LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012 ● USA
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

TEST REPORT #: 313222
LSR Job #: C-1785

Compliance Testing of:
Connected Touchscreen

Test Date(s):
8/20/13, 8/22/13, 8/26/13, 8/29/13, 9/6/13

Prepared For:
Ingersoll Rand
Attn: Frank Nardelli
11819 North Pennsylvania Street
Carmel, IN 46032

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.249
Industry Canada (IC) RSS 210 Annex 2
Transmitters Operating in the
Frequency Band 902 MHz – 928 MHz

This Test Report is issued under the Authority of:
Michael Hintzke, EMC Engineer

Signature: Date: 9/10/13

Test Report Reviewed by:	**Tested by:**
Khairul Aidi Zainal, Senior EMC Engineer	Michael Hintzke, EMC Engineer
Signature:	Signature: Date: 9/10/13

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EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	Title 47 CFR FCC Part 15, Subpart C, Section 15.249 RSS GEN and RSS 210 Annex 2
Title:	FCC : Telecommunication – Code of Federal Regulations, CFR 47, Part 15. IC : Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-Power License-Exempt Transmitters.
Test Procedures:	Radiated emissions measurements were performed in accordance with American National Standards Institute ANSI C63.4 – 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.
Environmental Classification:	• Residential

1.2 NORMATIVE REFERENCES

Publication	Title
47 CFR, Parts 0-15 (FCC)	Code of Federal Regulations - Telecommunications
RSS 210	Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment
ANSI C63.4	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.

1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to 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. Accreditation status can be verified at A2LA’s web site: www.a2la.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012.

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated by a calibration laboratory accredited to the requirements of ISO 17025, and is traceable to the SI standard.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	**Ingersoll Rand**
Address:	**11819 North Pennsylvania Street**
Contact Name:	**Carmel, IN 46032**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	Connected Touchscreen
Model Number:	24529380
Serial Number:	Engineering Sample

2.3 ASSOCIATED ANTENNA DESCRIPTION

PCB trace folded monopole.

2.4 EUT'S TECHNICAL SPECIFICATIONS

EUT Operating Frequency	908.42 MHz
Field Strength at 3 meters	
Minimum:	83.1 dBuV/m @ 3m
Maximum:	89.2 dBuV/m @ 3m
EIRP (in mW)	
Minimum:	0.061 mW
Maximum:	0.249 mW
Type of Modulation	FSK
Occupied Bandwidth (99%) in kHz	122.54 kHz
Emission Designator	122KF1D
Transmitter Spurious (worst case) at 3 meters	47.7 dBuV/m @ 3m @ 1492 MHz Listed in section 5.6
Receiver Spurious (worst case) at 3 meters	39.9 @ 3m @ 1817 MHz Listed in section 5.8
Stepped (Yes/No)	No
Step Value:	N/A
Microprocessor Model # (if applicable)	Transceiver: ZW0301 Microcontroller: Microchip PIC18F87K22-I/PTRSL
Antenna Information	
Detachable/non-detachable	Non-detachable
Type	PCB trace folded monopole
EUT will be operated under FCC Rule Part(s)	15.249
EUT will be operated under RSS Rule Part(s)	RSS 210
Modular Filing	☐ Yes ☒ No
Portable or Mobile?	Mobile

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	X	RF Evaluation

If RF Evaluation checked above, test engineer to complete the following:

- Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
- Duty Cycle used in evaluation: %
- Standard used for evaluation: OET 65
- Measurement Distance: 20 cm
- RF Value: 0.00005 ☐ V/m ☐ A/m ☒ W/m^2
  ☐ Measured ☐ Computed ☒ Calculated

2.5 PRODUCT DESCRIPTION

"This deadbolt can be monitored and operated remotely through an integrated home automation system. It features a sleek aesthetic with a backlit touchscreen, and is targeted to meet the needs of security and home automation integrators."

EXHIBIT 3. EUT OPERATION CONDITIONS AND CONFIGURATION

3.1 CLIMATE TEST CONDITIONS

Temperature:	22 ° C
Humidity:	44 %
Pressure:	752 mmHg

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC and IC Paragraph	Test Requirements	Compliance (yes/no)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	N/A
IC : RSS GEN section 4.6.1	20 dB Bandwidth	YES
FCC : 15.249(A) & 1.1310 IC : RSS 210 A2.9 (a)	Maximum Output Power	YES
FCC : 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	YES
FCC : 15.249(a) IC : RSS 210 A2.9(a)	Transmitter harmonics	YES
FCC : 15.249(d) & 15.205 IC : RSS 210 A2.9(b),	Transmitter Radiated Emissions	YES

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☒ **None** ☐ **Yes (explain below)**

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☒ **None** ☐ **Yes (explain below)**

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.249, and Industry Canada RSS-210.

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.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in continuously transmitting modulated mode utilizing the firmware supplied with the Z-Wave tool for regulatory testing. The EUT power was powered by batteries. The EUT has the capability to operate on 1 channel.

The applicable limits apply at a 3 meter distance. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on the standard channel: **908.42 MHz.**

5.2 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 10000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 10 GHz.

In the frequency range of 30 MHz to 6 GHz, the maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height while for the range of 4 GHz to 10 GHz the antenna was raised and lowered between 1 and 1.8 meters in height. In addition, the polarity of the antenna was switched between horizontal and vertical polarity.

The EUT was positioned in one orientation for the test, as it has one orientation for use.

Battery voltage was periodically monitored to ensure sufficient supply.

The EUT was tested with 2 differently populated PCB's. The less populated PCB has eliminated components not related to the radio circuitry. The EUT was also tested with 2 different stylized escutcheons.

5.3 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with resolution bandwidths as described in ANSI C63.4.

5.4 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.249 and Canada RSS-210. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

Field Strength of Fundamental Frequencies:
The fundamental emissions for an intentional radiator in the 902-928 MHz band, operating under FCC part 15.249 and RSS 210 A2.9 limits, must have electric field strength of no greater than 50 mV/m, for the fundamental frequency, when measured at 3 meters, and harmonic field strength of no greater than 500 µV/m, when measured at 3 meters. Spurious emissions outside the 902-928 MHz band shall be attenuated by at least 50 dB below the level of the fundamental, or meet the limits expressed in FCC part 15.209 under general emission limits.

Field Strength of Fundamental Frequencies is Limited to 50,000 µV/m, or 94 dBµV/m.
Field Strength of Harmonic and Spurious Frequencies is Limited by FCC 15.249 a and d

The harmonic limit of –50 dBc with respect to the fundamental limit would be:
94 dBµV/m – 50 dB = 44 dBµV/m,
*****with the exception of where FCC 15.209 allows for a higher limit to be used.

Frequency (MHz)	3 m Limit (µV/m)	3 m Limit (dBµV/m)
902-928	50,000	94.0
30-88 ; 88-216	159	44.0
216-902 ; 928-960	500	46.0*****
960-40,000	500	54.0*****

The following table depicts the general radiated emission limits obtained from Title 47 CFR, part 15.209a, for radiated emissions measurements, including restricted band limits as expressed in 47 CFR, part 15.205.

Frequency (MHz)	3 m Limit (µV/m)	3 m Limit (dBµV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-40,000	500	54.0

Sample conversion from field strength µV/m to dBµV/m:

$$dB\mu V/m = 20 \log_{10} (3m\ limit)$$

from 30 - 88 MHz for example: $dB\mu V/m = 20 \log_{10} (100)$

$$40.0\ dB\mu V/m = 20 \log_{10} (100)$$

For measurements made at 1 meter, a 9.5 dB correction may be been invoked.

960 MHz to 40,000 MHz
500 µV/m or 54.0 dBµV/m at 3 meters
54.0 + 9.5 = 63.5 dBµV/m at 1 meter

Note: Limits are conservatively rounded to the nearest tenth of a whole number.

Reported data:

For both fundamental and spurious emissions measurement, the data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBµV/m) + Antenna correction Factor + Cable factor (dB) + Miscellaneous factors when applicable (dB) – amplification factor when applicable (dB).

Generic example of reported data at 200 MHz:

Reported Measurement data = 18.2 (raw receiver measurement) + 15.8 (antenna factor) + 1.45 (cable factor) = 35.45 (dBµV/m).

5.6 RADIATED EMISSIONS TEST DATA CHART

Measurements of Electromagnetic Radiated Emissions
Frequency Range Inspected: 30 MHz to 10000 MHz

Manufacturer:	Ingersoll Rand						
Date(s) of Test:	August 20, 22,26, 29 2013; September 6, 2013;						
Project Engineer:	Michael Hintzke						
Test Engineer(s):	Michael Hintzke						
Voltage:	6 VDC						
Operation Mode:	Continuously Modulated Mode						
Environmental Conditions in the Lab:	Temperature: 71° F Relative Humidity: 42 %						
EUT Power:		Single Phase 120 VAC		3 Phase ___VAC			
	X	Battery		Other:			
EUT Placement:	X	80cm non-conductive table		10cm Spacers			
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS			
Measurements:		Pre-Compliance		Preliminary	X	Final	
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average	

The following table depicts the worst case level of the radiated fundamental:

A. Less populated PCB with rounded escutcheon.

Frequency MHz	Antenna	EUT	Height (m)	Azimuth (0° - 360°)	Peak (dBuV/m)	Quasi-Peak (dBuV/m)	Limit (dBuV/m)	Margin (dB)
908.42	V	V	1.00	1	89.5	89.2	94.0	4.8

B. More populated PCB with square escutcheon.

Frequency MHz	Antenna	EUT	Height (m)	Azimuth (0° - 360°)	Peak (dBuV/m)	Quasi-Peak (dBuV/m)	Limit (dBuV/m)	Margin (dB)
908.42	V	V	1.00	0	88.2	87.9	94	6.1

C. Less populated PCB with square escutcheon

Frequency MHz	Antenna	EUT	Height (m)	Azimuth (0° - 360°)	Peak (dBuV/m)	Quasi-Peak (dBuV/m)	Limit (dBuV/m)	Margin (dB)
908.42	V	V	1.00	39	86.8	86.3	94	7.4

D. More populated PCB with round escutcheon.

Frequency MHz	Antenna	EUT	Height (m)	Azimuth (0° - 360°)	Peak (dBuV/m)	Quasi-Peak (dBuV/m)	Limit (dBuV/m)	Margin (dB)
908.42	V	V	1.06	260	85.6	85.3	94.0	8.7

The following table depicts the worst case level of significant spurious radiated RF emissions (other than harmonics) found:

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation	Notes
900.4	1.00	0	33.06	46.0	12.9	V	V	-
295.5	1.00	0	23.6	46.0	22.4	H	V	1
298.3	1.00	0	23.4	46.0	22.6	V	V	1
836.7	1.00	0	23.5	46.0	22.5	H	V	1
487.5	1.00	0	18	46.0	28.0	V	V	1

Note 1: Measurement taken was of the system noisefloor.

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
1492.0	1.00	0	59.4	47.7	54.0	6.3	H	V

Note 1: H = horizontal, V = vertical

RADIATED EMISSIONS DATA CHARTS **(continued)**

The following tables depicts the level of harmonic emissions observed:

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
1816.84	1.00	92	45.8	37.3	54.0	16.74	Horizontal	Vertical
1816.84	1.00	38	47.3	41.5	54.0	12.47	Vertical	Vertical
2725.26	Note 1				54.0	-	Horizontal	Vertical
2725.26	1.25	345	48.1	39.1	54.0	9.5	Vertical	Vertical

Notes:

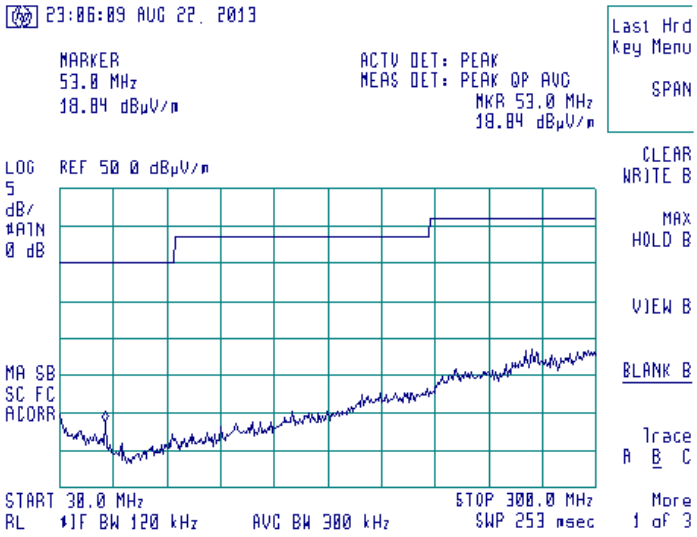
1) Measurement at receiver system noise floor.
2) A Peak Detector was used in measurements above 1 GHz, for average measurement, the peak detector was used with lower VBW. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
3) Measurements above 5 GHz were made at 1 meter of separation from the EUT.

5.7 Screen Captures - Radiated Emissions Test - Transmitter

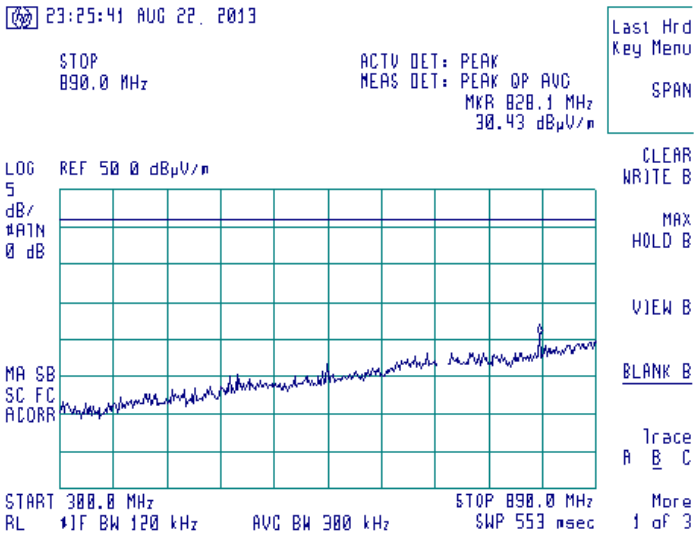
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and a peak detector with video averaging is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on one standard operating channel, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

Antenna Vertically Polarized, 30-300 MHz, at 3m



Antenna Horizontally Polarized, 300-890 MHz, at 3m



Screen Captures - Radiated Emissions Testing *(continued)*

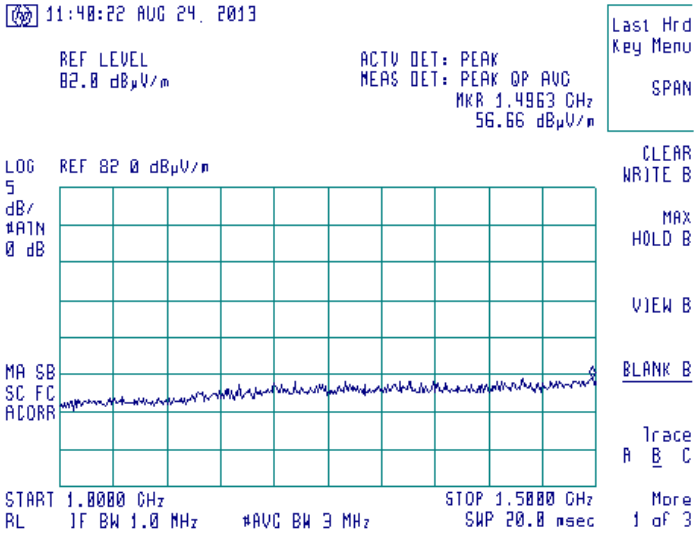
Antenna Vertically Polarized, 890-902 MHz, at 3m

Please see Exhibit 8

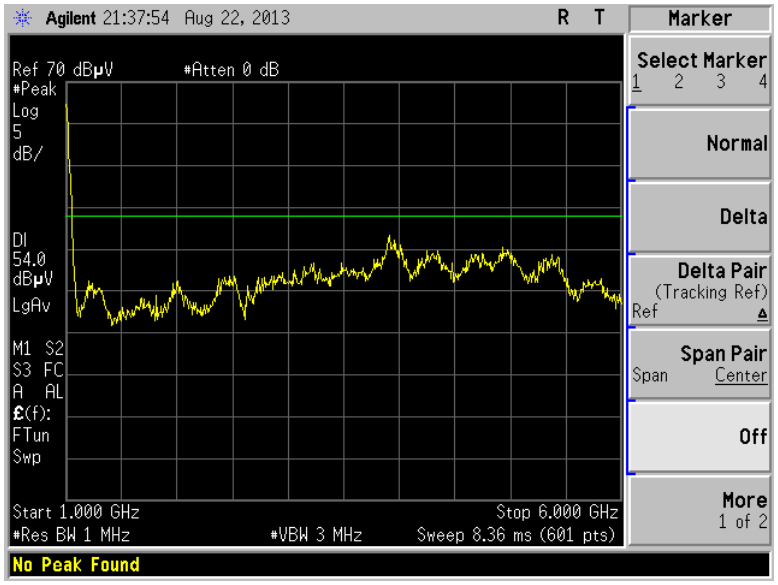
Antenna Horizontally Polarized, 928-1000 MHz, at 3m

Please see Exhibit 8

Antenna Horizontally Polarized, 1000-1500 MHz, at 3m

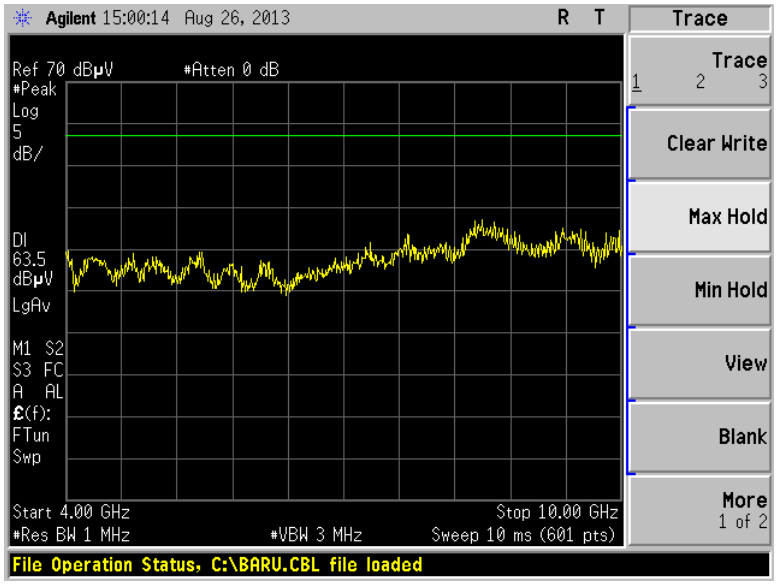


Antenna Vertically Polarized, 1000-6000 MHz, at 3m



Note: The high emission seen at 1 GHz in this plot is due to the roll-off of the 900 MHz high pass filter.

Antenna Vertically Polarized, 4000-10000 MHz, at 1m



5.8 Radiated Emissions Test - Receiver

Refer to section 5.1-5.4 for test setup and details.

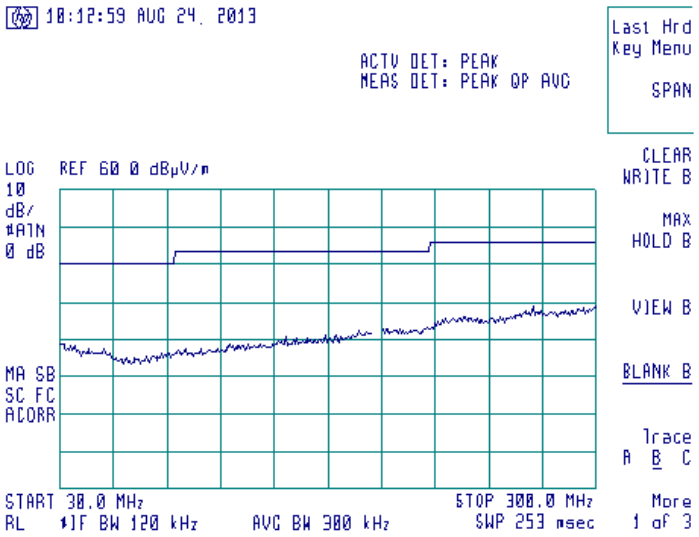
Test Data

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
978.5	1.00	0	24.3	54.0	29.7	V	V
995.8	1.00	0	25.5	54.0	28.5	H	V
299.9	1.00	0	24.3	46.0	21.7	H	V
293.9	1.00	0	22.7	46.0	23.3	H	H

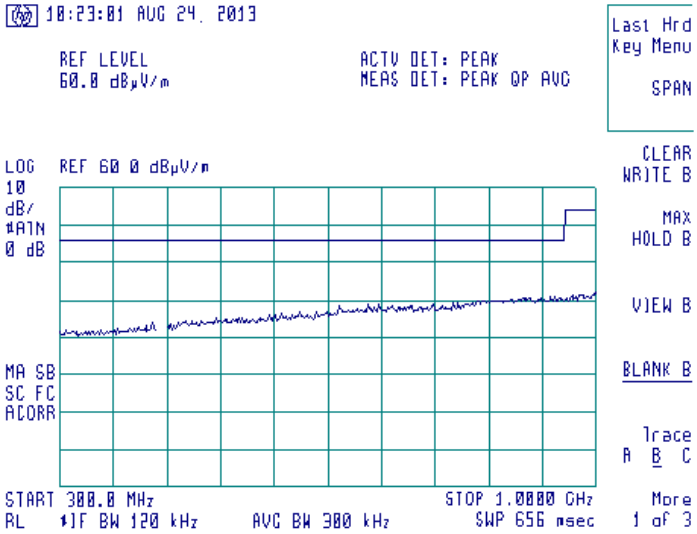
Frequency (GHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
1.817	1.00	111	43.7	35.7	54.0	18.3	H	V
1.817	1.00	33	45.7	39.9	54.0	14.1	V	V

5.9 Screen Captures - Radiated Emissions Test - Receiver

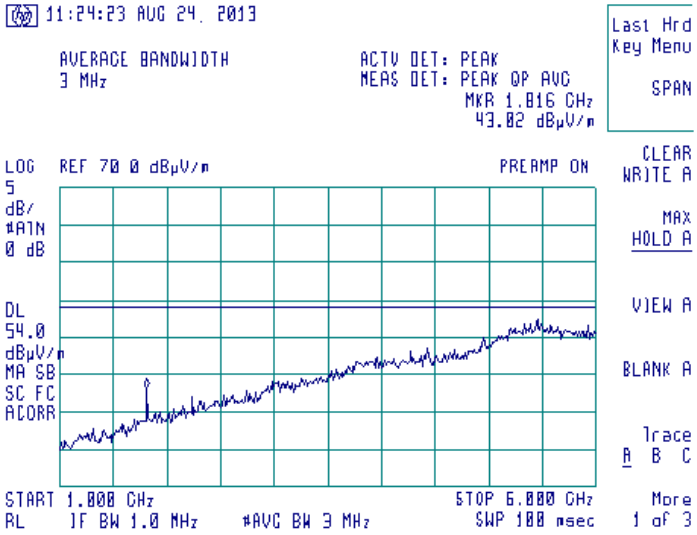
Antenna Vertically Polarized, 30-300 MHz, at 3m



Antenna Horizontally Polarized, 300-1000 MHz, at 3m



Antenna Vertically Polarized, 1000-6000 MHz, at 3m



Antenna Vertically Polarized, 4000-10000 MHz, at 1m

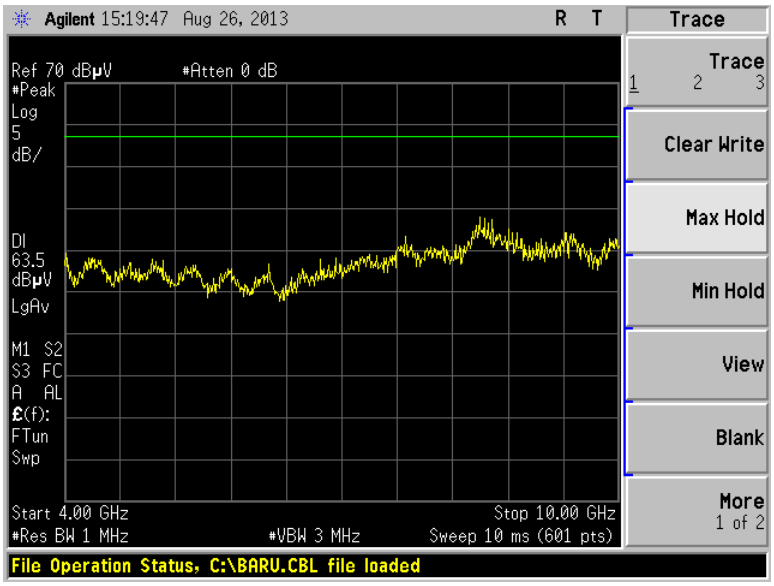


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

This test is not applicable for a battery-only operated device and was therefore not tested.

EXHIBIT 7. OCCUPIED BANDWIDTH

7.1 Limits

There are no limits specified. The occupied bandwidth need only be reported.

7.2 Method of Measurements

This test was performed radiated in a 3-meter semi-anechoic chamber. The resolution bandwidth was then set to a value that was greater than or equal to 1% of the bandwidth. Using the 20dBc and 99% Occupied Bandwidth measurement function of the spectrum analyzer, the bandwidth was measured.

7.3 Test Data

Center Frequency (MHz)	Measured 99% Occupied Bandwidth (kHz)
908.42	122.54

7.4 Screen Captures - OCCUPIED BANDWIDTH

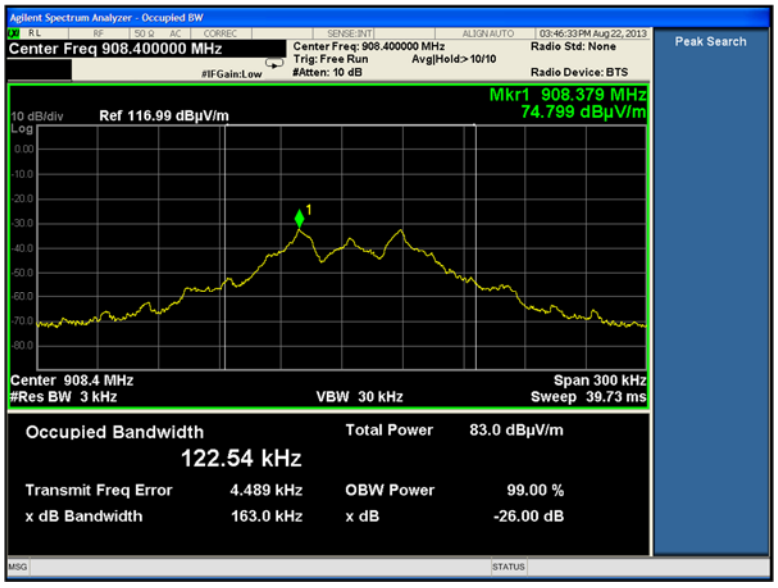


EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 Method of Measurements

FCC 15.249(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in tables 2 and 3 of the same standard and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the 902-928 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

Screen Capture Demonstrating Compliance at the **Band-Edges**

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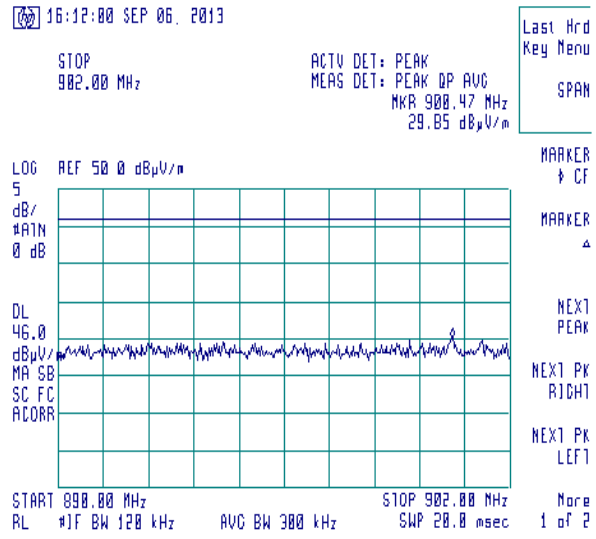
<td> 
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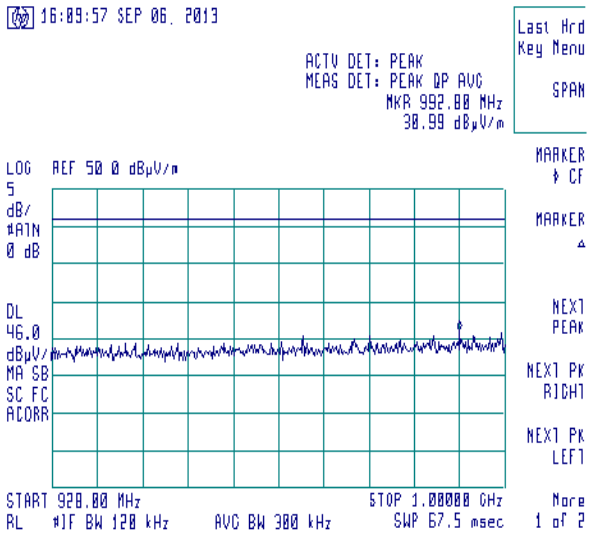
<td> 
</td>
</tr>
<tr>
<td>Lower band edge</td>
<td>Upper band edge</td>
</tr>
</table>

APPENDIX A

EQUIPMENT LIST

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 22-Aug-2013 Type Test: Occupied Bandwidth (99%) Job #: C-1785

Prepared By: Mike Customer: Ingersoll Rand Quote #: 313222

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	8/7/2013	8/7/2014	Active Calibration
2	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 22-Aug-2013 Type Test: Radiated Fundamental Job #: C-1785

Prepared By: Mike Customer: Ingersoll Rand Quote #: 313222

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	8/7/2013	8/7/2014	Active Calibration
2	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 22-Aug-2013 Type Test: Band-Edge Job #: C-1785

Prepared By: Mike Customer: Ingersoll Rand Quote #: 313222

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	2/11/2013	2/11/2014	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	2/11/2013	2/11/2014	Active Calibration
3	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 22-Aug-2013 Type Test: Spurious General Emissions Job #: C-1785

Prepared By: Mike Customer: Ingersoll Rand Quote #: 313222

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration
2	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	2/11/2013	2/11/2014	Active Calibration
3	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	2/11/2013	2/11/2014	Active Calibration
4	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
6	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	12/12/2012	12/12/2013	Active Calibration
7	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
8	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	2/1/2013	2/1/2014	Active Calibration
9	AA 960155	900MHz High Pass Filter	KWM	HPF-L-14185	7272-03	4/1/2013	4/1/2014	Active Calibration
9	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	System	System	System

Project Engineer: Quality Assurance:

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date: 22-Aug-2013 Type Test: Radiated Emissions (109) Job #: C-1785

Prepared By: Mike Customer: Ingersoll Rand Quote #: 313222

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration
2	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	2/11/2013	2/11/2014	Active Calibration
3	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	2/11/2013	2/11/2014	Active Calibration
4	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
6	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	12/12/2012	12/12/2013	Active Calibration
7	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
8	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	2/1/2013	2/1/2014	Active Calibration
9	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	System	System	System

Project Engineer: Quality Assurance:

APPENDIX B
TEST STANDARDS – CURRENT PUBLICATION DATES RADIO

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
RSS GEN	2010		
RSS 210	2010		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2013		

APPENDIX C
Uncertainty Statement

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