LS RESEARCH, LLC
Wireless Product Development

W66 N220 Commerce Court ● Cedarburg, WI 53012 USA ● Phone: 262.375.4400 ● Fax: 262.375.4248 ● www.lsr.com

ENGINEERING TEST REPORT # 312155
LSR Job #: C-1507

Compliance Testing of:
Model W8735 Envirocom Wireless Bridge

Test Date(s):
July 25, 26, 30 and August 3, 2012

Prepared For:
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422

This Test Report is issued under the Authority of: Adam Alger, EMC Engineer

Signature: Date: 8-9-12

Test Report Reviewed by:	**Report by:**
Peter Feilen, EMC Engineer	Adam Alger, EMC Engineer
Signature: Date: 8-7-12	Signature: Date: 8-2-12

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LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industrie Canada Industry Canada

Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A
On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.
Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

1.0 Summary of Test Report

In July and August 2012 the Honeywell Envirocom Wireless Bridge Model W8735 was tested and MEETS the following requirements.

Rule	Description	Procedure	Compliant	Note
FCC: 15.247(a)(1) IC: RSS-210 A8.1(a)	Emission Bandwidth 20dB & 99%	ANSI C63.4-2003	Yes	2
FCC: 15.247(b) IC: RSS-210 A8.4	Maximum Output Power	ANSI C63.4-2003	Yes	2
FCC: 15.247(a)(1)(i) IC: RSS-210 A8.1(c)	Hopping Requirements	ANSI C63.4-2003	Yes	2
FCC: 15.247(d) IC: RSS-210 A8.5	Band-edge	ANSI C63.4-2003	Yes	2
FCC: 15.247(d) IC: RSS-210 A8.5	Spurious Emissions	ANSI C63.4-2003	Yes	2
FCC: 15.247(d) IC: RSS-210 A8.5	Radiated Maximum Output Power	ANSI C63.4-2003	Yes	1
FCC: 15.247(d) IC: RSS-210 A8.5	Radiated Emissions at Band-edge	ANSI C63.4-2003	Yes	1
FCC: 15.247(d) IC: RSS-210 A8.5	Radiated Harmonics	ANSI C63.4-2003	Yes	1
FCC: 15.247(d) IC: RSS-210 A8.5	Radiated Emissions	ANSI C63.4-2003	Yes	1
FCC: 15.207 IC: RSS-GEN 7.2.2	Power Line Conducted Emissions	ANSI C63.4-2003	Yes	3
FCC: 2.1091 IC: RSS-102 2.5.1	MPE Calculations	OET 65	Yes	None
FCC: 15.109 IC: RSS-GEN	Receiver radiated Emissions	ANSI C63.4-2003	Yes	1

Note 1: Tested as a wall mount device in its intended orientation.
Note 2: RF Conducted measurement at antenna terminal.
Note 3: Device operates at 24VAC 60Hz.

2.0 Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.
LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted.

3.0 Client Information

Manufacturer Name:	Honeywell
Address:	1985 Douglas Dr Golden Valley, MN 55422
Contact Person:	Alan Bredon

3.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Envirocom Wireless Bridge
Model Number:	W8735
Serial Number:	FCC Sample 1 (RF conducted unit), FCC Sample 2 (radiated unit)
FCC ID	HS9-W8735ER01
IC Number	573R-W8735ER01

3.2 Product Description

OTC (Outdoor Temperature Compensation module) is an RF equivalent to the Enviracom bridge. It receives the outdoor temperature wirelessly from RF sensor then converts the RF message to Enviracom message and sends it over Enviracom bus. This way outdoor temperature is made available to devices that need it, like Aqua stat, w/o running wires through the walls as we currently do. The OTC will be a host device (enrolls with outdoor RF sensor and indoor RF sensor) powered via 24VAC.

Frequency Range (MHz)	903.0 – 926.4
RF Power In Watts (conducted)	Max: 0.01122; Min: 0.01047
Max Conducted Output Power (dBm)	10.5
Field Strength at 3 meters (dBµV/m)	111.36
Occupied Bandwidth 99%	63.8 kHz
Type of Modulation	FSK
Emission Designator	63K8FXD
Transmitter Spurious (worst case) at 3 meters	46.76 dBµV/m (average) 5418 MHz
Stepped (Y/N)	No
Step Value	N/A
Frequency Tolerance %,Hz, ppm	Better than 100 ppm
Microprocessor Model #	MSP430F5528
Antenna: Detachable / Non-detachable	Non-Detachable
Antenna: Type	PCB trace inverted L
Antenna Gain (Measured over ground plane)	5.7 dBi (Maximum)
FCC Rule Part	Title 47 Part 15.247
Industry Canada Rule Part	RSS-210 Issue 8 2010
Modular Filing	No
RF Exposure Type	Mobile
Receiver Spurious (worst case) at 3 meters	49.58 dBµV/m (peak noise floor) at 4959.8 MHz

3.3 Modifications Incorporated In the EUT for Compliance Purposes

None noted at time of test.

3.4 Deviations & Exclusions from Test Specifications

None noted at time of test.

4.0 Conditions of Test

Environmental:

Temperature: 20-25º C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

Mains Voltage:

24VAC 60Hz from a transformer supplied with 120VAC 60Hz

5.0 Additional Information

Tested in continuous transmit, transmit hopping, and receive mode in the intended orientation (wall mount). Mode is selected by various button presses from a proprietary test program.

6.0 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below. For average measurements above 1000MHz the video bandwidth is set at 10Hz.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	200 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

7.0 Conformance Summary

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247 (2011) and Industry Canada RSS-210, Issue 8 (2010)

If some emissions are seen to be within 3 dB of their respective limits:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Appendix A – Test Equipment

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 25-Jul-2012 Type Test: Radiated Emissions (109) Job #: C-1507

Prepared By: Adam Customer: Honeywell Quote #: 312155

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	6/30/2012	6/30/2013	Active Calibration
2	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/29/2012	6/29/2013	Active Calibration
3	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/29/2012	6/29/2013	Active Calibration
4	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	11/15/2011	11/15/2012	Active Calibration
5	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	11/15/2011	11/15/2012	Active Calibration
6	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	5/16/2012	5/16/2013	Active Calibration
7	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	5/16/2012	5/16/2013	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 25-Jul-2012 Type Test: Radiated Harmonic Emissions Job #: C-1507

Prepared By: Adam Customer: Honeywell Quote #: 312155

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	6/30/2012	6/30/2013	Active Calibration
2	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/29/2012	6/29/2013	Active Calibration
3	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/29/2012	6/29/2013	Active Calibration
4	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	5/16/2012	5/16/2013	Active Calibration
5	EE 960160	0.8-21GHz LNA	Mini-Circuits	ZVA-213X-S+	977711030	5/16/2012	5/16/2013	Active Calibration
6	AA 960155	900MHz High Pass Filter	KWM	HPF-L-14185	7272-03	3/5/2012	3/5/2013	Active Calibration
7	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/9/2012	5/9/2013	Active Calibration
8	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/6/2012	1/6/2013	Active Calibration
9	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	1/6/2012	1/6/2013	Active Calibration
10	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/1/2011	6/1/2013	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 25-Jul-2012 Type Test: RF Conducted Emissions Job #: C-1507

Prepared By: Adam Customer: Honeywell Quote #: 312155

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/9/2012	5/9/2013	Active Calibration
2	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	6/1/2011	6/1/2013	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 25-Jul-2012 Type Test: Radiated Emissions Fundamental Job #: C-1507

Prepared By: Adam Customer: Honeywell Quote #: 312155

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960156	100kHz-1GHz Analog Signal Generator	Agilent	N5181A	MY49060062	6/30/2012	6/30/2013	Active Calibration
2	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/29/2012	6/29/2013	Active Calibration
3	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/29/2012	6/29/2013	Active Calibration
4	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	11/15/2011	11/15/2012	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 25-Jul-2012 Type Test: AC Conducted Emissions Job #: C-1507

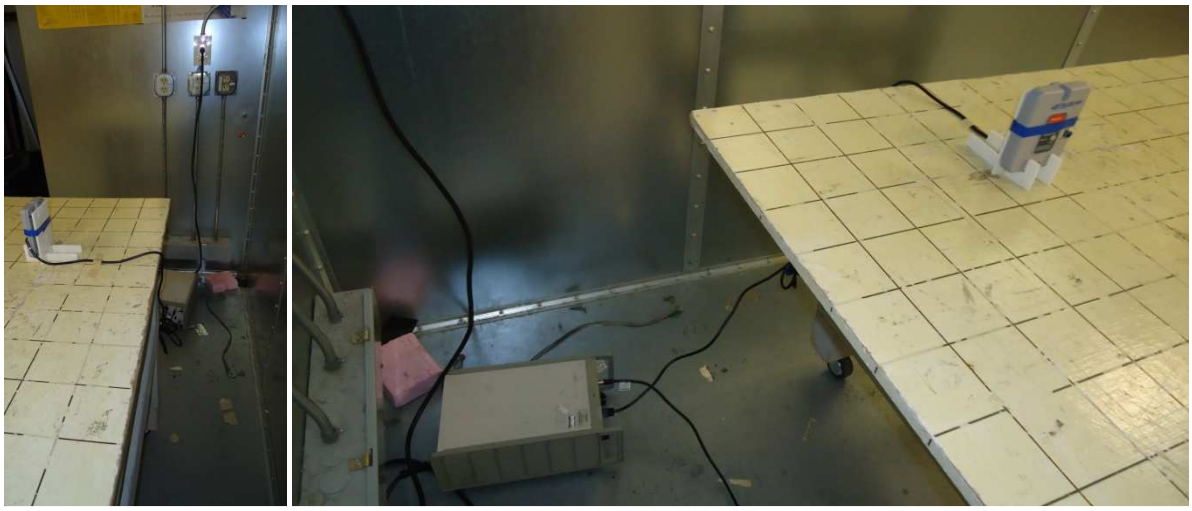
Prepared By: Adam Customer: Honeywell Quote #: 312155

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	11/22/2011	11/22/2012	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	11/22/2011	11/22/2012	Active Calibration
3	AA 960072	Transient Limiter	HP	11947A	3107A02515	11/2/2011	11/2/2012	Active Calibration
4	AA 960008	LISN	EMCO	3816/2NM	9701-1057	1/3/2012	1/3/2013	Active Calibration

Appendix B – Setup Photos

Radiated Emissions

AC Line Conducted Emissions



RF Conducted

Appendix C – Test Data

C.1 – RF Conducted Emissions

Manufacturer	Honeywell
Date	7-26-12
Operator	Adam A
Temp. / R.H.	20 - 25º C / 30-60% R.H.
Test Voltage	24 VAC 60 Hz
Test Location	LS Research, LLC – Bench Measurements
Rule Part	15.247
Measurement Procedure	FCC Public Notice DA00-705 March, 2000 ANSI C63.10-2009 Section 6.7.
Description of Measurement	A direct measurement of the transmitted signal was performed at the antenna port of the EUT via a cable connection to a spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings there by allowing direct measurements, without the need for any further corrections. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.
Additional Notes	1) Tested in continuous transmit mode on a low, middle and high channel during EBW, power, spurious, and band-edge measurements. 2) Tested in hopping mode for hopping requirements and band-edge measurements.

Summary of Results

Frequency (MHz)	EBW 20dB (kHz)	EBW 99 % (kHz)	Power (dBm)
903.0	64.7	63.8	10.5
914.6	64.6	63.6	10.4
926.4	64.6	63.6	10.2

Number of Channels: 50 (PASS)
Minimum Separation: 400 kHz (PASS)
Dwell Time: One pulse of 145ms in 20 second period. (PASS)

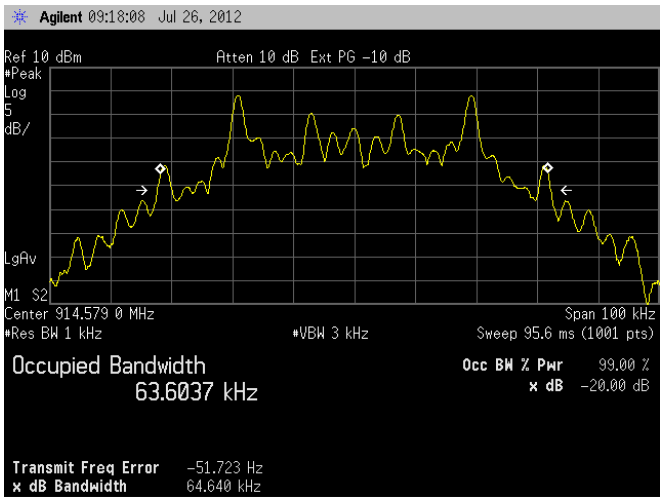
Per 15.247(a) (1) the channel separation is greater than the 20dB bandwidth of the hopping channel.

Per 15.247 (a) (1)(i) for a hopping system operating in the 902-928 MHz band with a 20dB bandwidth less than 250kHz, the system shall use at least 50 hopping frequencies and average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

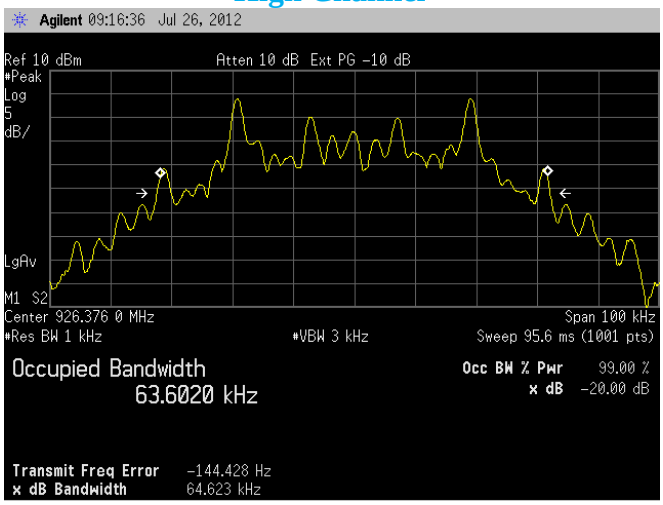
Emission Bandwidth

Low Channel

Middle Channel

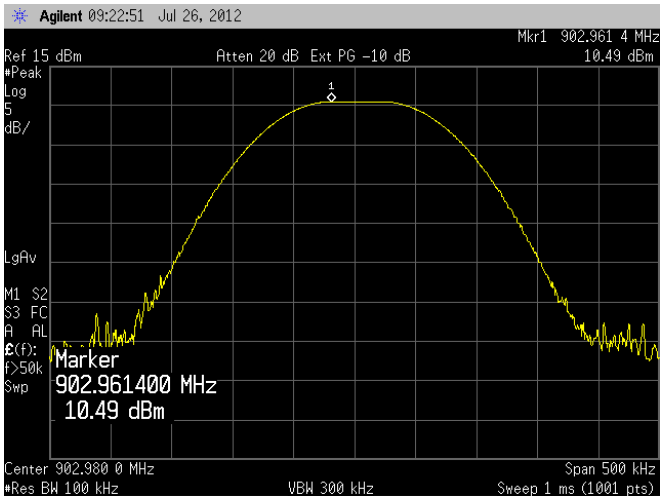


High Channel

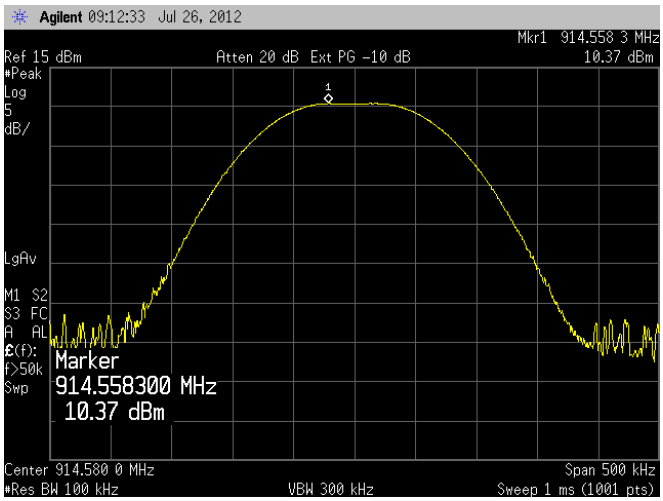


Output Power

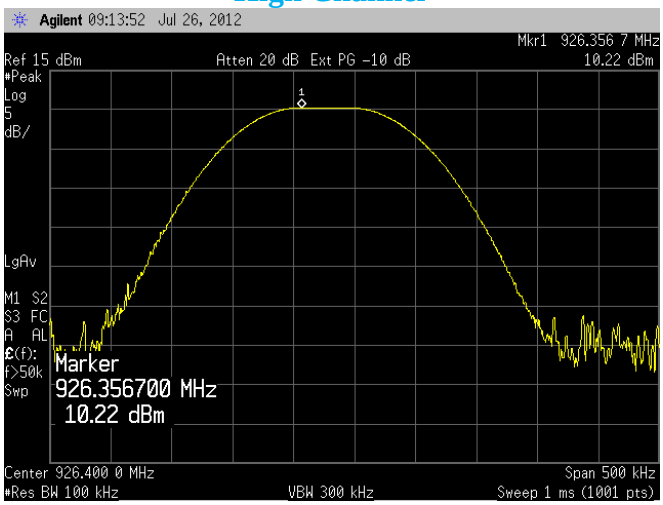
Low Channel



Middle Channel

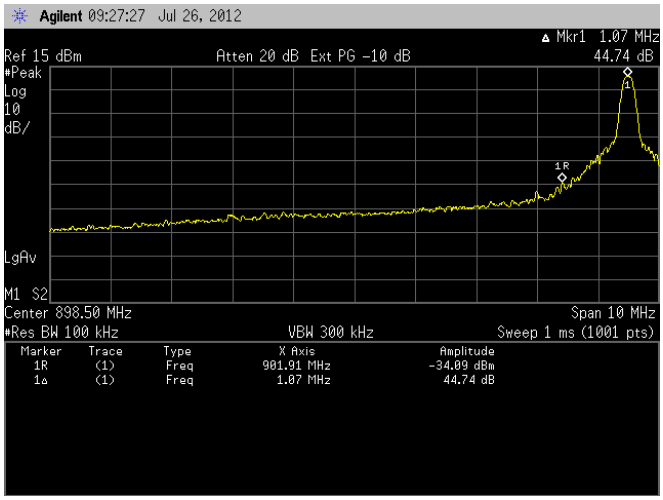


High Channel

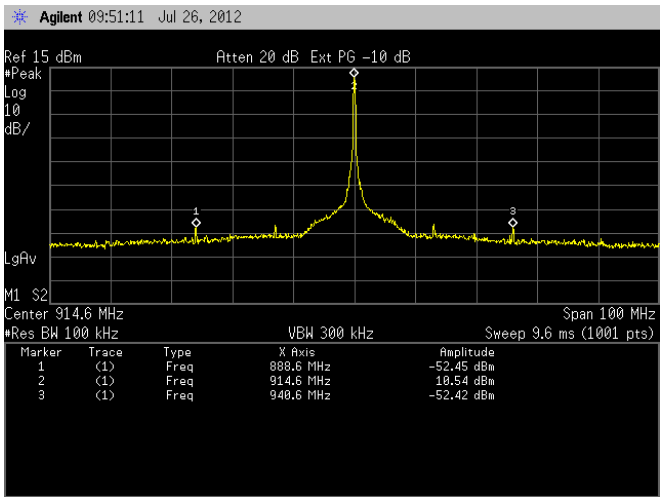


Band-edge

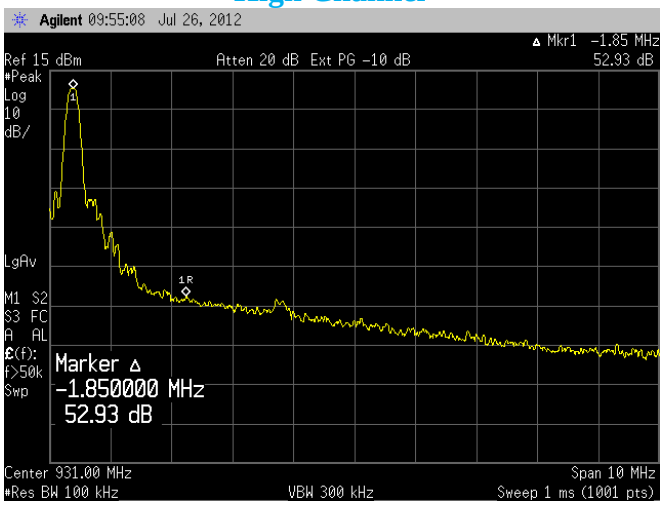
Low Channel



Middle Channel

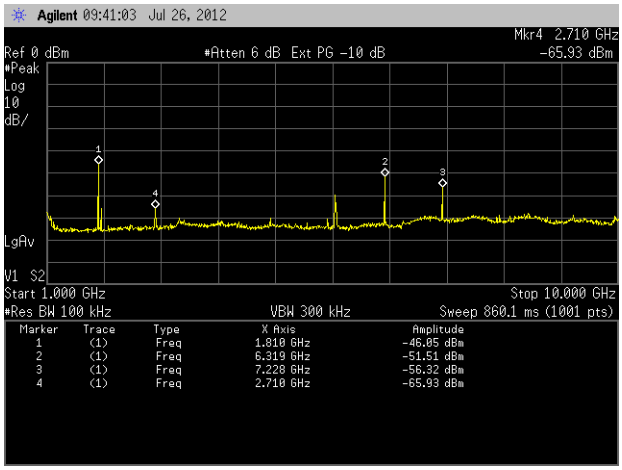


High Channel

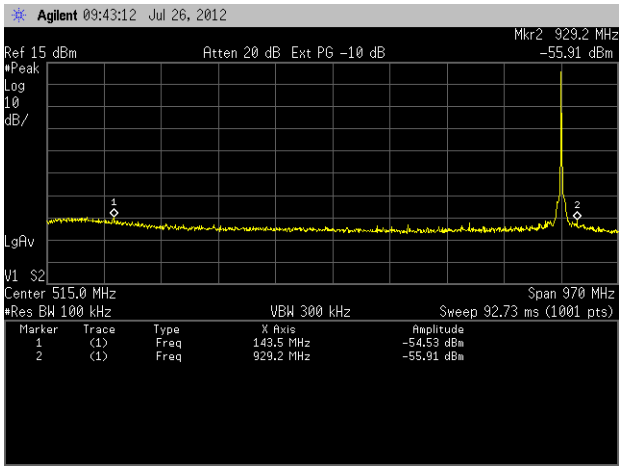


RF Port Spurious Emissions

Low Channel

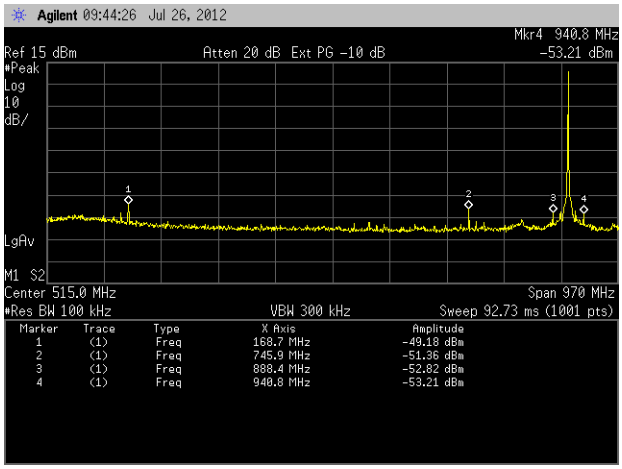


1-10 GHz

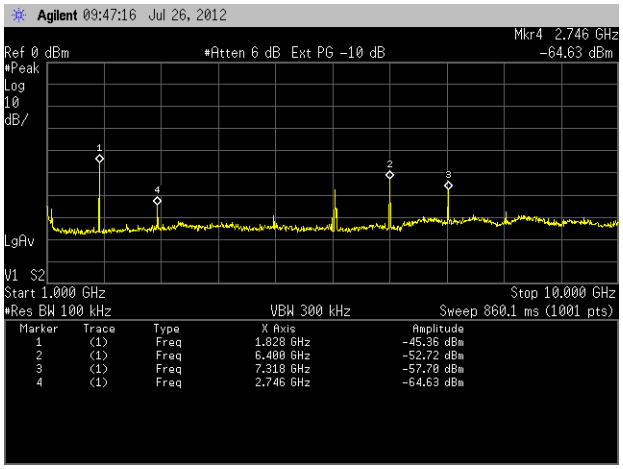


30-1000 MHz

Middle Channel

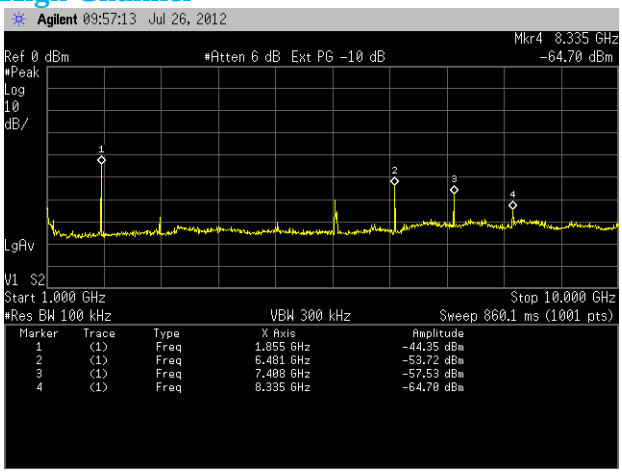


1-10 GHz

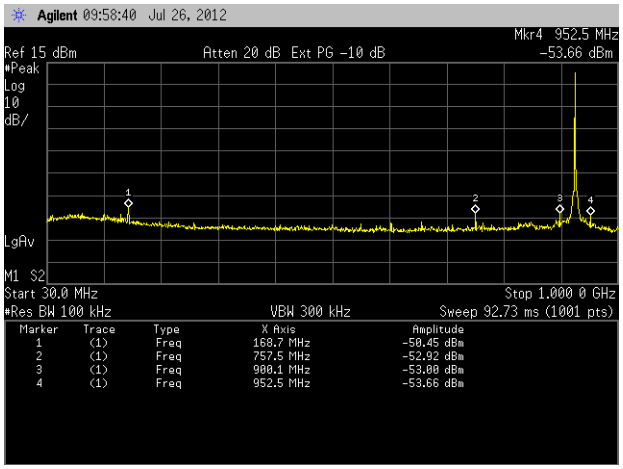


30-1000 MHz

High Channel



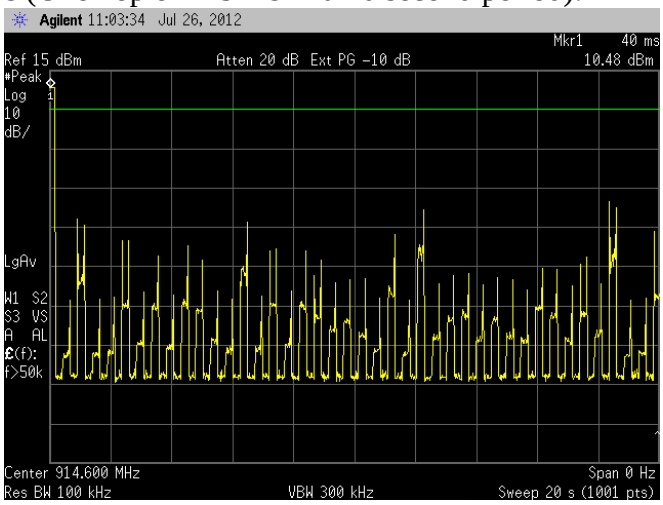
1-10 GHz



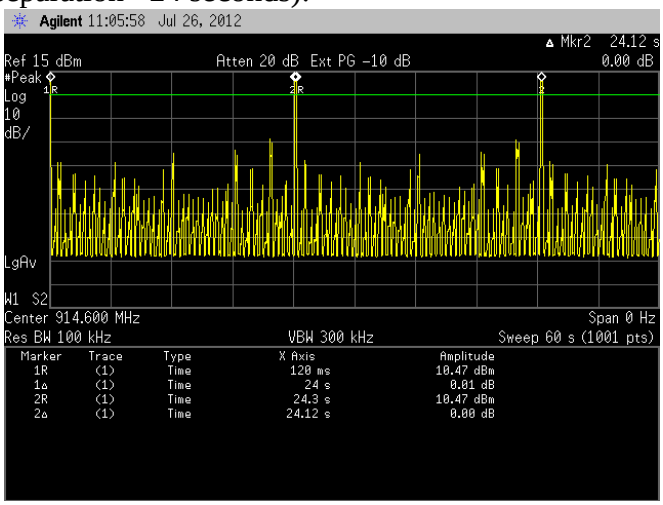
30-1000 MHz

Hopping

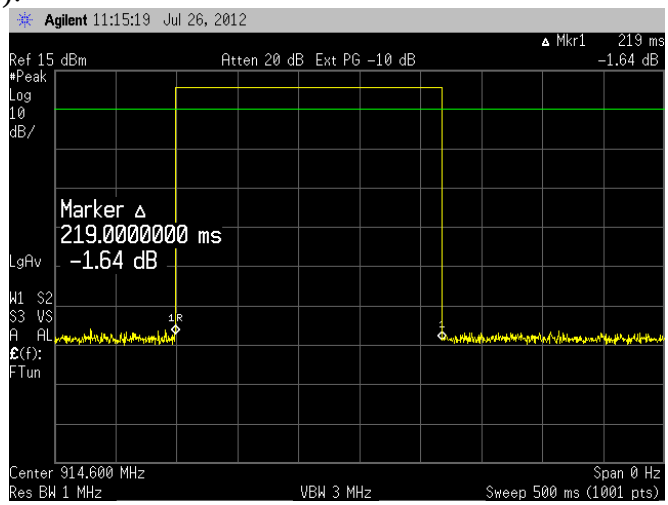
Dwell Time in 20 seconds (One hop of 219 ms in a 20 second period):



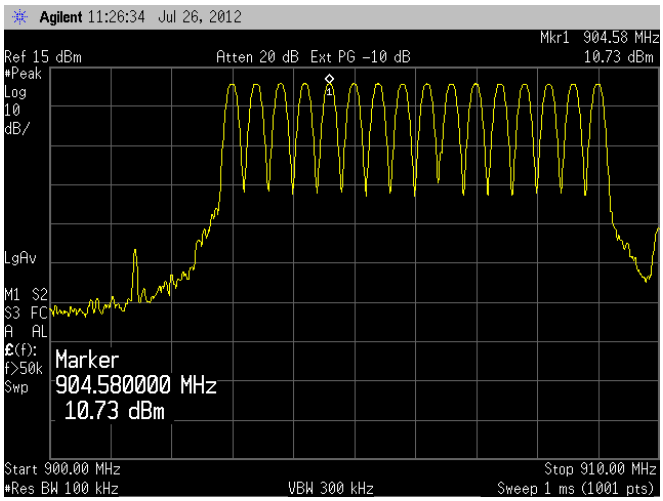
60 seconds sweep (Hop separation ~24 seconds):

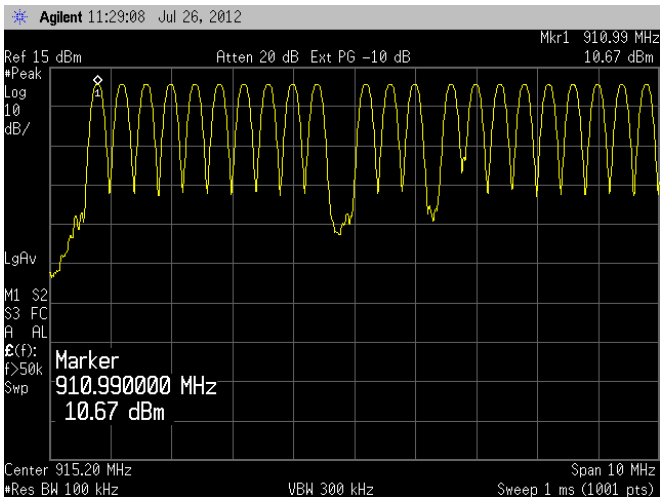


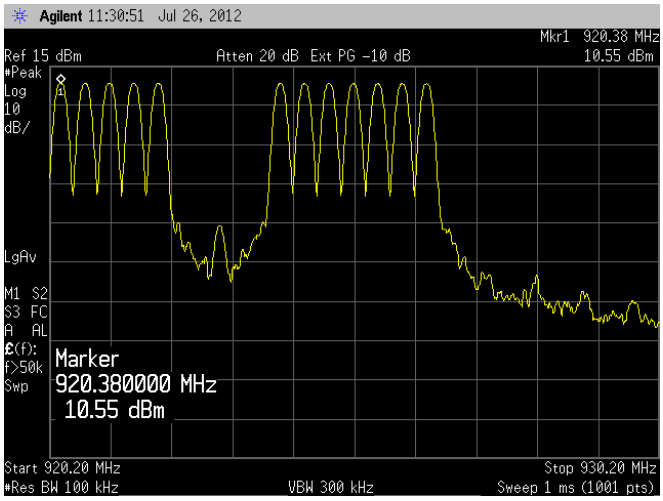
Length of Dwell (219ms):



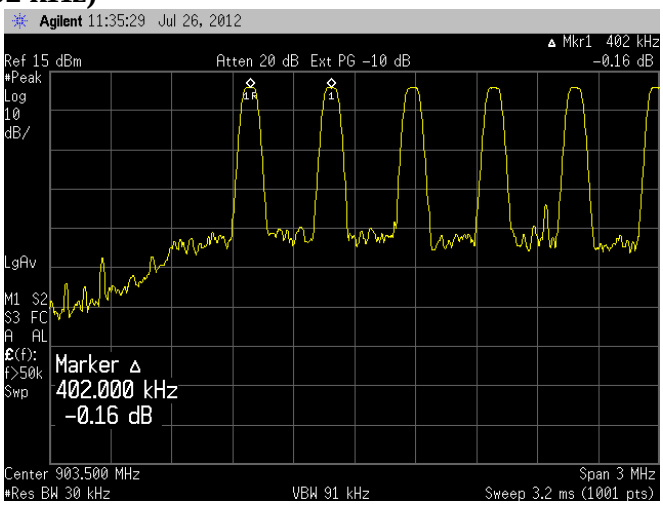
Number of Hops (50 Total)





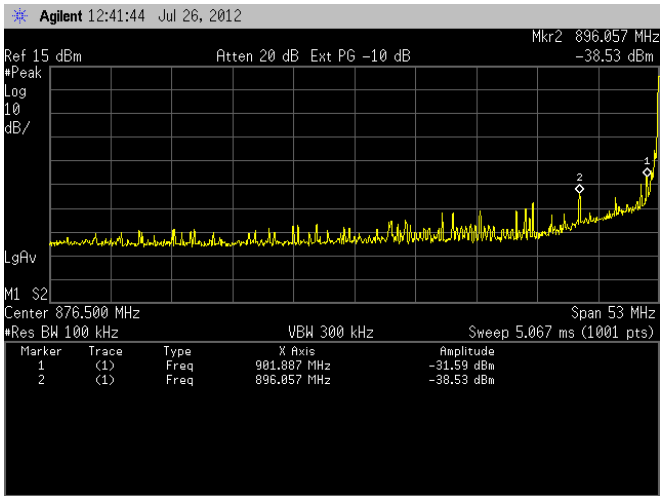


Channel Separation (402 kHz)

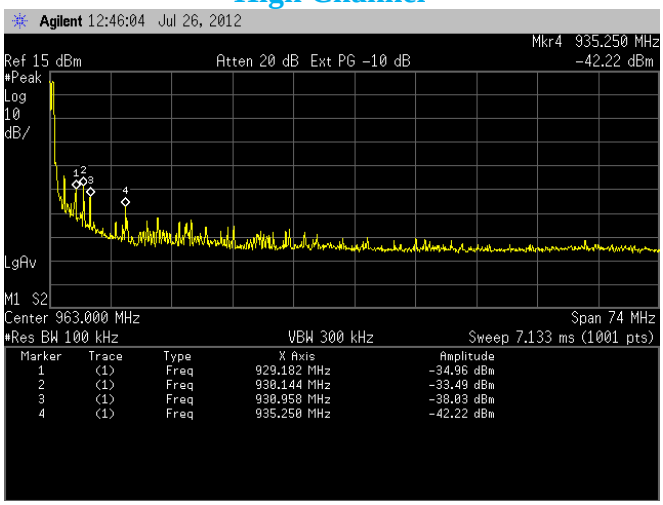


Band-edge with Hopping

Low Channel



High Channel



Frequency and Power Stability over Voltage Variations

The power and frequency stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the power and frequency at the appropriate frequency markers. Power was supplied by a variable AC power supply and was varied ±15% from the nominal.

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characteristics were well behaved, and the system returned to the same state of operation as before the power cycle.

20.4 VAC		24 VAC		27.6 VAC		Frequency Drift (Hz)
Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)	Power (dBm)	Frequency (Hz)	
10.5	902983710	10.5	902983870	10.5	902983510	360
10.4	914580160	10.4	914580240	10.4	914580120	120
10.2	926376770	10.2	926376650	10.2	926376530	240

C.2 – Radiated Emissions

Rule Part(s)	FCC: 15.247(d) / 15.205 / 15.209 / IC: RSS-210 A8.2 (b) / RSS-210 Section 2.2, 2.6, 2.7			
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 – 2009 FCC Public Notice DA00-705 March, 2000			
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber			
Test Distance	3 meters : 30 - 6000 MHz 1 meter: 6 - 10 GHz			
EUT Placement	80 cm height non-conductive table above reference ground plane			
Frequency Range of Measurement	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz	Standard Gain Horn: 18-25GHz
Measurement Detectors	30-1000MHz Peak Detector RBW: 120 kHz VBW: 300 kHz		1 - 25 GHz: Peak Detector RBW : 1MHz VBW: 3MHz (Peak Measurement) VBW: 10Hz (Average Measurement)	
Description of Measurement	1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT 3) Maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height.			
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)			

FCC Part 15.209 / IC RSS-210 Section 2.7 Limits:

Frequency (MHz)	3 m Limit (µV/m)	3 m Limit (dBµV/m)	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

C.2.1 – Radiated Harmonics in Restricted Bands above 1 GHz

Manufacturer	Honeywell
Date	7-25 & 7-30, 2012
Operator	Adam A
Temp. / R.H.	20 - 25º C / 30-60% R.H.
Test Voltage	24 VAC 60 Hz
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber
Rule Part	15.247 / 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009 FCC Public Notice DA00-705 March, 2000
Test Distance	3 meter (1-6 GHz) 1 meter (6-10 GHz)
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	RBW 1MHz; Peak (VBW 3MHz); Average (VBW 10Hz)
Additional Notes	1) Tested in continuous transmit modulated mode for radiated harmonics in restricted bands in low, mid, and high channels with EUT Antenna A and B in its intended orientation (wall mount). 2) Where noise floor measurements made, peak measurement compared to average limit.

Table:

Low Channel

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
2709.0	Noise Floor		42.84	-	54	11.2	Vert/Horz	A/B
3612.0	Noise Floor		44.92	-	54	9.1	Vert/Horz	A/B
4515.0	Noise Floor		44.45	-	54	9.6	Vert/Horz	A/B
5418.0	110	141	50.91	46.76	54	7.2	Vertical	A
8127.0	Noise Floor		49.24	-	63.5	14.3	Vert/Horz	A/B
9030.0	107	221	54.21	46.07	63.5	17.4	Vertical	A

Mid Channel

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
2743.8	Noise Floor		40.08	-	54	13.9	Vert/Horz	A/B
3658.4	Noise Floor		42.45	-	54	11.6	Vert/Horz	A/B
4573.0	Noise Floor		43.94	-	54	10.1	Vert/Horz	A/B
7316.8	Noise Floor		49.96	-	63.5	13.5	Vert/Horz	A/B
8231.4	Noise Floor		49.87	-	63.5	13.6	Vert/Horz	A/B
9146.0	115	235	54.73	46.5	63.5	17.0	Vertical	A

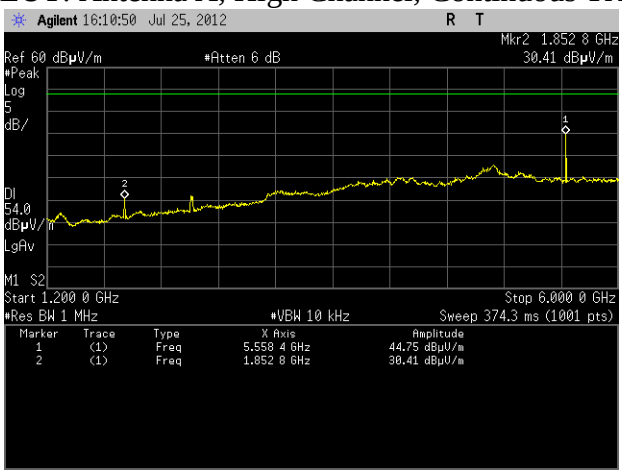
High Channel

Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
2779.2	Noise Floor		40.02	-	54	14.0	Vert/Horz	A/B
3705.6	Noise Floor		42.59	-	54	11.4	Vert/Horz	A/B
4632.0	Noise Floor		44.49	-	54	9.5	Vert/Horz	A/B
7411.2	Noise Floor		50.23	-	63.5	13.3	Vert/Horz	A/B
8337.6	Noise Floor		51.14	-	63.5	12.4	Vert/Horz	A/B

Note: Worst case emissions reported.

Plots:

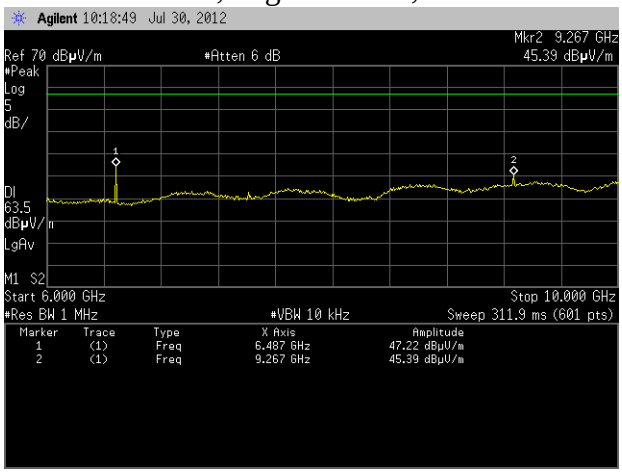
1.2-6GHz; Max Hold Vertical and Horizontal while rotating
EUT: Antenna A, High Channel, Continuous TX



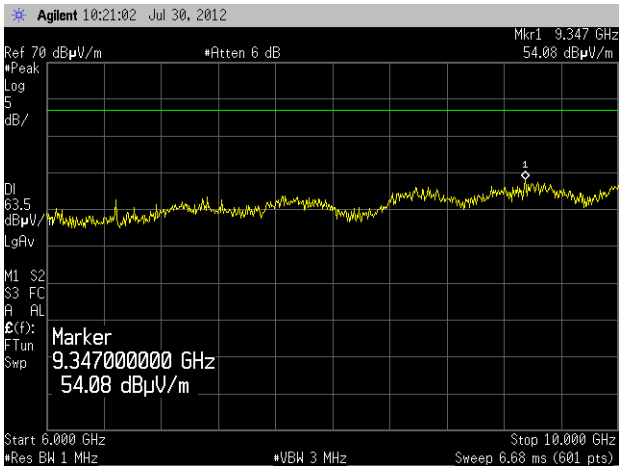
Average (Reduced VBW)

Peak

6-10 GHz; Max Hold Vertical and Horizontal while rotating
EUT: Antenna B, High Channel, Continuous TX



Average (Reduced VBW)



Peak

C2.2 - Radiated Fundamental and Band-edge

Manufacturer	Honeywell
Date	7-25-12
Operator	Adam A
Temp. / R.H.	20 - 25º C / 30-60% R.H.
Test Voltage	24 VAC 60 Hz
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber
Rule Part	15.247 / 15.205 / 15.209
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009 FCC Public Notice DA00-705 March, 2000
Test Distance	3 meter
EUT Placement	80 cm height non-conductive table
Detectors	RBW 120 kHz; Peak (VBW 300 kHz)
Additional Notes	1) Tested in continuous transmit modulated mode in low, mid, and high channels with EUT Antenna A and B in its intended orientation (wall mount).

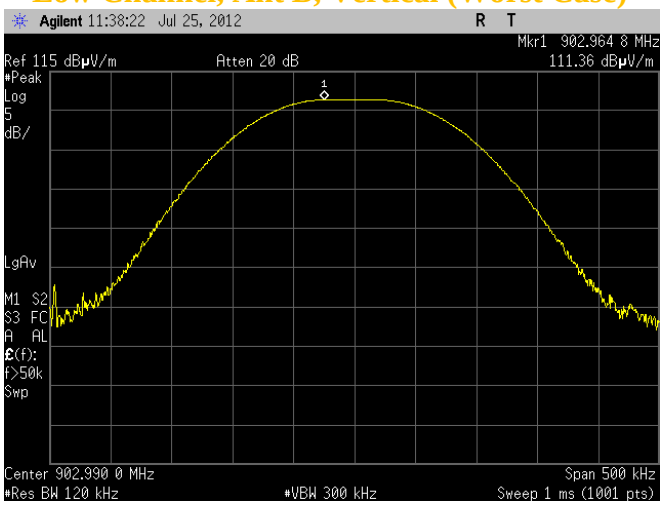
Example Calculation:

Peak Limit – Peak Reading = Peak Margin

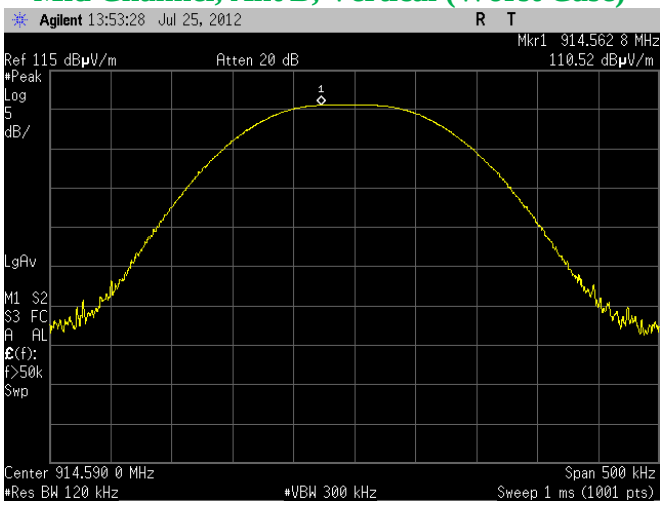
Average Limit – Average Reading = Average Margin

Frequency (MHz)	Antenna	Height (cm)	Azimuth (degree)	Peak (dBµV/m)	Limit (dBµV/m)	Margin	EUT
903.0	H	100	150	110.56	130	19.44	Ant A
903.0	V	100	84	106.94	130	23.06	Ant A
903.0	H	100	0	106.07	130	23.93	Ant B
903.0	V	115	98	111.36	130	18.64	Ant B
914.6	H	100	153	109.59	130	20.41	Ant A
914.6	V	104	89	106.83	130	23.17	Ant A
914.6	H	149	0	106.27	130	23.73	Ant B
914.6	V	117	114	110.52	130	19.48	Ant B
926.4	H	140	19	109.67	130	20.33	Ant A
926.4	V	105	76	106.49	130	23.51	Ant A
926.4	H	144	190	105.7	130	24.3	Ant B
926.4	V	111	93	110.53	130	19.47	Ant B

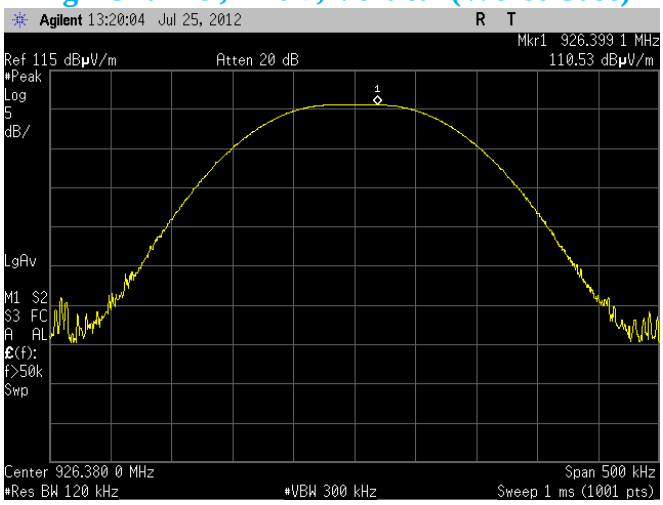
Low Channel, Ant B, Vertical (Worst Case)



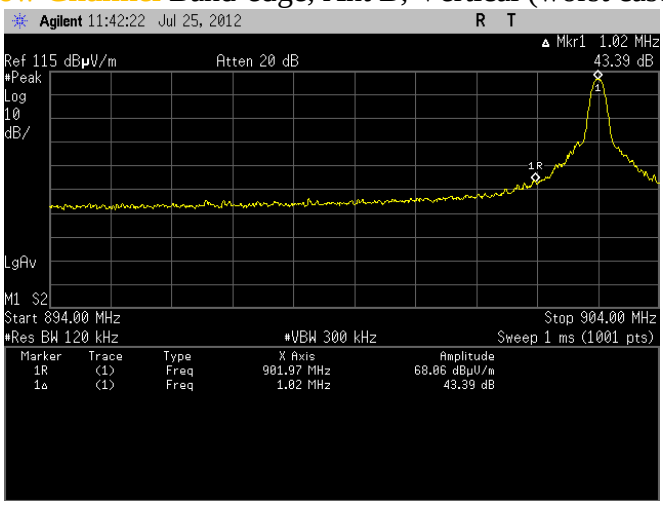
Mid Channel, Ant B, Vertical (Worst Case)



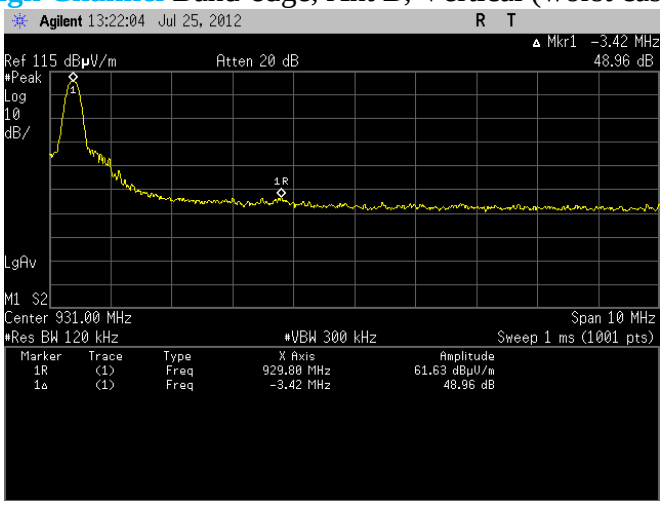
High Channel, Ant B, Vertical (Worst Case)



Low Channel Band-edge, Ant B, Vertical (worst case)



High Channel Band-edge, Ant B, Vertical (worst case)



C2.3 - Radiated Emissions 30-1000MHz

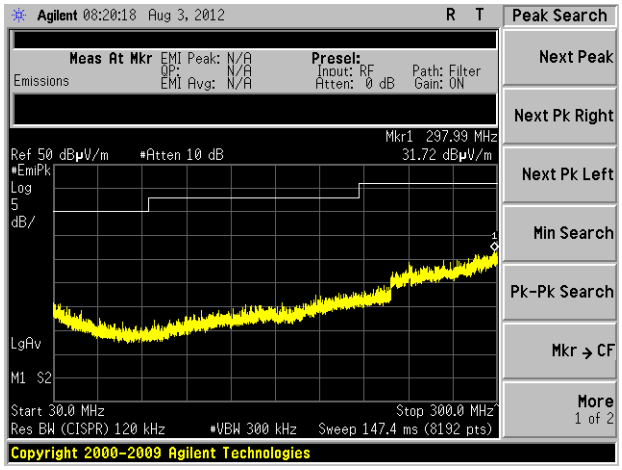
Manufacturer	Honeywell
Date	8-3-12
Operator	Adam A
Temperature	20 - 25º C
Humidity	30 – 60%
Test Voltage	24VAC 60Hz
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber
Test Distance	3 meter
EUT Placement	80 cm height non-conductive table
Measurements	Final
Detectors	Peak
Additional Notes	1) Tested with EUT Antenna A and B, low, mid, high channel continuous transmit. 2) No emissions found. 3) Peak detector compared to quasi-peak limit.

Table:

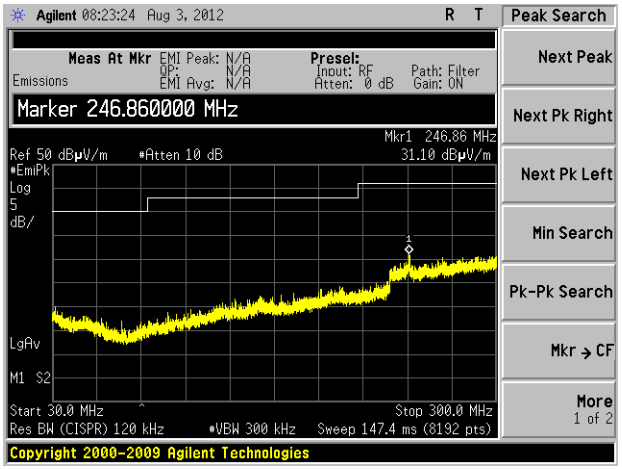
Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	Note
297.9	100	0	31.72	46.0	14.3	Horizontal	1
246.9	100	0	31.1	46.0	14.9	Vertical	1
848.1	100	0	35.16	46.0	10.8	Horizontal	1
786.7	100	0	32.81	46.0	13.2	Vertical	1
942.0	100	0	38.16	46.0	7.8	Horizontal	1
994.4	100	0	35.71	54.0	18.3	Vertical	1

Note 1: System Noise Floor (Not associated with EUT)

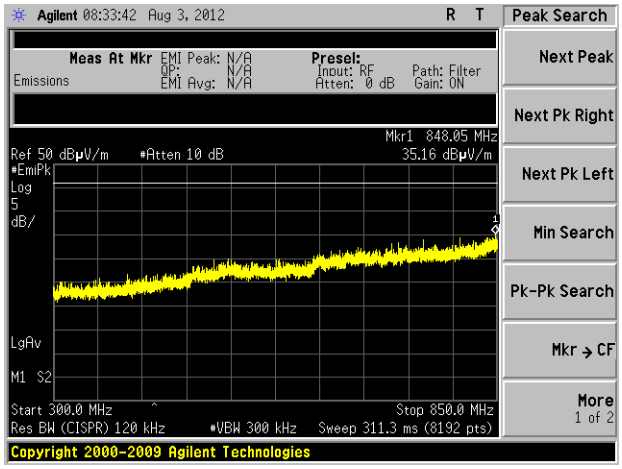
Plots:



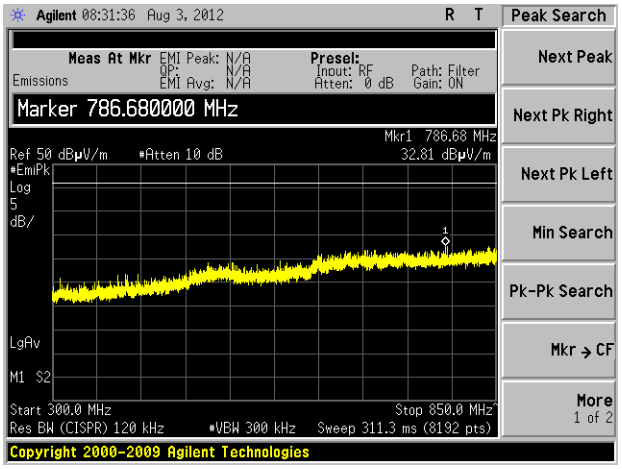
30-300 MHz Horizontal



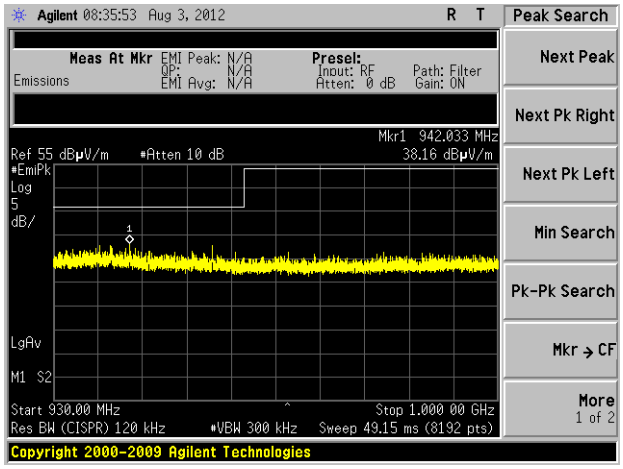
30-300 MHz Vertical



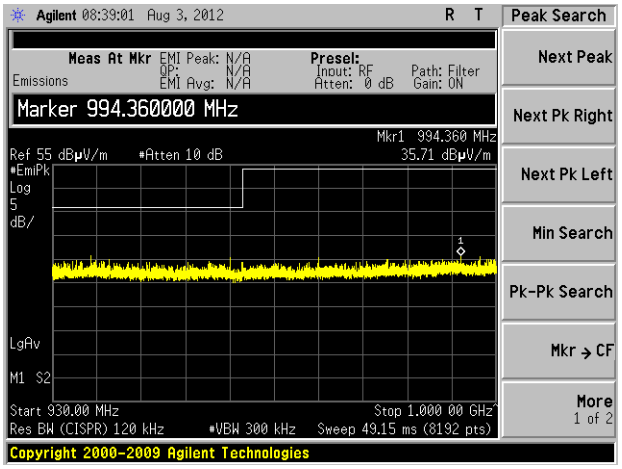
300-850 MHz Horizontal



300-850 MHz Vertical



930 -1000 MHz Horizontal



930 -1000 MHz Vertical

C.2.4 – Receive Mode Radiated Emissions

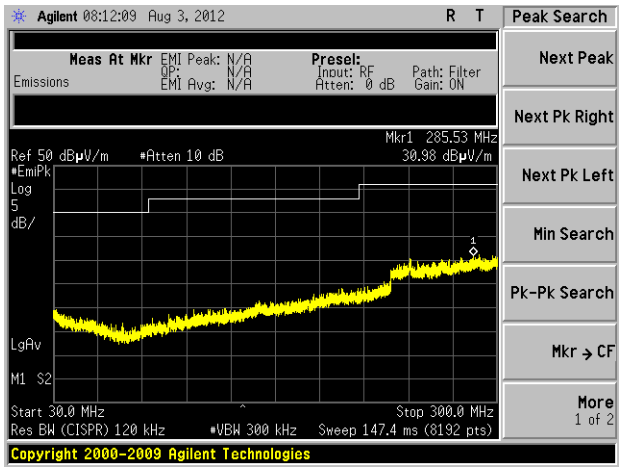
Manufacturer	Honeywell
Date	7-30 & 8-3 2012
Operator	Adam A
Temperature	20 - 25º C
Humidity	30 – 60%
Test Voltage	24VAC 60Hz
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber
Test Distance	3 meter (30 MHz to 6 GHz) 1 meter (1 GHz to 10 GHz)
EUT Placement	80 cm height non-conductive table
Measurements	Final
Detectors	Peak
Additional Notes	1) Emissions found not associated with receive mode. Tested with Antenna A and B, low, mid, high channel. 2) Peak system noise floor compared to quasi-peak / average limit.

Table:

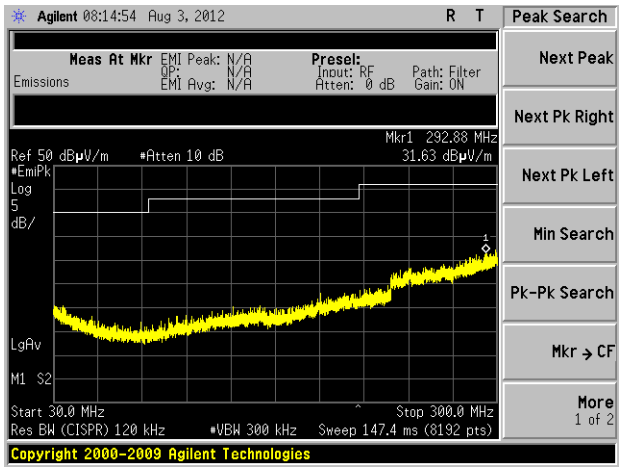
Frequency (MHz)	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarity	Note
285.5	100	0	30.98	46.0	15.0	Horizontal	1
292.8	100	0	31.63	46.0	14.4	Vertical	1
973.7	100	0	34.03	54.0	20.0	Horizontal	1
994.3	100	0	35.74	54.0	18.3	Vertical	1
4959.8	100	0	49.58	54.0	4.4	Horz / Vert	1

Note 1: System Noise Floor (Not associated with EUT)

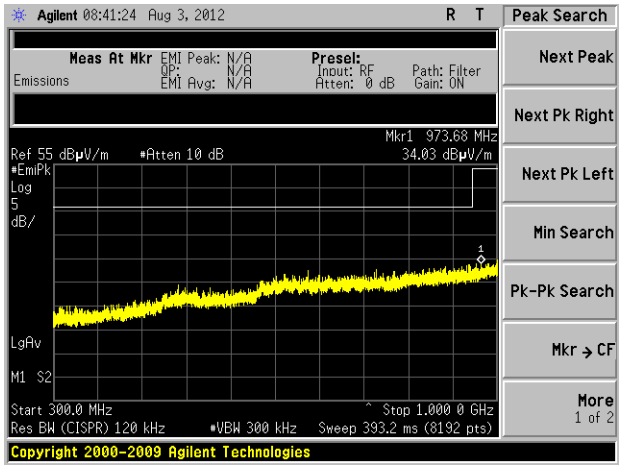
Plots:



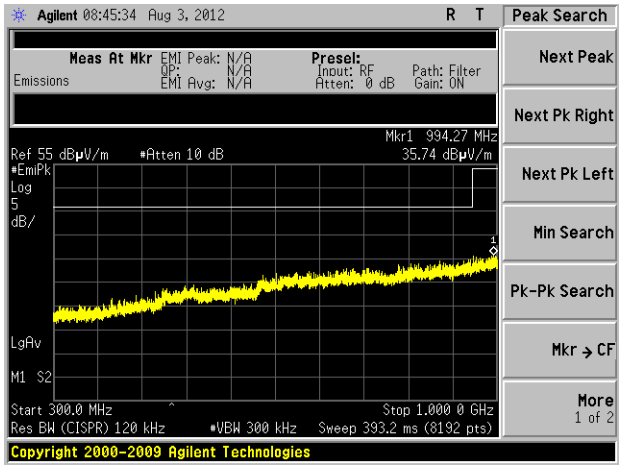
30-300 MHz Horizontal



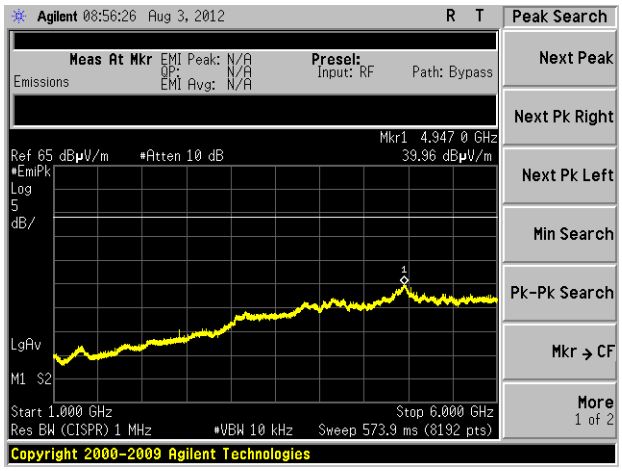
30-300 MHz Vertical



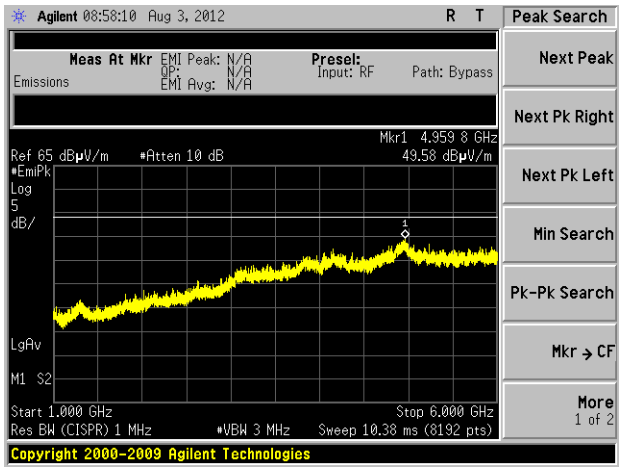
300-1000 MHz Horizontal



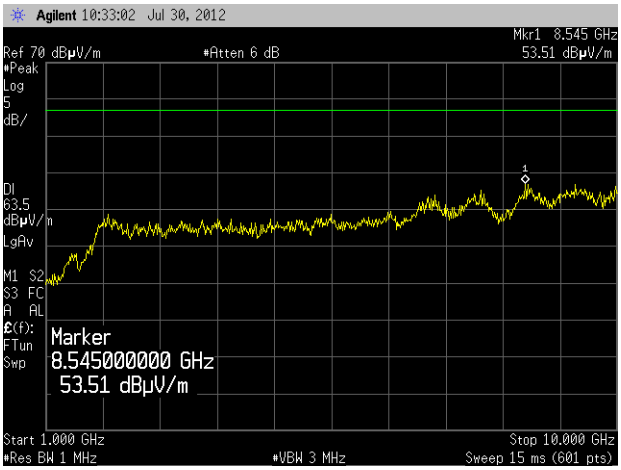
300-1000 MHz Vertical



1-6 GHz Vertical and Horizontal (Average)



1-6 GHz Vertical and Horizontal (Peak)



1-10 GHz at 1 meter distance (Peak compared to average limit)

C.3 – Power line Conducted Emissions

Rule Part(s)	FCC: 15.207 / 15.107 IC: RSS-GEN
Measurement Procedure	ANSI C63.4 - 2003 RSS-GEN Issue 3 2010
Test Location	LS Research, LLC – Conducted Emissions Area
Equipment	50 Ω / 250 μH Line Impedance Stabilization Network (LISN)
EUT Placement	80 cm height non-conductive table above reference ground plane, centered on the table
Frequency Range	150 kHz to 30 MHz
Measurement Detectors / Bandwidths	RBW = 9 kHz VBW ≥ 9 kHz for PK/QP VBW = 1 Hz for Average
Description of Measurement	1) The LISN, cable, attenuator/limiter, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The AC power supply was provided via an appropriate broadband EMI Filter, and then to the LISN line input. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the EMI System.
Example Calculations	Reported Measurement data = Raw receiver measurement + LISN Correction Factor + Cable factor (dB) + attenuator factor (when applicable) + Additional factor (when applicable)

Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Quasi-Peak	Average
0.150 -0.50 *	66-56	56-46
0.5 – 5.0	56	46
5.0 – 30	60	50

* The limit decreases linearly with the logarithm of the frequency in this range.

C.3 – Conducted Emissions

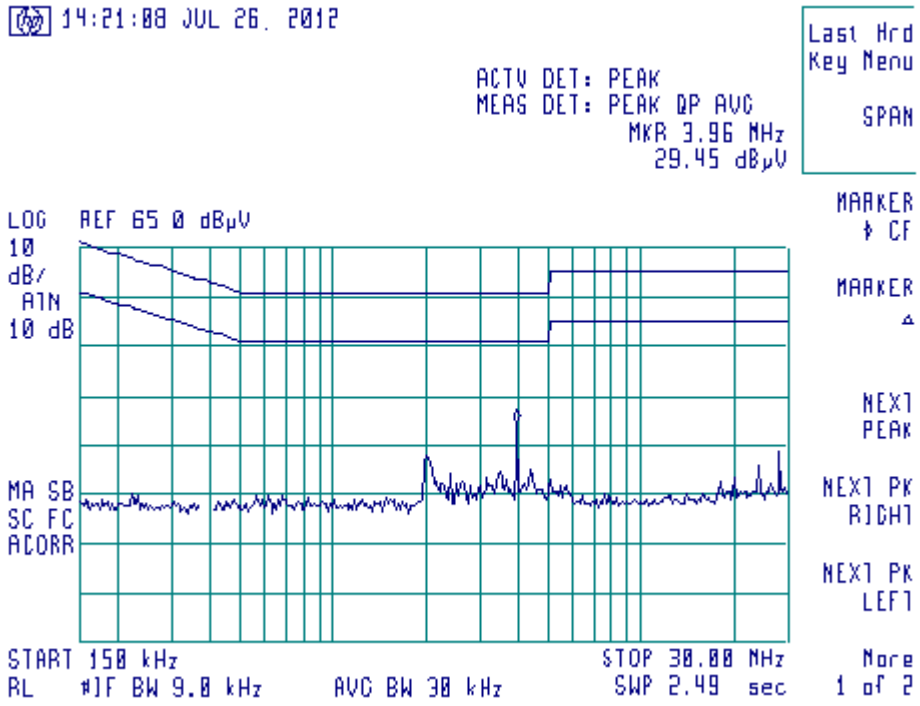
Manufacturer	Honeywell
Date	7-26-12
Operator	Adam A
Temperature	20 - 25º C
Humidity	30 – 60%
Test Voltage	24VAC 60Hz
Test Location	LS Research, LLC – Conducted Emissions Area
EUT Placement	80 cm height non-conductive table
Measurements	Final
Detectors	Peak
Additional Notes	Continuous transmit determined worst case. (Receive mode and hopping mode investigated)

Table:

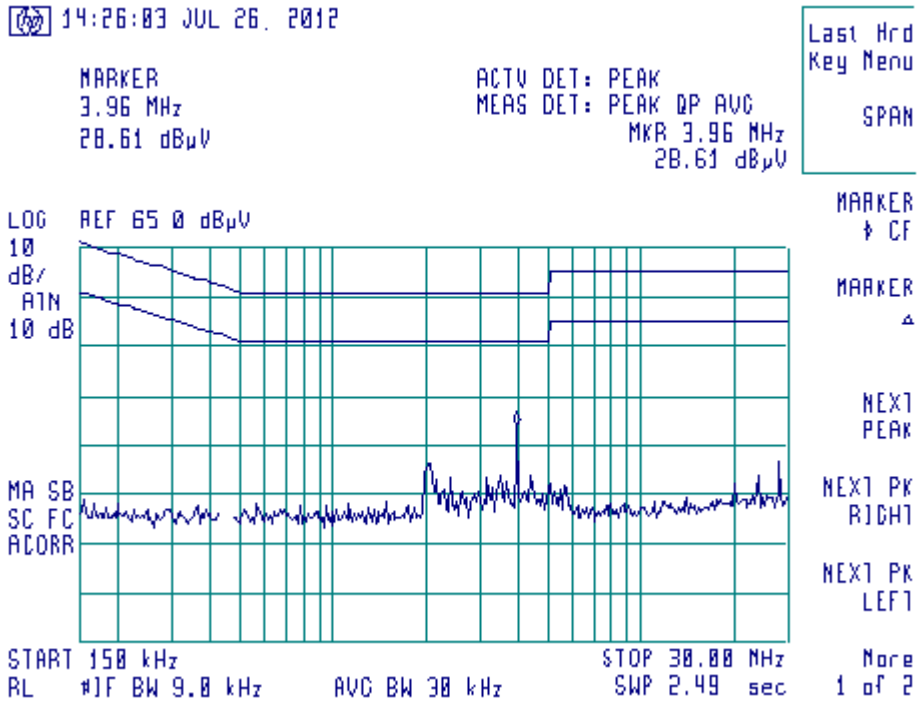
Frequency (MHz)	Line	Peak Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
3.96	L1	28.6	46	17.4
2.00	L1	22.5	46	23.5
27.89	L1	23.1	50	26.9
3.96	L2	29.5	46	16.5
2.00	L2	22.8	46	23.2
27.89	L2	23.3	50	26.7

Plots:

L2 Continuous Transmit



L1 Continuous Transmit



Appendix D - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.82 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.88 dB
Radiated Emissions	3-Meter Chamber, Horn Antenna	4.85 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.32 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.63 dB
Absolute Conducted Emissions	Agilent PSA/ESA Series	1.38 dB
AC Line Conducted Emissions	Shielded Room/EMCO LISN	3.20 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	2.05 Volts/Meter
Conducted Immunity	3 Volts level	2.33 V
EFT Burst, Surge, VDI	230 VAC	54.4 V
ESD Immunity	Discharge at 15kV	3200 V
Temperature/Humidity	Thermo-hygrometer	0.64°/ 2.88 %RH

Appendix E - References

Publication	Year	Title
FCC CFR Parts 0-15	2011	Code of Federal Regulations – Telecommunications
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
RSS-210 Annex 8	2010	Low-power License-exempt Radio communication Devices (All Frequency Bands): Category I Equipment
RSS-GEN Issue 3	2010	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
FCC Public Notice DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

Appendix F – MPE Calculations

The following MPE calculations are based on measured field strength of 111.36 dBµV/m at 3m and conducted RF power of +10.5 dBm as presented to the antenna. The calculated gain of this antenna, based on the field strength measurements (over a conducting ground plane) is 5.7 dBi.
The output power is less than 200mW and exempt from evaluation as stated in Industry Canada RSS-102 section 2.5.1.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	10.50	(dBm)
Maximum peak output power at antenna input terminal:	11.220	(mW)
Antenna gain(typical):	5.7	(dBi)
Maximum antenna gain:	3.715	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	903	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.6	(mW/cm^2)
Power density at prediction frequency:	0.008293	(mW/cm^2)
Maximum allowable antenna gain:	24.3	(dBi)
Margin of Compliance at 20 cm =	18.6	dB

END OF REPORT

Date	Version	Comments	Person
8-6-12	V0	Initial Draft Release	Adam A
8-8-12	V1	Minor Clarification and grammatical changes	Peter/Adam