.0	39.3	54.0	-14.7	Low Ch. 2405 MHz, EUT Horz
14428.580	25.9	13.4	1.3	229.0	3.0	0.0	Horz	AV	0.0	39.3	54.0	-14.7	Low Ch. 2405 MHz, EUT Vert
12027.250	39.0	0.2	2.1	320.0	3.0	0.0	Horz	AV	0.0	39.2	54.0	-14.8	Low Ch. 2405 MHz, EUT Vert
4948.958	51.6	7.5	2.4	320.0	3.0	0.0	Vert	PK	0.0	59.1	74.0	-14.9	High Ch. 2475 MHz, EUT Horz
4808.933	51.6	7.4	2.0	335.0	3.0	0.0	Vert	PK	0.0	59.0	74.0	-15.0	Low Ch. 2405 MHz, EUT Horz
12202.370	37.3	1.1	1.0	308.0	3.0	0.0	Horz	AV	0.0	38.4	54.0	-15.6	Mid Ch. 2440 MHz, EUT Vert
7423.900	43.0	15.4	2.2	155.0	3.0	0.0	Vert	PK	0.0	58.4	74.0	-15.6	High Ch. 2475 MHz, EUT Horz
7318.500	43.0	15.2	1.9	162.0	3.0	0.0	Vert	PK	0.0	58.2	74.0	-15.8	Mid Ch. 2440 MHz, EUT Horz
7321.175	42.2	15.2	1.0	151.0	3.0	0.0	Horz	PK	0.0	57.4	74.0	-16.6	Mid Ch. 2440 MHz, EUT Vert
4950.725	49.8	7.5	2.9	339.0	3.0	0.0	Horz	PK	0.0	57.3	74.0	-16.7	High Ch. 2475 MHz, EUT On Side
4879.075	49.9	7.4	1.4	156.0	3.0	0.0	Horz	PK	0.0	57.3	74.0	-16.7	Mid Ch. 2440 MHz, EUT Vert
4808.967	49.9	7.4	1.3	162.0	3.0	0.0	Horz	PK	0.0	57.3	74.0	-16.7	Low Ch. 2405 MHz, EUT Vert
7424.450	41.2	15.4	1.0	259.0	3.0	0.0	Horz	PK	0.0	56.6	74.0	-17.4	High Ch. 2475 MHz, EUT Vert
4948.958	48.5	7.5	1.0	149.0	3.0	0.0	Vert	PK	0.0	56.0	74.0	-18.0	High Ch. 2475 MHz, EUT Vert
4948.983	48.3	7.5	2.3	206.0	3.0	0.0	Horz	PK	0.0	55.8	74.0	-18.2	High Ch. 2475 MHz, EUT Horz
16837.210	37.1	15.7	2.2	263.0	3.0	0.0	Horz	PK	0.0	52.8	74.0	-21.2	Low Ch. 2405 MHz, EUT Horz
16834.810	37.0	15.7	1.0	360.0	3.0	0.0	Vert	PK	0.0	52.7	74.0	-21.3	Low Ch. 2405 MHz, EUT Horz
14428.100	37.8	13.4	1.0	333.0	3.0	0.0	Vert	PK	0.0	51.2	74.0	-22.8	Low Ch. 2405 MHz, EUT Horz
14428.380	37.3	13.4	1.3	229.0	3.0	0.0	Horz	PK	0.0	50.7	74.0	-23.3	Low Ch. 2405 MHz, EUT Vert
12372.190	46.9	1.8	2.2	186.0	3.0	0.0	Horz	PK	0.0	48.7	74.0	-25.3	High Ch. 2475 MHz, EUT Vert
12027.200	48.1	0.2	1.9	53.0	3.0	0.0	Vert	PK	0.0	48.3	74.0	-25.7	Low Ch. 2405 MHz, EUT Horz
12377.280	45.9	1.8	1.2	307.0	3.0	0.0	Vert	PK	0.0	47.7	74.0	-26.3	High Ch. 2475 MHz, EUT Horz
12197.640	46.2	1.1	1.0	308.0	3.0	0.0	Horz	PK	0.0	47.3	74.0	-26.7	Mid Ch. 2440 MHz, EUT Vert
12027.090	46.4	0.2	2.1	320.0	3.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	Low Ch. 2405 MHz, EUT Vert
12200.480	23.9	1.1	2.6	350.0	3.0	0.0	Vert	AV	0.0	25.0	54.0	-29.0	Mid Ch. 2440 MHz, EUT Horz
12202.500	35.6	1.1	2.6	350.0	3.0	0.0	Vert	PK	0.0	36.7	74.0	-37.3	Mid Ch. 2440 MHz, EUT Horz

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

Low Channel 2405 MHz, 250 Kbps

Mid Channel 2440 MHz, 250 Kbps

High Channel 2475 MHz, 250 Kbps

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

HOLE0021 - 1

HOLE0021 - 2

HOLE0021 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz

Stop Frequency 26000 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
Low Pass Filter, 0 - 1000 MHz	Micro-Tronics	LPM50004	LFC	11/14/2014	12 mo
Attenuator	Coaxicom	66702 3910AF-20	TKH	3/4/2015	12 mo
High Pass Filter, 2.8 - 18 GHz	Micro-Tronics	HPM50111	HFM	2/9/2015	12 mo
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AOI	12/31/2014	12 mo
Antenna, Horn	EMCO	3160-09	AHN	NCR	0 mo
OC Floating Cable	Northwest EMC	18-26GHz RE Cables	OCK	2/27/2015	12 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AOF	9/11/2014	12 mo
Antenna, Horn	ETS Lindgren	3160-08	AHT	NCR	0 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AOE	9/11/2014	12 mo
Antenna, Horn	ETS Lindgren	3160-07	AHR	NCR	0 mo
OC 10 Cables	Northwest EMC	8-18GHz RE Cables	OCO	9/11/2014	12 mo
Pre-Amplifier	Miteq	AMF-4D-010120-30-10P-1	AOP	3/2/2015	12 mo
Antenna, Horn	EMCO	3115	AHB	3/10/2014	24 mo
OC10 Cables	Northwest EMC	1-8GHz RE Cables	OCJ	3/2/2015	12 mo
Antenna, Biconilog	EMCO	3142B	AXK	10/6/2014	24 mo
OC10 Cables	Northwest EMC	10kHz-1GHz RE Cables	OCH	3/4/2015	12 mo
Pre-Amplifier	Miteq	AM-1064-9079	AOO	3/5/2015	12 mo
Spectrum Analyzer	Agilent	N9010A	AFJ	10/1/2014	12 mo

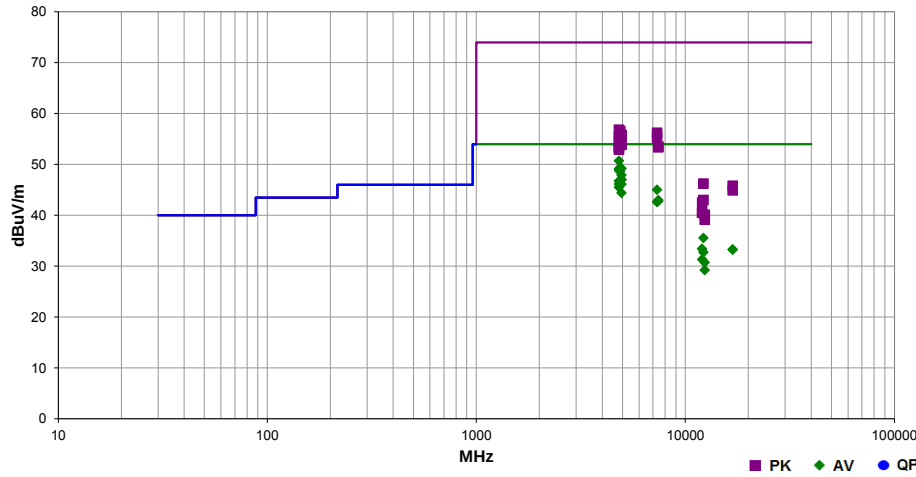
TEST DESCRIPTION

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.

Work Order:	HOLE0021	Date:	07/22/15		
Project:	WMPR	Temperature:	21.5 °C		
Job Site:	OC10	Humidity:	50.5% RH		
Serial Number:	00:40:84:05:BF:F1 #4	Barometric Pres.:	1012 mbar	Tested by:	Mike Tran & Johnny Candelas
EUT:	Wireless Multi-Protocol Receiver				
Configuration:	1,2,3				
Customer:	Holjeron				
Attendees:	Patrick Moore, Aaby				
EUT Power:	110VAC/60Hz				
Operating Mode:	IEEE 802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.				
Deviations:	None				
Comments:	Reference data comments for EUT channel and orientation. 9dBi antenna				

Test Specifications	Test Method
FCC 15.247:2015	ANSI C63.10:2009

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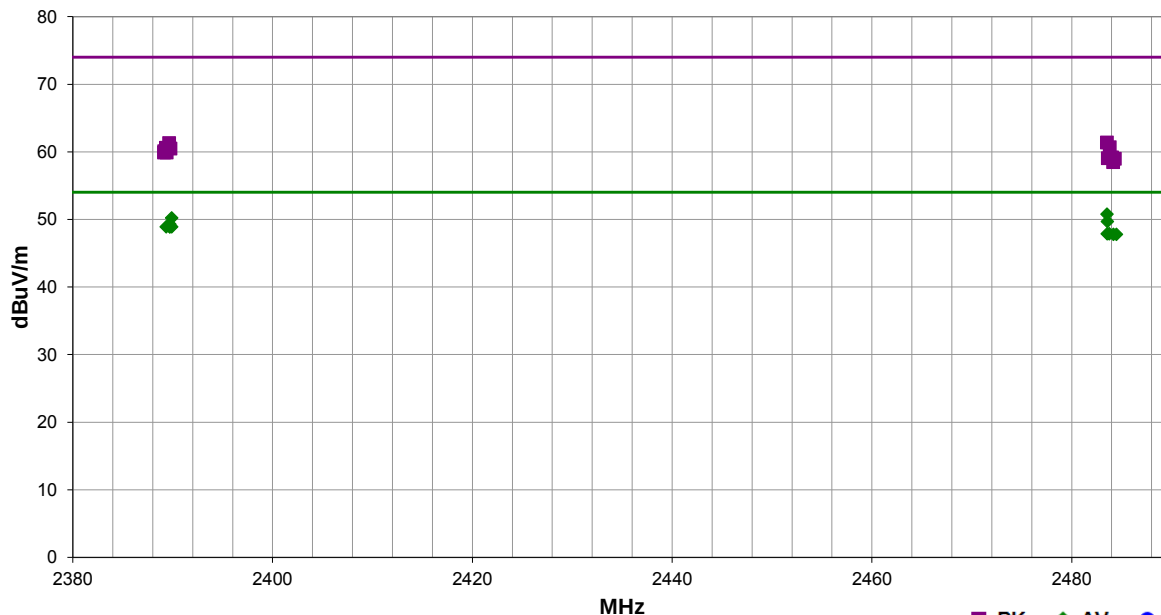


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4808.942	41.5	9.2	1.2	283.0	3.0	0.0	Horz	AV	0.0	50.7	54.0	-3.3	EUT on Side, Low Ch
4878.975	40.0	9.4	1.2	310.0	3.0	0.0	Horz	AV	0.0	49.4	54.0	-4.6	EUT on Side, Mid Ch
4948.892	39.7	9.5	1.2	321.0	3.0	0.0	Vert	AV	0.0	49.2	54.0	-4.8	EUT on Side, High Ch
4810.925	39.9	9.2	1.2	328.0	3.0	0.0	Vert	AV	0.0	49.1	54.0	-4.9	EUT Horz, Low Ch
4810.917	39.6	9.2	1.0	314.0	3.0	0.0	Vert	AV	0.0	48.8	54.0	-5.2	EUT on Side, Low Ch
4880.925	39.3	9.4	1.2	330.0	3.0	0.0	Vert	AV	0.0	48.7	54.0	-5.3	EUT Horz, Mid Ch
4948.933	38.4	9.5	1.3	344.0	3.0	0.0	Vert	AV	0.0	47.9	54.0	-6.1	EUT Vert, High Ch
4948.917	37.5	9.5	2.2	341.0	3.0	0.0	Horz	AV	0.0	47.0	54.0	-7.0	EUT Vert, High Ch
4948.933	37.5	9.5	1.2	157.0	3.0	0.0	Horz	AV	0.0	47.0	54.0	-7.0	EUT on Side, High Ch
4808.917	37.5	9.2	1.2	331.0	3.0	0.0	Horz	AV	0.0	46.7	54.0	-7.3	EUT Vert, Low Ch
4810.933	36.9	9.2	1.2	352.0	3.0	0.0	Vert	AV	0.0	46.1	54.0	-7.9	EUT Vert, Low Ch
4948.942	36.6	9.5	1.4	202.0	3.0	0.0	Vert	AV	0.0	46.1	54.0	-7.9	EUT Horz, High Ch
4808.933	36.3	9.2	1.2	199.0	3.0	0.0	Horz	AV	0.0	45.5	54.0	-8.5	EUT Horz, Low Ch
7318.517	29.4	15.6	1.2	25.0	3.0	0.0	Horz	AV	0.0	45.0	54.0	-9.0	EUT on Side, Mid Ch
4950.933	34.9	9.5	1.2	185.0	3.0	0.0	Horz	AV	0.0	44.4	54.0	-9.6	EUT Horz, High Ch
7423.408	27.3	15.7	1.2	305.0	3.0	0.0	Vert	AV	0.0	43.0	54.0	-11.0	EUT on Side, High Ch
7423.475	27.1	15.7	1.2	124.0	3.0	0.0	Horz	AV	0.0	42.8	54.0	-11.2	EUT Vert, High Ch
7318.508	27.0	15.6	1.5	198.0	3.0	0.0	Vert	AV	0.0	42.6	54.0	-11.4	EUT Horz, Mid Ch
4808.958	47.6	9.2	1.2	283.0	3.0	0.0	Horz	PK	0.0	56.8	74.0	-17.2	EUT on Side, Low Ch
4878.850	47.2	9.4	1.2	310.0	3.0	0.0	Horz	PK	0.0	56.6	74.0	-17.4	EUT on Side, Mid Ch
7318.533	40.6	15.6	1.2	25.0	3.0	0.0	Horz	PK	0.0	56.2	74.0	-17.8	EUT on Side, Mid Ch
4948.825	46.3	9.5	1.2	321.0	3.0	0.0	Vert	PK	0.0	55.8	74.0	-18.2	EUT on Side, High Ch
4880.792	46.2	9.4	1.2	330.0	3.0	0.0	Vert	PK	0.0	55.6	74.0	-18.4	EUT Horz, Mid Ch
12202.420	44.3	-8.8	1.1	8.0	3.0	0.0	Horz	AV	0.0	35.5	54.0	-18.5	EUT on Side, Mid Ch
4810.975	46.3	9.2	1.2	328.0	3.0	0.0	Vert	PK	0.0	55.5	74.0	-18.5	EUT Horz, Low Ch
7321.250	39.6	15.6	1.5	198.0	3.0	0.0	Vert	PK	0.0	55.2	74.0	-18.8	EUT Horz, Mid Ch
4948.950	45.6	9.5	2.2	341.0	3.0	0.0	Horz	PK	0.0	55.1	74.0	-18.9	EUT Vert, High Ch
4948.992	45.3	9.5	1.2	185.0	3.0	0.0	Horz	PK	0.0	54.8	74.0	-19.2	EUT Horz, High Ch
4809.033	45.5	9.2	1.0	314.0	3.0	0.0	Vert	PK	0.0	54.7	74.0	-19.3	EUT on Side, Low Ch
4948.917	45.2	9.5	1.3	344.0	3.0	0.0	Vert	PK	0.0	54.7	74.0	-19.3	EUT Vert, High Ch
4948.950	45.0	9.5	1.4	202.0	3.0	0.0	Vert	PK	0.0	54.5	74.0	-19.5	EUT Horz, High Ch
4948.892	44.4	9.5	1.2	157.0	3.0	0.0	Horz	PK	0.0	53.9	74.0	-20.1	EUT on Side, High Ch
4809.000	44.3	9.2	1.2	331.0	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	EUT Vert, Low Ch
7426.400	37.8	15.7	1.2	305.0	3.0	0.0	Vert	PK	0.0	53.5	74.0	-20.5	EUT on Side, High Ch
12022.500	42.5	-9.1	1.2	12.0	3.0	0.0	Horz	AV	0.0	33.4	54.0	-20.6	EUT on Side, Low Ch
7422.708	37.7	15.7	1.2	124.0	3.0	0.0	Horz	PK	0.0	53.4	74.0	-20.6	EUT Vert, High Ch
4808.925	44.1	9.2	1.2	199.0	3.0	0.0	Horz	PK	0.0	53.3	74.0	-20.7	EUT Horz, Low Ch
16833.440	26.5	6.8	1.2	30.0	3.0	0.0	Horz	AV	0.0	33.3	54.0	-20.7	EUT on Side, Low Ch
16834.800	26.4	6.8	1.2	31.0	3.0	0.0	Vert	AV	0.0	33.2	54.0	-20.8	EUT Horz, Low Ch
4810.967	43.7	9.2	1.2	352.0	3.0	0.0	Vert	PK	0.0	52.9	74.0	-21.1	EUT Vert, Low Ch
12202.400	41.5	-8.8	1.3	30.0	3.0	0.0	Vert	AV	0.0	32.7	54.0	-21.3	EUT Horz, Mid Ch
12027.270	40.4	-9.1	1.2	168.0	3.0	0.0	Vert	AV	0.0	31.3	54.0	-22.7	EUT Horz, Low Ch
12372.500	39.2	-8.5	1.2	36.0	3.0	0.0	Vert	AV	0.0	30.7	54.0	-23.3	EUT on Side, High Ch
12372.500	37.7	-8.5	1.2	230.0	3.0	0.0	Horz	AV	0.0	29.2	54.0	-24.8	EUT Vert, High Ch
12202.360	55.0	-8.8	1.1	8.0	3.0	0.0	Horz	PK	0.0	46.2	74.0	-27.8	EUT on Side, Mid Ch
16833.280	39.0	6.8	1.2	31.0	3.0	0.0	Vert	PK	0.0	45.8	74.0	-28.2	EUT Horz, Low Ch
16837.100	38.1	6.8	1.2	30.0	3.0	0.0	Horz	PK	0.0	44.9	74.0	-29.1	EUT on Side, Low Ch
12197.580	51.8	-8.8	1.3	30.0	3.0	0.0	Vert	PK	0.0	43.0	74.0	-31.0	EUT Horz, Mid Ch
12027.460	51.6	-9.1	1.2	12.0	3.0	0.0	Horz	PK	0.0	42.5	74.0	-31.5	EUT on Side, Low Ch
12022.580	49.6	-9.1	1.2	168.0	3.0	0.0	Vert	PK	0.0	40.5	74.0	-33.5	EUT Horz, Low Ch
12377.190	48.6	-8.5	1.2	36.0	3.0	0.0	Vert	PK	0.0	40.1	74.0	-33.9	EUT on Side, High Ch
12377.000	47.6	-8.5	1.2	230.0	3.0	0.0	Horz	PK	0.0	39.1	74.0	-34.9	EUT Vert, High Ch

Work Order:	HOLE0021	Date:	07/22/15		
Project:	WMPR	Temperature:	21.5 °C		
Job Site:	OC10	Humidity:	50.5% RH		
Serial Number:	00:40:84:05:BF:F1 #4	Barometric Pres.:	1012 mbar	Tested by:	Mike Tran & Candelas
EUT:	Wireless Multi-Protocol Receiver				
Configuration:	1.3				
Customer:	Holjeron				
Attendees:	Patrick Moore, Greg Aaby				
EUT Power:	110VAC/60Hz				
Operating Mode:	IEEE 802.15.4, 2.4 GHz DTS radio; Continuous transmission using single modulation rate of 250 Kbps.				
Deviations:	None				
Comments:	Reference data comments for EUT channel and orientation. 9dBi Antenna				

Test Specifications	Test Method
FCC 15.247:2015	ANSI C63.10:2009

Run #	6	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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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
2483.540	29.7	1.1	1.2	350.0	3.0	20.0	Horz	AV	0.0	50.8	54.0	-3.2	EUT on Side, High Ch
2389.912	29.6	0.6	1.2	122.0	3.0	20.0	Vert	AV	0.0	50.2	54.0	-3.8	EUT Vert, Low Ch
2483.580	28.6	1.1	1.2	219.0	3.0	20.0	Vert	AV	0.0	49.7	54.0	-4.3	EUT Vert, High Ch
2389.725	28.7	0.6	1.2	183.0	3.0	20.0	Horz	AV	0.0	49.3	54.0	-4.7	EUT on Side, Low Ch
2389.912	28.3	0.6	1.2	1.0	3.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	EUT Horz, Low Ch
2389.713	28.3	0.6	1.2	92.0	3.0	20.0	Horz	AV	0.0	48.9	54.0	-5.1	EUT Vert, Low Ch
2389.720	28.3	0.6	1.2	125.0	3.0	20.0	Vert	AV	0.0	48.9	54.0	-5.1	EUT on Side, Low Ch
2389.360	28.3	0.6	1.7	97.0	3.0	20.0	Vert	AV	0.0	48.9	54.0	-5.1	EUT Horz, Low Ch
2483.773	26.8	1.1	1.2	147.0	3.0	20.0	Horz	AV	0.0	47.9	54.0	-6.1	EUT Horz, High Ch
2483.552	26.8	1.1	1.2	186.0	3.0	20.0	Vert	AV	0.0	47.9	54.0	-6.1	EUT Horz, High Ch
2484.493	26.7	1.1	1.2	41.0	3.0	20.0	Horz	AV	0.0	47.8	54.0	-6.2	EUT Vert, High Ch
2484.185	26.7	1.1	1.2	214.0	3.0	20.0	Vert	AV	0.0	47.8	54.0	-6.2	EUT on Side, High Ch
2483.530	40.3	1.1	1.2	350.0	3.0	20.0	Horz	PK	0.0	61.4	74.0	-12.6	EUT on Side, High Ch
2389.643	40.7	0.6	1.2	122.0	3.0	20.0	Vert	PK	0.0	61.3	74.0	-12.7	EUT Vert, Low Ch
2483.808	39.6	1.1	1.2	219.0	3.0	20.0	Vert	PK	0.0	60.7	74.0	-13.3	EUT Vert, High Ch
2389.318	40.0	0.6	1.2	125.0	3.0	20.0	Vert	PK	0.0	60.6	74.0	-13.4	EUT on Side, Low Ch
2389.765	39.9	0.6	1.2	183.0	3.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	EUT on Side, High Ch
2389.160	39.5	0.6	1.7	97.0	3.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9	EUT Horz, Low Ch
2389.395	39.3	0.6	1.2	1.0	3.0	20.0	Horz	PK	0.0	59.9	74.0	-14.1	EUT Horz, Low Ch
2389.127	39.3	0.6	1.2	92.0	3.0	20.0	Horz	PK	0.0	59.9	74.0	-14.1	EUT Vert, Low Ch
2484.023	38.1	1.1	1.2	214.0	3.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	EUT on Side, High Ch
2483.618	38.0	1.1	1.2	147.0	3.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Horz, High Ch
2484.308	37.9	1.1	1.2	41.0	3.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT Vert, High Ch
2484.145	37.4	1.1	1.2	186.0	3.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Horz, High Ch