



## EMC TEST REPORT

**Report Number:** 101052328ATL-007B

**Project Number:** G10152328

**Report Issue Date:** November 25, 2014

**Report Revised Date:** April 9, 2015

**Product Designation:** IQDWSensor, QS1100

**Standards:** 47 CFR Part 15 Subpart C:2014 Section 15.231  
RSS-210 Issue 8, 2010

Tested by:  
Intertek Testing Services NA, Inc.  
1950 Evergreen Blvd, Suite 100  
Duluth, GA 30096 USA

Client:  
Qolsys Inc.  
1900 The Alameda, Suite 420  
San Jose, CA. 95126 USA

Report prepared by

Mary Sampson/Senior Project Engineer

Report reviewed by

Krishna Vemuri/Senior Staff Engineer

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## 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

## 2 Test Summary

Section	Test full name	Result
3	Client Information	
4	Description of Equipment Under Test	
5	System Setup and Method	
6	Restrictions (47 CFR Part 15 Subpart C:2014 Section 15.231(a)(2) RSS-210 Issue 8, 2010, Section A1.1.1(b))	Pass
-	AC Mains Conducted Emissions (Battery operated device)	N/A
7	Fundamental Emissions (47 CFR Part 15 Subpart C:2014 Section 15.231(b) RSS-210 Issue 8, 2010, Section A1.1.2)	Pass
8	Radiated Spurious Emissions below 1GHz (47 CFR Part 15 Subpart C:2014 Section 15.231(b) RSS-210 Issue 8, 2010, Section A1.1.2)	Pass
9	Radiated Spurious Emissions Above 1 GHz (47 CFR Part 15 Subpart C:2014 Section 15.231(b) RSS-210 Issue 8, 2010, Section A1.1.2)	Pass
10	Bandwidth (47 CFR Part 15 Subpart C:2014 Section 15.231(c) RSS-210 Issue 8, 2010, Section A1.1.3)	Pass
11	Duty Cycle (47 CFR Part 15 Subpart C:2014 Section 15.35(c) RSS-GEN Issue 3, 2010, Section 4.5)	Pass
12	RF Exposure Compliance (47 CFR Part 2 Subpart J: 2014 Section 2.1091)	Pass
13	Revision History	

### 3 Client Information

This EUT was tested at the request of:

**Client:** Qolsys Inc.  
1900 The Alameda, Suite 420  
San Jose, CA. 95126  
USA

**Contact:** Mark Skeen  
**Telephone:** 408-857-8415  
**Fax:** 408-927-5832  
**Email:** mark.skeen@qolsys.com

### 4 Description of Equipment Under Test

**Manufacturer:** Qolsys Inc.  
1900 The Alameda, Suite 420  
San Jose, CA. 95126  
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Door Window Sensor	Qolsys Inc	IQDWSensor	QSCB134100300
Wireless Door Window Sensor	Qolsys Inc	IQDWSensor	QSCB134700503

Receive Date:	10/16/2014
Received Condition:	Good
Type:	Production

#### Description of Equipment Under Test (provided by client)

The IQDW Sensor is door/window wireless sensor to be used in the Qolsys IQ home security system.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
2.2 to 3 Vdc	30 $\mu$ A	N/A	N/A

#### Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Continuous Transmission is a special test mode used only for simplifying the compliance testing process. This will never be activated by the end user.
2	Normal mode is transmission upon sensor activation or at supervisory interval (approximately 70 minutes).

#### Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None provided

**5 System Setup and Method**

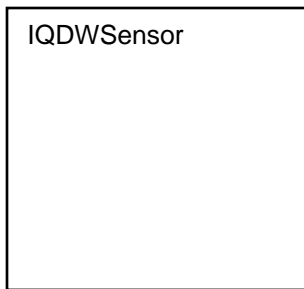
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
None					

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None			

**5.1 Method:**

Configuration as required by ANSI C63.10: 2013.

**5.2 EUT Block Diagram:**



## 6 Restrictions

### 6.1 Method

Tests are performed in accordance with 47 CFR Part 15 Subpart C:2014 Section 15.231(a)(2) and RSS-210 Issue 8, 2010, Section A1.1.1(b).

**TEST SITE:** 10m Semi-Anechoic Chamber Control Room

**10 Meter Semi-Anechoic Chamber** The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

### 6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
T006217;	THDX	Oregon Scientific	BA888	NSN	12/11/2013	12/11/2014
211505;	EMI Receiver	Hewlett Packard	8546A	3650A00362	04/09/2014	04/09/2015
015762;	EMI Receiver, Preselector section	Hewlett Packard	85460A	3330A00158	04/09/2014	04/09/2015

#### Software Utilized:

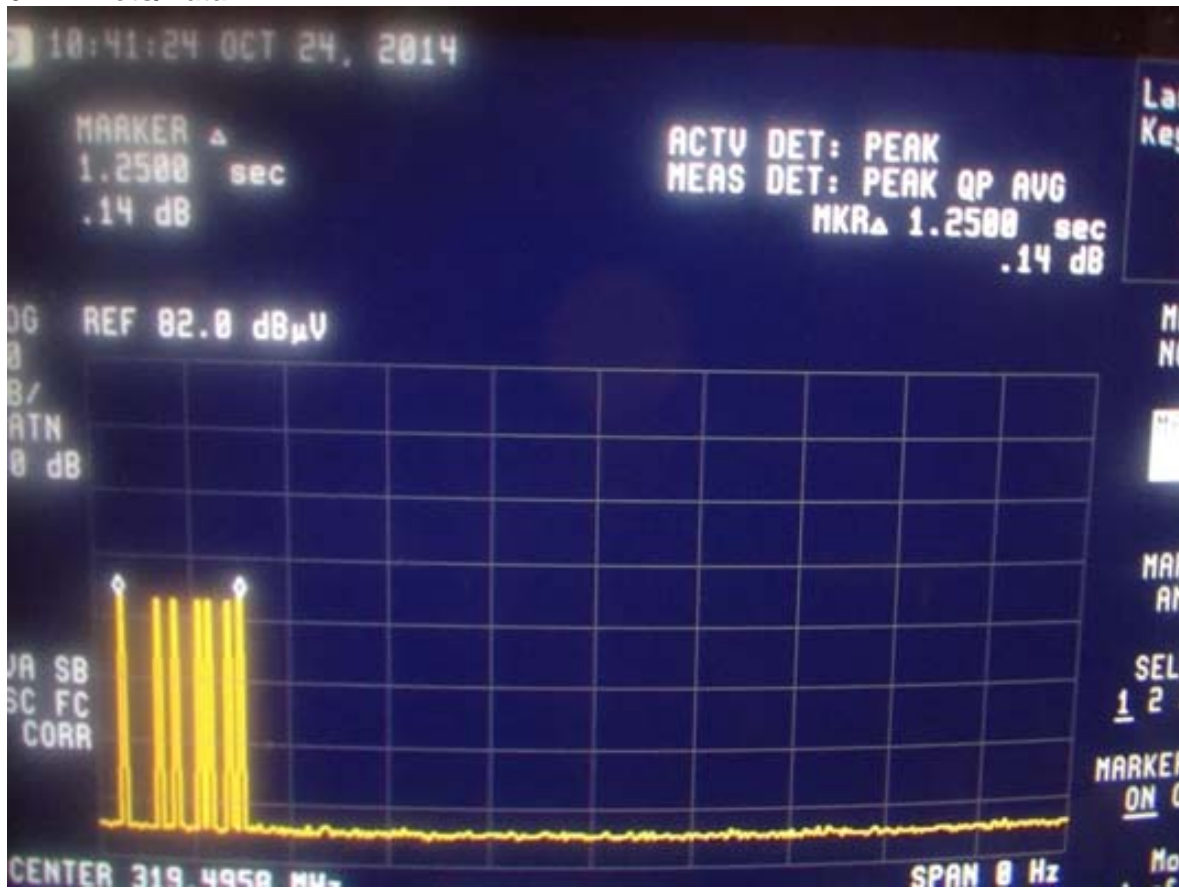
Name	Manufacturer	Version
None (Spectrum Analyzer Firmware)		

### 6.3 Results:

§ 15.231 Periodic operation in the band 40.66–40.70 MHz and above 70 MHz. (a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation: A transmitter activated automatically shall cease transmission within 5 seconds after activation.

The sample tested was found to Comply.

**6.4 Plots/Data:**



Test Personnel: Mary Sampson MTS  
 Supervising/Reviewing Engineer: \_\_\_\_\_  
 (Where Applicable) N/A  
 Product Standard: 47 CFR Part 15 Subpart C:2014 Section 15.231(a)(2) and RSS-210 Issue 8, 2010, Section A1.1.1(b)  
 Input Voltage: 2 "AAA" batteries

Test Date: 10/24/14  
 Limit Applied: See Section 6.3  
 Ambient Temperature: 23 °C  
 Relative Humidity: 47 %  
 Atmospheric Pressure: 990 mbars

Deviations, Additions, or Exclusions: None

## 7 Fundamental Emissions

### 7.1 Method

Tests are performed in accordance with 47 CFR Part 15 Subpart C:2014 Section 15.231(b) and RSS-210 Issue 8, 2010, Section A1.1.2.

**TEST SITE:** 10m Semi-Anechoic Chamber

**10 Meter Semi-Anechoic Chamber** The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

#### Measurement Uncertainty

For conducted emissions,  $U_{lab}$  (2.8 dB in worst case)  $< U_{CISPR}$  (3.6 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

#### **Sample Calculations**

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB $\mu$ V

RF = Reading from receiver in dB $\mu$ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB $\mu$ V

#### **Example:**

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

**7.2 Test Equipment Used:**

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
T00621;7	THDX	Oregon Scientific	BA888	NSN	12/11/2013	12/11/2014
200162;	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014
211386;	Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	2622	12/12/2013	12/12/2014
TT6;	RF Coax Cable. Rated 9KHz to 2 GHz.	Andrews	Cable TT-6	TT6	06/18/2014	06/18/2015
E205;	Cable, N-N, 3 meters, 18GHz	Megaphase	TM18-NKNK-118	9053201 003	05/28/2014	05/28/2015
MP3;	Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/08/2014	05/08/2015

**Software Utilized:**

Name	Manufacturer	Version
None (Spectrum Analyzer Firmware)		

**7.3 Results:**

47CFR Part 15 §15.231(b)

In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under §15.231 shall not exceed the following:

Fundamental Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/com)
40.66 - 40.7	2,250	225
70 - 130	1,250	125
130- 174	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174 - 260	3,750	375
260 - 470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250
<sup>1</sup> Linear Interpolations		

The sample tested was found to Comply.



**7.4 Setup Photographs:**



**7.5 Plots/Data:**

**Client:** Qolsys Inc  
**Model Number:** QS-1100  
**Project Number:** G101052328  
**Tested By:** MS  
**Date:** 10/29/14  
**Frequency Range (MHz):** Fundamental  
**Input power:** 2 coin cell batteries

**Receiver:** R&S ESU 40  
**Antenna:** Chase 2622  
**Cables:** TT-6+MP3+E-205  
**Preamp:**  
**Limit:** FCC15 Class B-3m

**Test Distance (m):** 3

**Modifications for compliance (y/n):** n

**Notes: Sample 1 of 2**

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Duty Cycle Factor dB	Net dB(uV/m)	3m Limit dB(uV/m)	Margin dB	Axis / Detector
V	319.500	60.8	14.0	3.0	0.0	0.0	77.8	95.9	-18.1	X/PK
V	319.500	60.8	14.0	3.0	0.0	23.0	54.8	75.9	-21.1	X/AVG
V	319.500	69.0	14.0	3.0	0.0	0.0	86.0	95.9	-9.9	Y/PK
V	319.500	69.0	14.0	3.0	0.0	23.0	63.0	75.9	-12.9	Y/AVG
V	319.500	71.2	14.0	3.0	0.0	0.0	88.2	95.9	-7.7	Z/PK
V	319.500	71.2	14.0	3.0	0.0	23.0	65.2	75.9	-10.7	Z/AVG
H	319.500	74.1	14.5	3.0	0.0	0.0	91.6	95.9	-4.3	X/PK
H	319.500	74.1	14.5	3.0	0.0	23.0	68.6	75.9	-7.3	X/AVG
H	319.500	68.2	14.5	3.0	0.0	0.0	85.7	95.9	-10.2	Y/PK
H	319.500	68.2	14.5	3.0	0.0	23.0	62.7	75.9	-13.2	Y/AVG
H	319.500	65.7	14.5	3.0	0.0	0.0	83.2	95.9	-12.7	Z/PK
H	319.500	65.7	14.5	3.0	0.0	23.0	60.2	75.9	-15.7	Z/AVG
<b>Calculations</b>		H=C+D+E-F-G		J=H-I						

Note: X, Y, and Z denote the EUT was placed in the X, Y and Z orthogonal axes.

Test Personnel: Mary Sampson MTS  
 Supervising/Reviewing Engineer: \_\_\_\_\_  
 (Where Applicable) N/A  
 Product Standard: 47 CFR Part 15 Subpart C:2014 Section 15.231(b) and RSS-210 Issue 8, 2010, Section A1.1.2  
 Input Voltage: 2 "CR2032" batteries  
 Pretest Verification w/ Ambient Signals or BB Source: BB Source

Test Date: 10/29/14  
 Limit Applied: See Section 7.3  
 Ambient Temperature: 21.5 °C  
 Relative Humidity: 43 %  
 Atmospheric Pressure: 983 mbars

Deviations, Additions, or Exclusions: None

## 8 Radiated Spurious Emissions below 1GHz

### 8.1 Method

Tests are performed in accordance with 47 CFR Part 15 Subpart C:2014 Section 15.231(b) and RSS-210 Issue 8, 2010, Section A1.1.2.

**TEST SITE:** 10m Semi-Anechoic Chamber

10 Meter Semi-Anechoic Chamber The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

### 8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
T006217;	THDX	Oregon Scientific	BA888	NSN	12/11/2013	12/11/2014
TT6;	RF Coax Cable. Rated 9KHz to 2 GHz.	Andrews	Cable TT-6	TT6	06/18/2014	06/18/2015
MP3;	Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/08/2014	05/08/2015
E205;	Cable, N-N, 3 meters, 18GHz	Megaphase	TM18-NKNK-118	9053201 003	05/28/2014	05/28/2015
E209;	RF Coax Cable	Megaphase	TM18-N1N1-120	14065201-003	05/08/2014	05/08/2015
200162;	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014
200069;	Preamplifier, 10 MHz to 2000 MHz, 30 dB gain	Mini-Circuits	ZKL-2	D011105	01/08/2014	01/08/2015
211386;	Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	2622	12/12/2013	12/12/2014

### Software Utilized:

Name	Manufacturer	Version
Tile	Quantum Change	3.4.K.22

### 8.3 Results:

Fundamental Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/com)
40.66 - 40.7	2,250	225
70 - 130	1,250	125
130 - 174	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174 - 260	3,750	375
260 - 470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250
<sup>1</sup> Linear Interpolations		

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.

Fundamental Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

\*\*Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

The sample tested was found to Comply.

**8.4 Setup Photographs:**



**8.5 Plots/Data:**

<b>Client:</b> Qolsys Inc <b>Model Number:</b> QS-1100 <b>Project Number:</b> GI01052328 <b>Tested By:</b> MS <b>Date:</b> 10/29/14 <b>Frequency Range (MHz):</b> 30-1000 <b>Input power:</b> 2 coin cell batteries	<b>Receiver:</b> R&S ESU 40 <b>Antenna:</b> Chase 2622 <b>Cables:</b> TT-6+MP3+E-205+E-209 <b>Preamp:</b> ZKL-2 200069 <b>Limit:</b> FCC15 Class B-3m <b>Test Distance (m):</b> 3 <b>Modifications for compliance (y/n):</b> n
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Notes: Sample 1 of 2

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Duty Cycle Factor dB	Net dB(uV/m)	3m Limit dB(uV/m)	Margin dB	Axis / Detector
V	639.000	38.0	19.8	5.3	31.0	0.0	32.0	75.9	-43.9	X/PK
V	639.000	38.0	19.8	5.3	31.0	23.0	9.0	55.9	-46.9	X/AVG
V	639.000	43.8	19.8	5.3	31.0	0.0	37.8	75.9	-38.1	Y/PK
V	639.000	43.8	19.8	5.3	31.0	23.0	14.8	55.9	-41.1	Y/AVG
V	639.000	45.5	19.8	5.3	31.0	0.0	39.6	75.9	-36.4	Z/PK
V	639.000	45.5	19.8	5.3	31.0	23.0	16.5	55.9	-39.4	Z/AVG
H	639.000	51.1	19.8	5.3	31.0	0.0	45.1	75.9	-30.8	X/PK
H	639.000	51.1	19.8	5.3	31.0	23.0	22.1	55.9	-33.8	X/AVG
H	639.000	42.3	19.8	5.3	31.0	0.0	36.4	75.9	-39.5	Y/PK
H	639.000	42.3	19.8	5.3	31.0	23.0	13.4	55.9	-42.6	Y/AVG
H	639.000	40.3	19.8	5.3	31.0	0.0	34.3	75.9	-41.6	Z/PK
H	639.000	40.3	19.8	5.3	31.0	23.0	11.3	55.9	-44.6	Z/AVG
V	958.500	45.5	21.2	6.6	30.6	0.0	42.7	75.9	-33.2	X/PK
V	958.500	45.5	21.2	6.6	30.6	23.0	19.7	55.9	-36.2	X/AVG
V	958.500	50.4	21.2	6.6	30.6	0.0	47.6	75.9	-28.3	Y/PK
V	958.500	50.4	21.2	6.6	30.6	23.0	24.6	55.9	-31.3	Y/AVG
V	958.500	45.1	21.2	6.6	30.6	0.0	42.4	75.9	-33.6	Z/PK
V	958.500	45.1	21.2	6.6	30.6	23.0	19.3	55.9	-36.6	Z/AVG
H	958.500	47.5	22.4	6.6	30.6	0.0	45.9	75.9	-30.0	X/PK
H	958.500	47.5	22.4	6.6	30.6	23.0	22.9	55.9	-33.0	X/AVG
H	958.500	42.7	22.4	6.6	30.6	0.0	41.1	75.9	-34.8	Y/PK
H	958.500	42.7	22.4	6.6	30.6	23.0	18.0	55.9	-37.9	Y/AVG
H	958.500	46.7	22.4	6.6	30.6	0.0	45.2	75.9	-30.7	Z/PK
H	958.500	46.7	22.4	6.6	30.6	23.0	22.1	55.9	-33.8	Z/AVG
<b>Calculations</b>		H=C+D+E-F-G			J=H-I					

Note: X, Y, and Z denote the EUT was placed in the X, Y and Z orthogonal axes.

<b>Test Personnel:</b> Mary Sampson <i>MTS</i> <b>Supervising/Reviewing Engineer:</b> (Where Applicable) N/A <b>Product Standard:</b> 47 CFR Part 15 Subpart C:2014 Section 15.231(b) and RSS-210 Issue 8, 2010, Section A1.1.2 <b>Input Voltage:</b> 2 "CR2032" batteries <b>Pretest Verification w/ Ambient Signals or BB Source::</b> <b>BB source</b>	<b>Test Date:</b> 10/29/14  <b>Limit Applied:</b> See Section 8.3  <b>Ambient Temperature:</b> 21..5 °C <b>Relative Humidity:</b> 43 % <b>Atmospheric Pressure:</b> 983 mbars
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Deviations, Additions, or Exclusions: None

## 9 Radiated Spurious Emissions Above 1 GHz

### 9.1 Method

Tests are performed in accordance with 47 CFR Part 15 Subpart C:2014 Section 15.231(b) RSS-210 Issue 8, 2010, Section A1.1.2.

**TEST SITE:** 10m Semi-Anechoic Chamber

10 Meter Semi-Anechoic Chamber The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

### 9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
T006217:	THDX	Oregon Scientific	BA888	NSN	12/11/2013	12/11/2014
213061:	Antenna, Horn, <18 GHz	EMCO	3115	9208-3919	07/22/2014	07/22/2015
200162:	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014
MP4:	RF Coax Cable	Megaphase	G919-N1N1-310	1GVT41411500101	08/26/2014	08/26/2015
MP5:	RF Coax Cable	Megaphase	G919-N1N1-310	1GVT41411500102	08/26/2014	08/26/2015
200108:	Preamplifier, 20 MHz to 18 GHz, 40 dB	A.H. Systems	PAM-0118	199	02/10/2014	02/10/2015

### Software Utilized:

Name	Manufacturer	Version
Tile	Quantum Change	3.4.K.22

### 9.3 Results:

Fundamental Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/com)
40.66 - 40.7	2,250	225
70 - 130	1,250	125
130- 174	<sup>1</sup> 1,250 to 3,750	<sup>1</sup> 125 to 375
174 - 260	3,750	375
260 - 470	<sup>1</sup> 3,750 to 12,500	<sup>1</sup> 375 to 1,250
Above 470	12,500	1,250
<sup>1</sup> Linear Interpolations		

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.

Fundamental Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.		

The sample tested was found to Comply.

**9.4 Setup Photographs:**



**9.5 Plots/Data:**

<p><b>Client:</b> Qolsys Inc  <b>Model Number:</b> QS-1100  <b>Project Number:</b> G101052328  <b>Tested By:</b> MS  <b>Date:</b> 10/30/14  <b>Frequency Range (MHz):</b> 1000-3200  <b>Input power:</b> 2 coin cell batteries</p>	<p><b>Receiver:</b> R&amp;S ESU 40  <b>Antenna:</b> EMCO 3115  <b>Cables:</b> MP4+MP5  <b>Preamp:</b> PAM-0118  <b>Limit:</b> FCC15 Class B-3m  <b>Test Distance (m):</b> 3  <b>Modifications for compliance (y/n):</b> n</p>
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Notes: Sample 1 of 2

A	B	C	D	E	F	G	H	I	J	K
Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Duty Cycle Factor dB	Net dB(uV/m)	3m Limit dB(uV/m)	Margin dB	Axis / Detector
H	1278.000	61.4	25.4	4.4	40.9	0.0	50.3	75.9	-25.6	X/PK
H	1278.000	61.4	25.4	4.4	40.9	23.0	27.3	55.9	-28.6	X/AVG
H	1597.500	58.8	25.7	4.9	40.9	0.0	48.4	74.0	-25.6	X/PK
H	1597.500	58.8	25.7	4.9	40.9	23.0	25.4	54.0	-28.6	X/AVG
H	1917.000	50.0	27.4	5.5	41.1	0.0	41.8	75.9	-34.1	X/PK
H	1917.000	50.0	27.4	5.5	41.1	23.0	18.8	55.9	-37.1	X/AVG
H	2236.500	60.7	27.7	5.9	41.0	0.0	53.2	74.0	-20.8	X/PK
H	2236.500	60.7	27.7	5.9	41.0	23.0	30.2	54.0	-23.8	X/AVG
H	2556.000	50.4	28.6	6.4	41.1	0.0	44.3	75.9	-31.6	X/PK
H	2556.000	50.4	28.6	6.4	41.1	23.0	21.3	55.9	-34.6	X/AVG
H	2875.500	49.0	28.9	6.7	41.1	0.0	43.5	74.0	-30.5	X/PK
H	2875.500	49.0	28.9	6.7	41.1	23.0	20.4	54.0	-33.6	X/AVG
<b>Calculations</b>		H=C+D+E-F-G			J=H-I					

Note: EUT was placed in the X, Y and Z orthogonal axes. Worst case data presented in table.

<p><b>Test Personnel:</b> Mary Sampson <i>MTS</i>  <b>Supervising/Reviewing Engineer:</b>          (Where Applicable) N/A  <b>Product Standard:</b> 47 CFR Part 15 Subpart C:2014 Section 15.231(b) and RSS-210 Issue 8, 2010, Section A1.1.2  <b>Input Voltage:</b> 2 "CR2032" batteries  <b>Pretest Verification w/ Ambient Signals or BB Source::</b> <b>BB source</b></p>	<p><b>Test Date:</b> 10/30/14  <b>Limit Applied:</b> See section 9.3  <b>Ambient Temperature:</b> 21 °C  <b>Relative Humidity:</b> 43 %  <b>Atmospheric Pressure:</b> 983 mbars</p>
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Deviations, Additions, or Exclusions: None



## 10 Bandwidth

### 10.1 Method

Tests are performed in accordance with 47 CFR Part 15 Subpart C:2014 Section 15.231(c) and RSS-210 Issue 8, 2010, Section A1.1.3.

**TEST SITE:** 10m Semi-Anechoic Chamber Control Room

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

### 10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200162:	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014

#### Software Utilized:

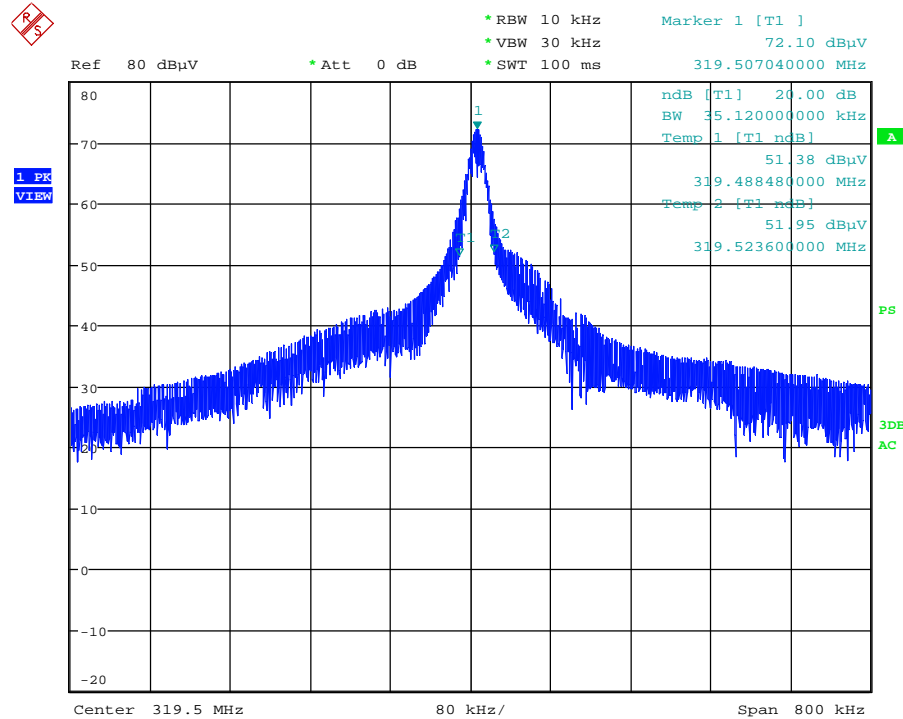
Name	Manufacturer	Version
None (Spectrum Analyzer Firmware)		

### 10.3 Results:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

The sample tested was found to Comply.

**10.4 Data:**



Date: 10.NOV.2014 10:41:03

Test Personnel: Mary Sampson MTS  
 Supervising/Reviewing Engineer: \_\_\_\_\_  
 (Where Applicable) N/A  
 Product Standard: 47 CFR Part 15 Subpart C:2014 Section 15.231(c) and RSS-210 Issue 8, 2010, Section A1.1.3  
 Input Voltage: 2 "CR2032" batteries

Test Date: 11/10/14  
 Test Levels: See Section 10.3  
 Ambient Temperature: 21.5 °C  
 Relative Humidity: 35 %  
 Atmospheric Pressure: 982 mbars

Deviations, Additions, or Exclusions: None

## 11 Duty Cycle

### 11.1 Method

Tests are performed in accordance with 47 CFR Part 15 Subpart C:2014 Section 15.35(c) and RSS-GEN Issue 3, 2010, Section 4.5.

**TEST SITE:** 10m Semi-Anechoic Chamber Control Room

**The EMC Lab** has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

### 11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
20016:2	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014

#### Software Utilized:

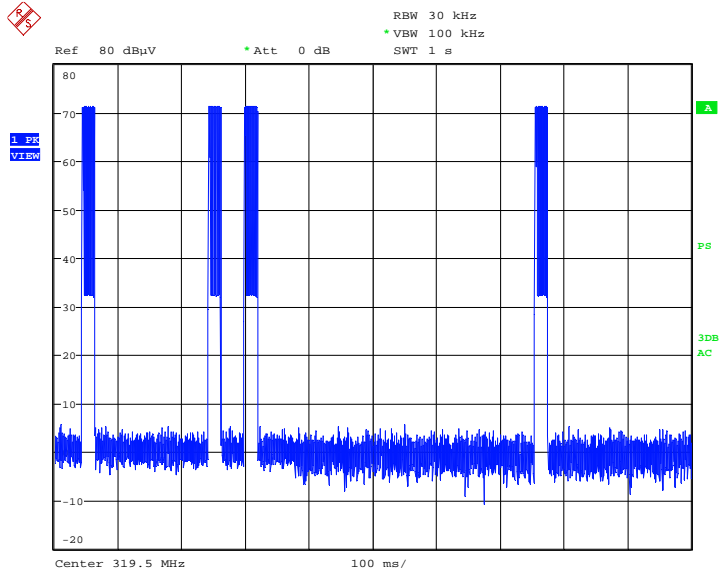
Name	Manufacturer	Version
None (Spectrum Analyzer Firmware)		

### 11.3 Results:

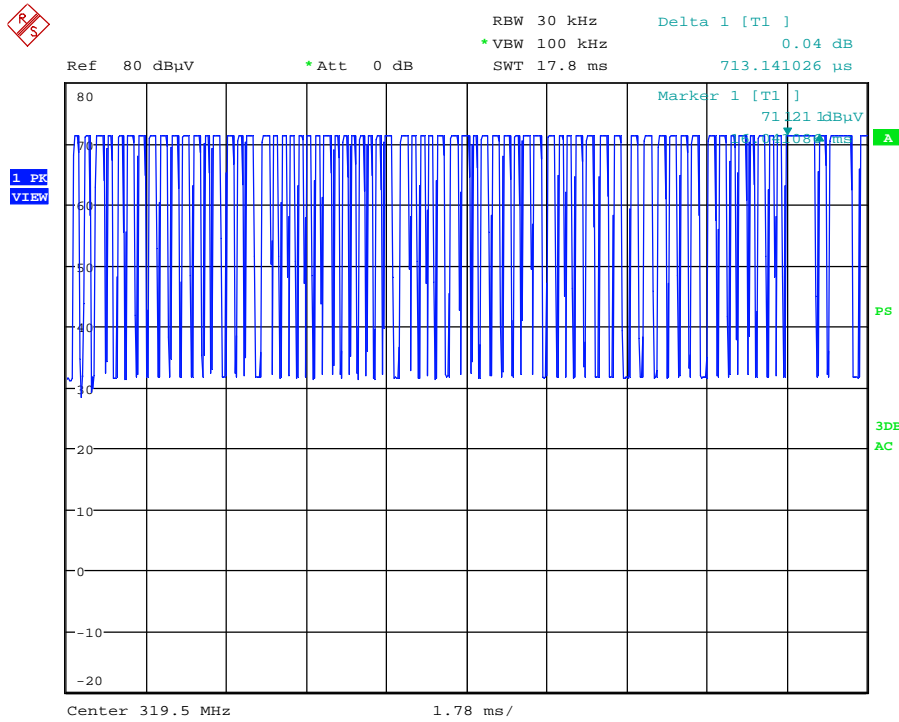
Unless otherwise specified, e.g., § 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

The sample tested was found to Comply.

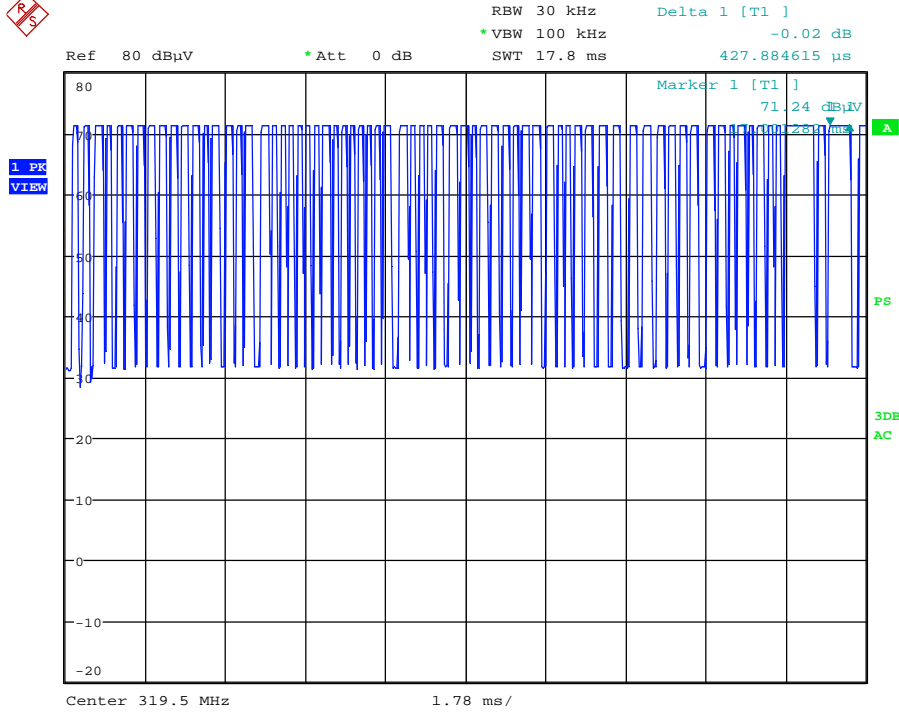
11.4 Data:



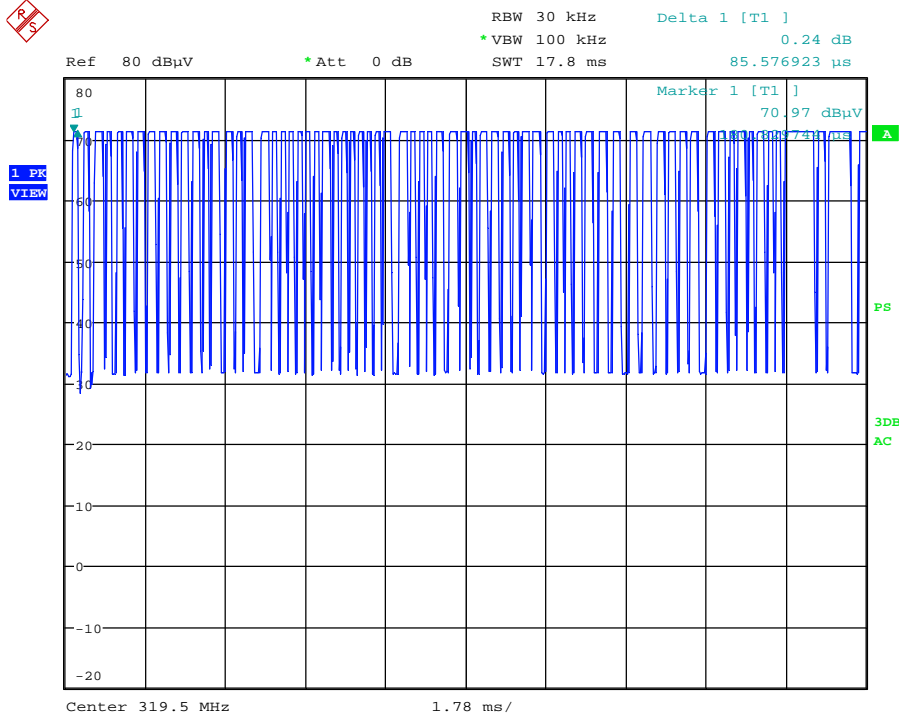
Date: 10.NOV.2014 09:54:13



Date: 10.NOV.2014 09:59:51



Date: 10.NOV.2014 10:00:34



Date: 10.NOV.2014 10:01:27

Duty cycle correction factor =  
1 pulse at .713141026 ms + 1 pulse at 0.427884615 ms + 69 pulses at .085576923 ms/100 ms =  
0.07045833328  
Duty correction factor = 20 log (0.07045833328) = -23.04 dB

Test Personnel: Mary Sampson *MTS*  
Supervising/Reviewing Engineer: \_\_\_\_\_  
(Where Applicable) N/A  
Product Standard: 47 CFR Part 15 Subpart A:2014 Section 15.35(c) and RSS-Gen Issue 4, 2014, Section 6.10  
Input Voltage: 2 "CR2032" batteries

Test Date: 11/10/14  
:  
Test Levels: See Section 11.3  
Ambient Temperature: 21.5 °C  
Relative Humidity: 35 %  
Atmospheric Pressure: 982 mbars

Deviations, Additions, or Exclusions: None

## 12 RF Exposure

SAR test exclusion threshold formula according to FCC KDB 447898 D01 v05r02 is

$$P \cdot \sqrt{f/d} < 3$$

where

*P* is max. power of channel, including tune-up tolerance, mW

*f* is operating frequency in GHz

*d* is min. test separation distance, mm

The maximum measured radiated power is 0.433 mW (-3.63 dBm). The antenna gain, G is 3.88 dBi (2.3 numerical). Therefore, the conducted power (P) is 0.177 mW.

At 5mm distance the condition for SAR exclusion threshold is

$$0.177 \times \sqrt{0.3195} \div 5 = 0.01 \text{ which is less than } 3.$$

Therefore, SAR testing is not required as the SAR Test Exclusion Threshold condition is satisfied.

SAR Exemption limit according to IC RSS-102 Issue 5, at 5 mm separation distance = 68.5 mW  
Routine evaluation is not required since the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time averaged output power is below the exemption limit.

**13 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	11/25/14	101052328ATL-007B	MS <i>MTS</i>	KV	Original Issue
1	04/09/2015	101052328ATL-007B	MS <i>MTS</i>	KV	Revised Section 12