

Honeywell

Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC

Report No. HONE0054

Report Prepared By



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

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EMC Test Report



22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Last Date of Test: May 14, 2010

Honeywell

Model: Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC

Emissions			
Test Description	Specification	Test Method	Pass/Fail
Spurious Radiated Emissions	FCC 15.247:2010	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.
41 Tesla Ave.
Irvine, CA 92618

Phone: (503) 844-4066

Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834B-2).

Approved By:

Don Facteau, IS Manager



NVLAP Lab Code: 200676-0

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 United States Department of Commerce, National Institute of Standards and Technology, and National Voluntary Laboratory Accreditation Program for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. 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).



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



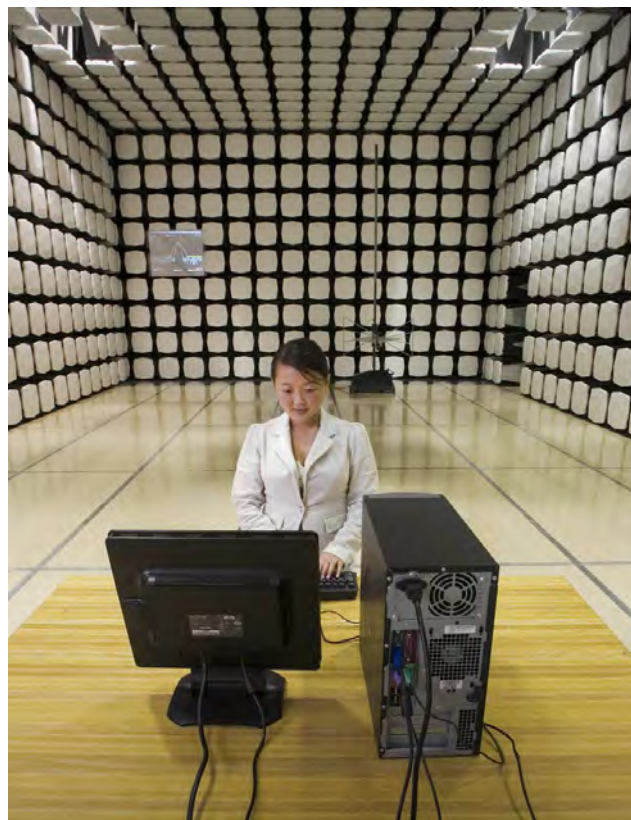
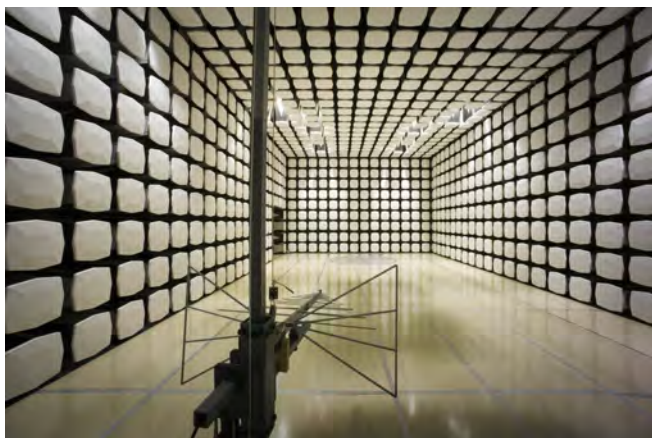
Oregon
Labs EV01-EV12
22975 NW Evergreen Pkwy
Suite 400
Hillsboro, OR 97124
(503) 844-4066

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



Northwest EMC	Product Description	Rev 11/17/06
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Party Requesting the Test

Company Name:	Honeywell
Address:	2500 W. Union Hills Road
City, State, Zip:	Phoenix, AZ 85027
Test Requested By:	David Shipley
Model:	Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC
First Date of Test:	May 14, 2010
Last Date of Test:	May 14, 2010
Receipt Date of Samples:	May 14, 2010
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test
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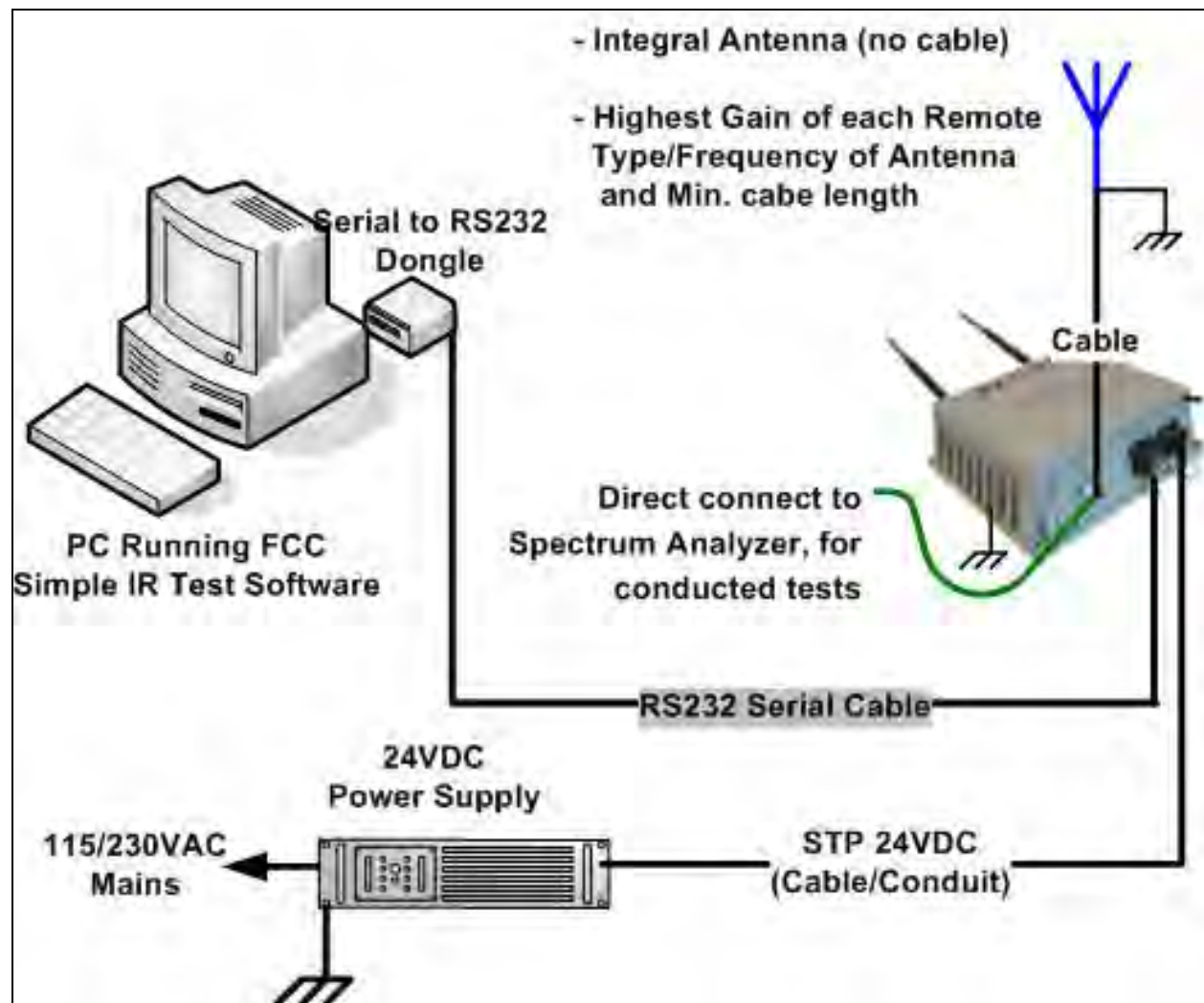
Functional Description of the EUT (Equipment Under Test):
2.4 GHz DSSS Radio

Testing Objective:
To demonstrate compliance to FCC 15.247 spurious radiated emissions requirements

EUT

Description

Refer to the configuration document provided by the client below.



Equipment modifications					
Item	Date	Test	Modification	Note	Disposition of EUT
1	5/14/2010	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.

MODES OF OPERATION

Transmitting at 2475 MHz
 Transmitting at 2440 MHz
 Transmitting at 2405 MHz

POWER SETTINGS INVESTIGATED

Battery

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
High Pass Filter	Micro-Tronics	HPM50111	HGC	11/20/2009	13
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AOI	5/3/2010	13
Antenna, Horn	EMCO	3160-09	AHN	NCR	0
OC floating Cable	N/A	18-26GHz RE Cables	OCK	5/3/2010	13
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVP	12/21/2009	13
Antenna, Horn	EMCO	3160-08	AHK	NCR	0
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVL	4/11/2010	13
Antenna, Horn	ETS	3160-07	AHX	NCR	0
OC11 Cables	N/A	12-18GHz RE Cables	OCS	4/11/2010	13
Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVJ	9/10/2009	13
Antenna, Horn	EMCO	3115	AHB	9/11/2009	24
OC11 Cables	N/A	1-8GHz RE Cables	OCR	3/19/2010	13
Spectrum Analyzer	Agilent	E4440A	AFA	2/9/2010	13
Antenna, Biconilog	EMCO	3142	AXJ	2/24/2010	13
OC10 Cables	N/A	10kHz-1GHz RE Cables	OCH	3/31/2010	13

MEASUREMENT BANDWIDTHS

	Frequency Range	Peak Data	Quasi-Peak Data	Average Data
	(MHz)	(kHz)	(kHz)	(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 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, 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.

EMC

SPURIOUS RADIATED EMISSIONS DATA SHEET

EUT:	Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC	Work Order:	HONE0054
Serial Number:	None	Date:	05/14/10
Customer:	Honeywell	Temperature:	20.24
Attendees:	David Shipley	Humidity:	50%
Project:	None	Barometric Pres.:	1012.2
Tested by:	Jaemi Suh	Power:	Battery
		Job Site:	OC11

TEST SPECIFICATIONS

Test Method

FCC 15.247:2010

ANSI C63.10:2009

TEST PARAMETERS

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

8dBi Left Hand Circular Polarized Flat Patch Antenna (Model# HG2409PCL). PC Power Level: 193 (16.3 dBm). 1m Cable. CC2420 CHIP PA level = -3 dBm. The duty cycle corr. factor is based on a 41msec dwell time: $20\log(41\text{ms}/100\text{ms}) = 7.7\text{dB}$.

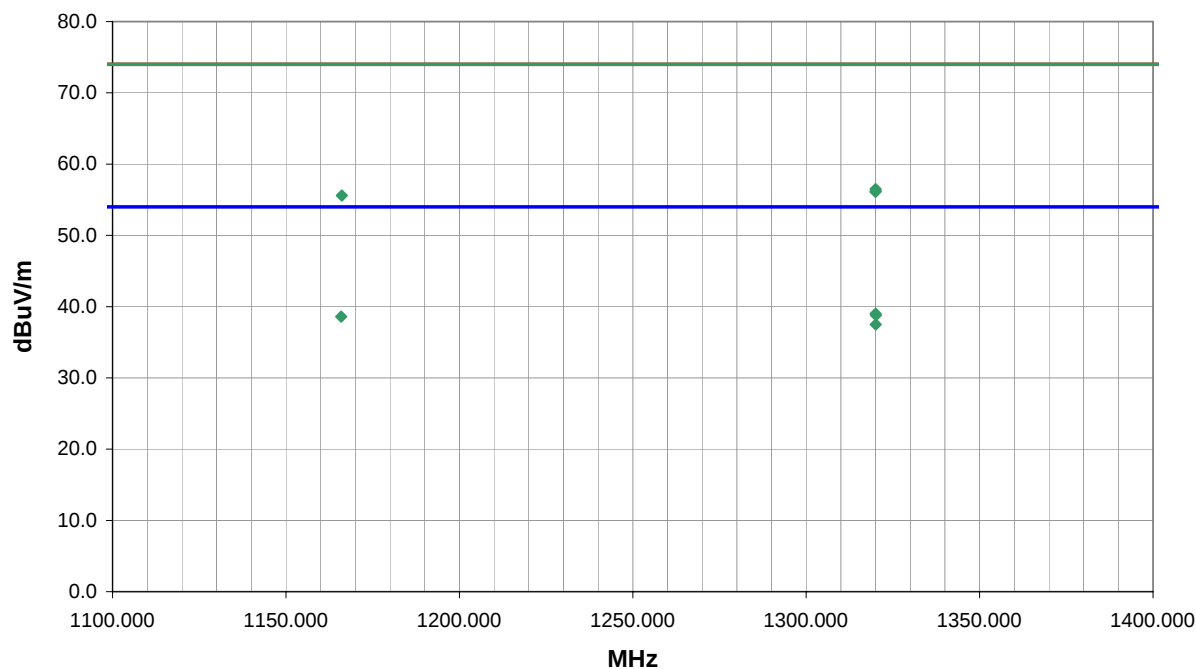
EUT OPERATING MODES

Transmitting at 2405 MHz. X-Axis

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	1	Signature 
Configuration #	1	
Results	Pass	



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)
1319.998	34.1	-7.4	125.0	1.2	7.7	20.0	V-Horn	AV	0.0	39.0	54.0	-15.0
1320.092	33.9	-7.4	127.0	1.2	7.7	20.0	V-Horn	AV	0.0	38.8	54.0	-15.2
1165.910	34.4	-8.1	150.0	1.2	7.7	20.0	H-Horn	AV	0.0	38.6	54.0	-15.4
1320.054	32.6	-7.4	227.0	1.2	7.7	20.0	H-Horn	AV	0.0	37.5	54.0	-16.5
1320.020	43.9	-7.4	227.0	1.2	0.0	20.0	H-Horn	PK	0.0	56.5	74.0	-17.5
1320.030	43.6	-7.4	125.0	1.2	0.0	20.0	V-Horn	PK	0.0	56.2	74.0	-17.8
1319.980	43.5	-7.4	127.0	1.2	0.0	20.0	V-Horn	PK	0.0	56.1	74.0	-17.9
1166.100	43.7	-8.1	150.0	1.2	0.0	20.0	H-Horn	PK	0.0	55.6	74.0	-18.4

EUT:	Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC	Work Order:	HONE0054
Serial Number:	None	Date:	05/14/10
Customer:	Honeywell	Temperature:	20.24
Attendees:	David Shipley	Humidity:	50%
Project:	None	Barometric Pres.:	1012.2
Tested by:	Jaemi Suh	Power:	Battery
		Job Site:	OC11

TEST SPECIFICATIONS

Test Method

FCC 15.247:2010

ANSI C63.10:2009

TEST PARAMETERS

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

8dBi Left Hand Circular Polarized Flat Patch Antenna (Model# HG2409PCL). PC Power Level: 193 (16.3 dBm). 1m Cable. CC2420 CHIP PA level = -3 dBm. The duty cycle corr. factor is based on a 41msec dwell time: $20\log(41\text{ms}/100\text{ms}) = 7.7\text{dB}$.

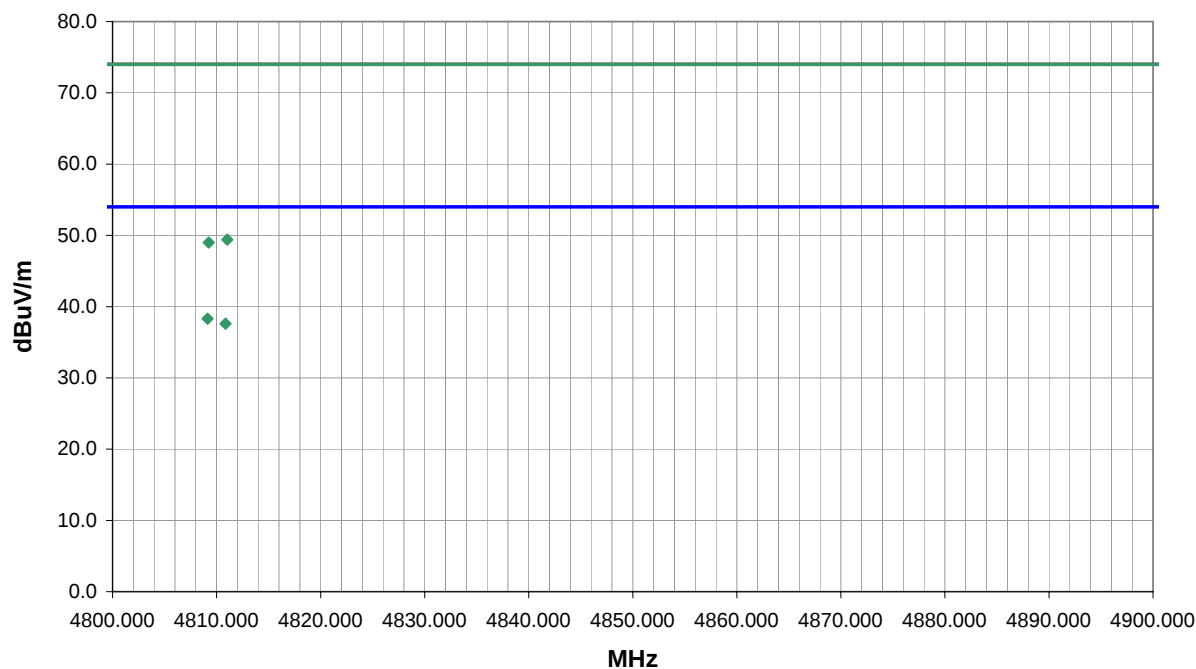
EUT OPERATING MODES

Transmitting at 2405 MHz. X-Axis

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	2	Signature 
Configuration #	1	
Results	Pass	



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)
4809.136	34.1	4.2	176.0	1.2	3.0	0.0	H-Horn	AV	0.0	38.3	54.0	-15.7
4810.857	33.4	4.2	141.0	1.2	3.0	0.0	V-Horn	AV	0.0	37.6	54.0	-16.4
4811.024	45.2	4.2	141.0	1.2	3.0	0.0	V-Horn	PK	0.0	49.4	74.0	-24.6
4809.239	44.8	4.2	176.0	1.2	3.0	0.0	H-Horn	PK	0.0	49.0	74.0	-25.0

EMC

SPURIOUS RADIATED EMISSIONS DATA SHEET

EUT:	Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC	Work Order:	HONE0054
Serial Number:	None	Date:	05/14/10
Customer:	Honeywell	Temperature:	20.24
Attendees:	David Shipley	Humidity:	50%
Project:	None	Barometric Pres.:	1012.2
Tested by:	Jaemi Suh	Power:	Battery
		Job Site:	OC11

TEST SPECIFICATIONS

Test Method

FCC 15.247:2010

ANSI C63.10:2009

TEST PARAMETERS

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

8dBi Left Hand Circular Polarized Flat Patch Antenna (Model# HG2409PCL). PC Power Level: 193 (16.3 dBm). 1m Cable. CC2420 CHIP PA level = -3 dBm. The duty cycle corr. factor is based on a 41msec dwell time: $20\log(41\text{ms}/100\text{ms}) = 7.7\text{dB}$.

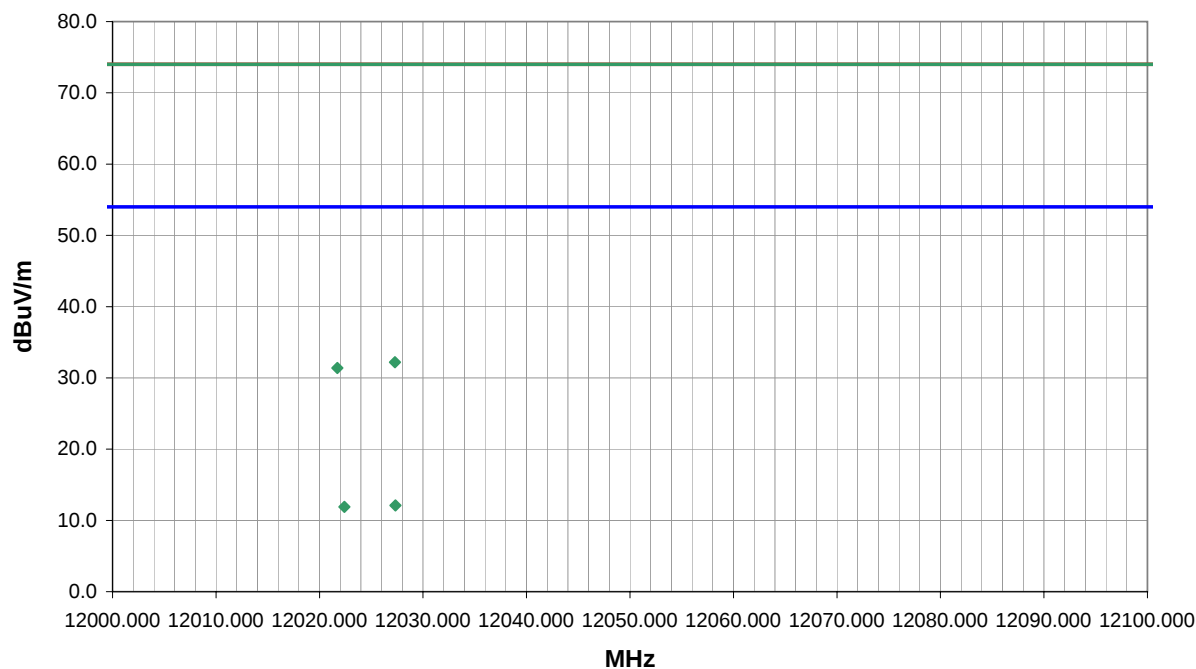
EUT OPERATING MODES

Transmitting at 2405. X-Axis

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	3	Signature 
Configuration #	1	
Results	Pass	



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)
12027.290	41.1	-8.9	263.0	1.0	0.0	0.0	V-Horn	PK	0.0	32.2	74.0	-41.8
12027.330	28.7	-8.9	263.0	1.0	7.7	0.0	V-Horn	AV	0.0	12.1	54.0	-41.9
12022.410	28.5	-8.9	283.0	1.9	7.7	0.0	H-Horn	AV	0.0	11.9	54.0	-42.1
12021.730	40.3	-8.9	283.0	1.9	0.0	0.0	H-Horn	PK	0.0	31.4	74.0	-42.6

EMC

SPURIOUS RADIATED EMISSIONS DATA SHEET

EUT:	Multinode 2.4 GHz 802.15.4 DSSS Radio. C2PC	Work Order:	HONE0054
Serial Number:	None	Date:	05/14/10
Customer:	Honeywell	Temperature:	20.24
Attendees:	David Shipley	Humidity:	50%
Project:	None	Barometric Pres.:	1012.2
Tested by:	Jaemi Suh	Power:	Battery
		Job Site:	OC11

TEST SPECIFICATIONS

Test Method

FCC 15.247:2010

ANSI C63.10:2009

TEST PARAMETERS

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

8dBi Left Hand Circular Polarized Flat Patch Antenna (Model# HG2409PCL). PC Power Level: 193 (16.3 dBm). 1m Cable. CC2420 CHIP PA level = -3 dBm. The duty cycle corr. factor is based on a 41msec dwell time: $20\log(41\text{ms}/100\text{ms}) = 7.7\text{dB}$.

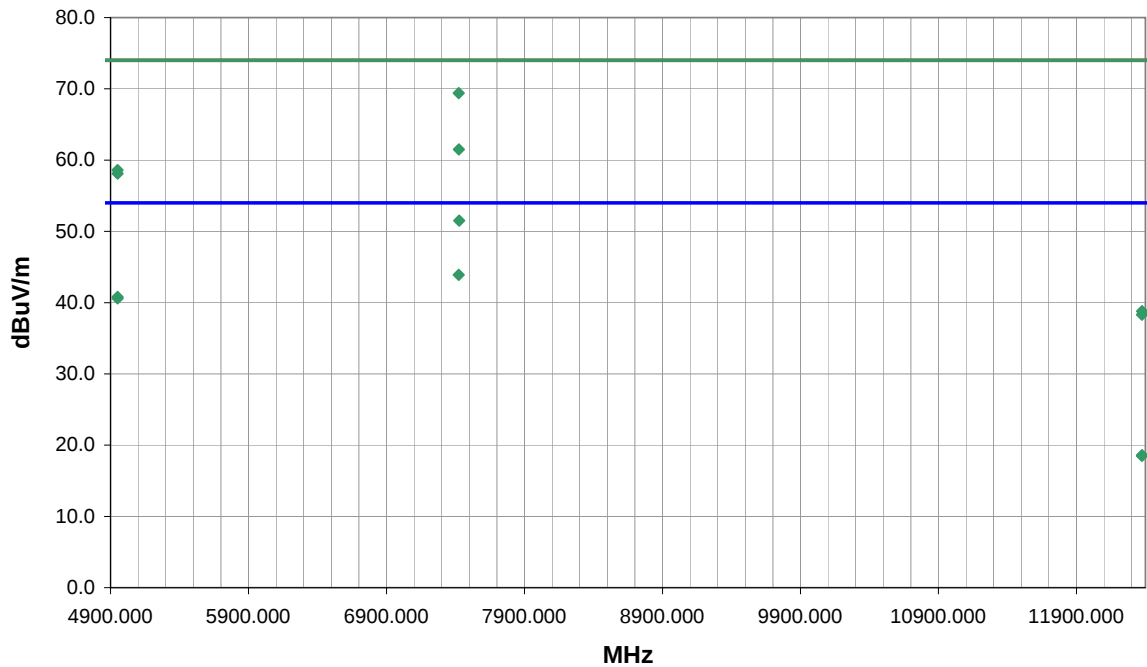
EUT OPERATING MODES

Transmitting at 2475. X-Axis

DEVIATIONS FROM TEST STANDARD

No deviations.

Run #	7	Signature 
Configuration #	1	
Results	Pass	



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)
7426.342	42.9	16.3	131.0	1.0	7.7	0.0	V-Horn	AV	0.0	51.5	54.0	-2.5
7423.360	53.1	16.3	131.0	1.0	0.0	0.0	V-Horn	PK	0.0	69.4	74.0	-4.6
7423.629	35.3	16.3	212.0	1.0	7.7	0.0	H-Horn	AV	0.0	43.9	54.0	-10.1
7423.900	45.2	16.3	212.0	1.0	0.0	0.0	H-Horn	PK	0.0	61.5	74.0	-12.5
4950.897	41.2	7.3	230.0	1.0	7.7	0.0	H-Horn	AV	0.0	40.8	54.0	-13.2
4950.911	41.0	7.3	308.0	1.0	7.7	0.0	V-Horn	AV	0.0	40.6	54.0	-13.4
4951.000	51.3	7.3	230.0	1.0	0.0	0.0	H-Horn	PK	0.0	58.6	74.0	-15.4
4951.040	50.8	7.3	308.0	1.0	0.0	0.0	V-Horn	PK	0.0	58.1	74.0	-15.9
12375.340	46.7	-7.9	170.0	1.0	0.0	0.0	V-Horn	PK	0.0	38.8	74.0	-35.2
12375.290	34.2	-7.9	162.0	1.0	7.7	0.0	H-Horn	AV	0.0	18.6	54.0	-35.4
12375.060	34.1	-7.9	170.0	1.0	7.7	0.0	V-Horn	AV	0.0	18.5	54.0	-35.5
12374.680	46.2	-7.9	162.0	1.0	0.0	0.0	H-Horn	PK	0.0	38.3	74.0	-35.7