

## TEST REPORT

**Report Number:** 101773309LAX-001b  
**Project Number:** G101773309

**Report Issue Date:** August 29, 2014

**Product Designation:** Recessed Door Sensor  
Model: WST-221

**Standards:** FCC Part 15.231  
Industry Canada RSS 210 Issue 8, December 2010

**FCC ID:** XQC-WST221  
**IC ID:** 9863B-WST221

**Tested by:**  
Intertek Testing Services NA, Inc.  
25791 Commercentre Drive  
Lake Forest, CA 92630 USA

**Client:**  
Ecolink  
2055 Corte Del Nogal  
Carlsbad, CA 92011 USA

**Report prepared by**



Meak Nget  
EMC Engineering Supervisor

**Report reviewed by**



Krishna K Vemuri  
EMC 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 3.0. 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 found **to comply** 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

TEST	FCC REFERENCE	IC REFERENCE	Test Date	RESULTS
Radiated Emission	15.231(b)	RSS-210 A1.1.2	08/06/2014 to 08/20/2014	Complies
Out of Band Radiated Emission	15.231(b)	RSS-210 A1.1.2	08/06/2014 to 08/20/2014	Complies
AC Conducted Emission	15.207	RSS-Gen (6.1)	Not Applicable*	Not Applicable*
20 dB / 99% Bandwidth	15.231(c)	RSS-210 A1.1.3	08/07/2014	Complies
Transmitter Deactivation Time	15.231(a)	RSS-210 A1.1.1(a)	08/07/2014	Complies
Antenna Requirement	15.203	-	08/07/2014	Complies

(\*) Test not applicable due to the EUT being battery operated.

### 3 Client Information

This EUT was tested at the request of:

**Company:** Ecolink  
2055 Corte Del Nogal  
Carlsbad, CA 92011 USA

**Contact Person:** Mike Bailey

**Telephone:** (877) 285-5448

**Email:** mikeb@discoverecolink.com

#### 3.1 Overview of the EUT:

Applicant:	Ecolink
Product Description:	Recessed door sensor
Model Number:	WST-221
FCC Identifier:	XQC-WST221
IC Identifier:	9863B-WST221
Transmitter activation:	Manually operated. Deactivates within 5 seconds of being released.
Fundamental Frequency (MHz):	319.5 MHz
Antenna Requirement:	The EUT uses a permanently connected internal antenna.
Manufacturer name & address:	Ecolink 2055 Corte Del Nogal Carlsbad, CA 92011 USA

#### 3.2 Environmental Conditions:

During the measurement the environmental conditions were within the listed ranges:

**Temperature:** 10-40 ° C

**Humidity:** 10-90 %

**Atmospheric pressure:** 86-106 kPa

### **3.3 Measurement Uncertainty**

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of  $k = 2$ , providing a confidence level of respectively 95% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

The expanded uncertainty ( $k = 2$ ) for radiated emissions from 30 to 1000 MHz has been determined to be:  $\pm 4.2$  dB at 3m

The expanded uncertainty ( $k = 2$ ) for conducted emissions from 150 kHz to 30 MHz has been determined to be:  $\pm 2.6$  dB

### **3.4 Statement of the Measurement Uncertainty**

The measured result in this report is within the specification limits by more than the measurement uncertainty; the measured result indicates that the product tested complies with the specification limit.

**4 Description of Equipment Under Test**

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Recessed Door Sensor	Ecolink	WST-221	N/A

Received Date:	08/04/2014
Received Condition:	Good
Type:	Production Sample

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Frequency	Number of Phases
3VDC Battery Operated	NA	NA	NA

**Operating modes of the EUT:**

No.	Descriptions of EUT Exercising
1	Normal mode of operation: <ul style="list-style-type: none"> <li>➤ Trigger switch to activate momentary operation</li> </ul>
2	Continuous Transmit Mode

**4.1 Justification:**

For emission testing, the test procedures, as described in American National Standards Institute C63.4-2009 & C63.10-2009 were employed. The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it).

If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is configured to transmit full power.

Each test was performed with a new battery.

**4.2 Software Exercise Program:**

No special software program was required to exercise the EUT.

**4.3 Modifications Required for Compliance:**

No modifications were made by Intertek.

**4.4 Additions, Deviations and Exclusions from Standards:**

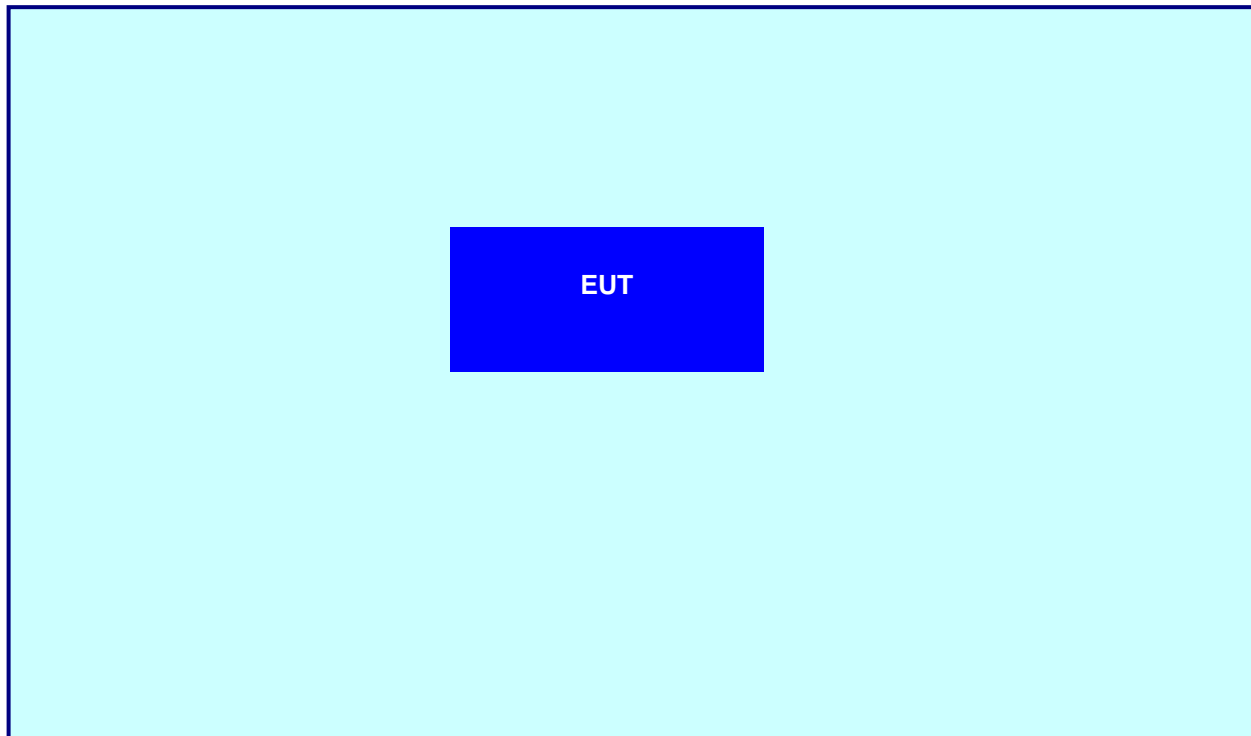
No additions, deviations or exclusions from the standard were made.

**5 System setup including cable interconnection details, support equipment and simplified block diagram**

**5.1 Method:**

Record the details of EUT cabling, document the support equipment, and show the interconnections in a block diagram.

**5.2 EUT Block Diagram:**



**5.3 Data:**

ID	Description	Length	Shielding	Ferrites
1	N/A	N/A	N/A	N/A

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
N/A	N/A	N/A	N/A

## 6 Radiated Emissions (FCC Part 15.231)

<b>Date:</b>	08/06/2014 to 08/20/2014	<b>Result:</b> Complies
<b>Tested by:</b>	Meak Nget	
<b>Standard:</b>	FCC Part 15.231(b)	
<b>Test Point:</b>	Anechoic Chamber 3 meters distance	
<b>Operation mode:</b>	See Section 4	
<b>Note:</b>	Battery Operated	

### 6.1 General:

Tests are performed in accordance with FCC Part 15.231(b).

Radiated emissions measurements were performed according to the procedures in ANSI C63.10 (2009). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

### 6.2 Related Submittal(s) Grants:

This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application: WST-221 (Recessed door sensor).

### 6.3 Test Facility:

The 3 meter semi-anechoic chamber used to collect the radiated data is located in 25791 Commercentre Drive, Lake Forest, CA 92630 USA. This test facility is on file with the FCC and A2LA accredited.

### 6.4 Sample Calculation:

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:  
 $FS = RA + AF + CF - AG + DCF$  (Duty Cycle Factor used in Average measurements)

Where: FS = Field Strength in dB ( $\mu V/m$ )  
 RA = Receiver Amplitude (including preamplifier) in dB ( $\mu V$ )  
 CF = Cable Attenuation Factor in dB  
 AF = Antenna Factor in dB (1/m)  
 AG = Amplifier Gain in dB  
 DCF = Duty Cycle Factor (used in Average measurements)

### 6.5 Bench Top Measurement:

***DCF = Duty Cycle Factor (used in Average measurements)***

- 1) Use the marker - delta function to determine the total transmission ON time (t), and period of the transmission (T).
- 2) If  $T < 0.1$  second, calculate the Duty Cycle correction factor as  $20\text{Log}(t/T)$ .
- 3) If  $T > 0.1$  second, calculate the Duty Cycle correction factor as  $20\text{Log}(t/0.1)$ .



**6.6 Radiated Emission:**

FCC Rule 15.231(b) and RSS-210 A1.1.2

The limit specified in section 15.231(b) was used.

**Procedure**

For radiated emission measurements, the EUT is placed on a plastic table rotated by a turntable. The signal is maximized through rotation and placement in the three orthogonal axes.

During the test the EUT is rotated and the antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Radiated emission measurements were performed from 30 MHz to 5000 MHz.

Analyzer resolution is:

100 kHz or greater for frequencies below 1000 MHz,

1 MHz for frequencies above 1000 MHz.

The Peak and Average values of the Field Strength of the fundamental frequency and harmonics were measured.

A sample calculation, configuration photographs and data tables of the emissions are included.

**6.7 Test Equipment Used:**

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
1140	EMI Test Receiver	Rohde & Schwarz	ESCI7	100825	01/27/2014	01/27/2015
690	FSP Spectrum Analyzer	Rohde & Schwarz	FSP40	100027	01/21/2014	01/21/2015
1445	Preamplifier	A.H.Systems	PAM-0207	266	03/25/2014	03/25/2015
1147	Bilog Antenna	TESEQ	CBL 6112D	32852	02/01/2014	02/01/2015
692	DRG Horn Antenna	ETS Lindgren	3115	00031626	10/15/2013	10/15/2014
1014	Barometer Temp/Humidity	Omega	IBTHX-W	0480395	04/02/2014	04/02/2015

**6.8 Software Utilized:**

Description	Manufacturer	Version
Excel	Microsoft	Office 2010

**6.9 Results:**

- ❖ The sample tested was found to comply.

**6.10 Test Setup Photographs:**

**Setup pictures are confidential and provide as a separate exhibit**

**6.11 Test Setup Photographs:**

**Setup pictures are confidential and provide as a separate exhibit**

Test Setup: X Orthogonal Position

**6.12 Test Setup Photographs:**

**Setup pictures are confidential and provide as a separate exhibit**

Test Setup: Y Orthogonal Position

**Setup pictures are confidential and provide as a separate exhibit**

Test Setup: Z Orthogonal Position

**6.13 Test Data:**

Test: Radiated Emissions  
 Frequency Range: 30 MHz to 5000 MHz  
 Limits: FCC Part 15.231(b)  
 Measurement Distance: 3 meters

Measurement Uncertainty: 4.2 dB  
 Power Input: Battery Operated  
 EUT: WST-221  
 Test Mode: Transmitting continuously

FCC Part 15.231 ( X-Position-Horizontal Polarization)										
Frequency MHz	FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB	Detector Pk/Av	Restricted ✓
319.5	83.58	95.9	-12.3	66.07	0	14.5	3.01	0	Pk	
319.5	63.58	75.9	-12.3	66.07	0	14.5	3.01	-20	Av	
639	45.9	75.9	-30.0	21	0	19.6	5.3	0	Pk	
639	25.9	55.9	-30.0	21	0	19.6	5.3	-20	Av	
958.5	6.33	75.9	-69.6	21.21	45.78	25.2	5.7	0	Pk	
958.5	-13.67	55.9	-69.6	21.21	45.78	25.2	5.7	-20	Av	
1278	20.79	75.9	-55.1	34.41	45.52	25.84	6.06	0	Pk	
1278	0.79	55.9	-55.1	34.41	45.52	25.84	6.06	-20	Av	
1597.5	34.48	74.0	-39.5	43.95	45.33	27.75	8.11	0	Pk	✓
1597.5	14.48	54.0	-39.5	43.95	45.33	27.75	8.11	-20	Av	✓
1917	31.23	75.9	-44.7	39.19	44.83	28.76	8.11	0	Pk	
1917	11.23	55.9	-44.7	39.19	44.83	28.76	8.11	-20	Av	
2236.5	31.98	74.0	-42.0	36.2	44.36	29.96	10.18	0	Pk	✓
2236.5	11.98	54.0	-42.0	36.2	44.36	29.96	10.18	-20	Av	✓
2551	33.85	75.9	-42.1	36.83	44.3	31.14	10.18	0	Pk	
2551	13.85	55.9	-42.1	36.83	44.3	31.14	10.18	-20	Av	
2870.5	34.98	74.0	-39.0	36.2	43.84	32.44	10.18	0	Pk	✓
2870.5	14.98	54.0	-39.0	36.2	43.84	32.44	10.18	-20	Av	✓
3190	39.21	75.9	-36.7	40.39	43.5	32.14	10.18	0	Pk	
3190	19.21	55.9	-36.7	40.39	43.5	32.14	10.18	-20	Av	
Detectors/Bandwidths (Det/RBW/VBW)= (120kHz/300kHz) (1 MHz/3MHz)										

Notes: DCF is stand for Duty Cycle factor  
 Quasi FS – (Final) Quasi Peak Field Strength  
 RA – Receiver (quasi peak) Amplitude  
 AG – Preamp Gain  
 AF – Antenna Factor  
 CF – Cable Factor  
 DCF- Duty Cycle Factor  
**Calculation:** FS=RA+AF+CF-AG+DCF

Test Result: (\*)The EUT PASSED Radiated Emission test with 12.3 dB Av margin at 319.5 MHz.

Deviations, Additions, or Exclusions: NONE

**6.14 Test Data:**

Test: Radiated Emissions  
 Frequency Range: 30 MHz to 5000 MHz  
 Limits: FCC Part 15.231(b)  
 Measurement Distance: 3 meters

Measurement Uncertainty: 4.2 dB  
 Power Input: Battery Operated  
 EUT: WST-221  
 Test Mode: Transmitting continuously

FCC Part 15.231 ( X-Position-Vertical Polarization)										
Frequency MHz	FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB	Detector Pk/Av	Restricted ✓
319.5	83.01	95.9	-12.9	65.5	0	14.5	3.01	0	Pk	
319.5	63.01	75.9	-12.9	65.5	0	14.5	3.01	-20	Av	
639	45.98	75.9	-29.9	21.08	0	19.6	5.3	0	Pk	
639	25.98	55.9	-29.9	21.08	0	19.6	5.3	-20	Av	
958.5	1.92	75.9	-74.0	16.8	45.78	25.2	5.7	0	Pk	
958.5	-18.08	55.9	-74.0	16.8	45.78	25.2	5.7	-20	Av	
1278	21.19	75.9	-54.7	34.81	45.52	25.84	6.06	0	Pk	
1278	1.19	55.9	-54.7	34.81	45.52	25.84	6.06	-20	Av	
1597.5	35.75	74.0	-38.3	45.22	45.33	27.75	8.11	0	Pk	✓
1597.5	15.75	54.0	-38.3	45.22	45.33	27.75	8.11	-20	Av	✓
1917	25.14	75.9	-50.8	33.1	44.83	28.76	8.11	0	Pk	
1917	5.14	55.9	-50.8	33.1	44.83	28.76	8.11	-20	Av	
2236.5	31.2	74.0	-42.8	35.42	44.36	29.96	10.18	0	Pk	✓
2236.5	11.2	54.0	-42.8	35.42	44.36	29.96	10.18	-20	Av	✓
2551	33.53	75.9	-42.4	36.51	44.3	31.14	10.18	0	Pk	
2551	13.53	55.9	-42.4	36.51	44.3	31.14	10.18	-20	Av	
2870.5	35.58	74.0	-38.4	36.8	43.84	32.44	10.18	0	Pk	✓
2870.5	15.58	54.0	-38.4	36.8	43.84	32.44	10.18	-20	Av	✓
3190	44.89	75.9	-31.0	46.07	43.5	32.14	10.18	0	Pk	
3190	24.89	55.9	-31.0	46.07	43.5	32.14	10.18	-20	Av	
Detectors/Bandwidths (Det/RBW/VBW)= (120kHz/300kHz) (1 MHz/3MHz)										

Notes: DCF is stand for Duty Cycle factor  
 Quasi FS – (Final) Quasi Peak Field Strength  
 RA – Receiver (quasi peak) Amplitude  
 AG – Preamp Gain  
 AF – Antenna Factor  
 CF – Cable Factor  
 DCF- Duty Cycle Factor  
**Calculation:** FS=RA+AF+CF-AG+DCF

Test Result: (\*)The EUT PASSED Radiated Emission test with 12.9 dB Av margin at 319.5 MHz.

Deviations, Additions, or Exclusions: NONE

**6.15 Test Data:**

Test: Radiated Emissions  
 Frequency Range: 30 MHz to 5000 MHz  
 Limits: FCC Part 15.231(b)  
 Measurement Distance: 3 meters

Measurement Uncertainty: 4.2 dB  
 Power Input: Battery Operated  
 EUT: WST-221  
 Test Mode: Transmitting continuously

FCC Part 15.231 ( Y-Position-Horizontal Polarization)										
Frequency MHz	FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB	Detector Pk/Av	Restricted ✓
319.5	87.82	95.9	-8.1	70.31	0	14.5	3.01	0	Pk	
319.5	67.82	75.9	-8.1	70.31	0	14.5	3.01	-20	Av	
639	46.16	75.9	-29.7	21.26	0	19.6	5.3	0	Pk	
639	26.16	55.9	-29.7	21.26	0	19.6	5.3	-20	Av	
958.5	9.71	75.9	-66.2	24.59	45.78	25.2	5.7	0	Pk	
958.5	-10.29	55.9	-66.2	24.59	45.78	25.2	5.7	-20	Av	
1278	20.64	75.9	-55.3	34.26	45.52	25.84	6.06	0	Pk	
1278	0.64	55.9	-55.3	34.26	45.52	25.84	6.06	-20	Av	
1597.5	33.07	74.0	-40.9	42.54	45.33	27.75	8.11	0	Pk	✓
1597.5	13.07	54.0	-40.9	42.54	45.33	27.75	8.11	-20	Av	✓
1917	31.96	75.9	-43.9	39.92	44.83	28.76	8.11	0	Pk	
1917	11.96	55.9	-43.9	39.92	44.83	28.76	8.11	-20	Av	
2236.5	34.67	74.0	-39.3	38.89	44.36	29.96	10.18	0	Pk	✓
2236.5	14.67	54.0	-39.3	38.89	44.36	29.96	10.18	-20	Av	✓
2551	33.07	75.9	-42.8	36.05	44.3	31.14	10.18	0	Pk	
2551	13.07	55.9	-42.8	36.05	44.3	31.14	10.18	-20	Av	
2870.5	38.78	74.0	-35.2	40	43.84	32.44	10.18	0	Pk	✓
2870.5	18.78	54.0	-35.2	40	43.84	32.44	10.18	-20	Av	✓
3190	44.77	75.9	-31.1	45.95	43.5	32.14	10.18	0	Pk	
3190	24.77	55.9	-31.1	45.95	43.5	32.14	10.18	-20	Av	
Detectors/Bandwidths (Det/RBW/VBW)=( 120kHz/300kHz) (1 MHz/3MHz)										

Notes: DCF is stand for Duty Cycle factor  
 Quasi FS – (Final) Quasi Peak Field Strength  
 RA – Receiver (quasi peak) Amplitude  
 AG – Preamp Gain  
 AF – Antenna Factor  
 CF – Cable Factor  
 DCF- Duty Cycle Factor

**Calculation:** FS=RA+AF+CF-AG+DCF

Test Result:

(\*)The EUT PASSED Radiated Emission test with 8.1 dB Av margin at 319.5 MHz.

Deviations, Additions, or Exclusions: NONE

**6.16 Test Data:**

Test: Radiated Emissions  
 Frequency Range: 30 MHz to 5000 MHz  
 Limits: FCC Part 15.231(b)  
 Measurement Distance: 3 meters

Measurement Uncertainty: 4.2 dB  
 Power Input: Battery Operated  
 EUT: WST-221  
 Test Mode: Transmitting continuously

FCC Part 15.231 ( Y-Position-Vertical Polarization)										
Frequency MHz	FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB	Detector Pk/Av	Restricted ✓
319.5	77.3	95.9	-18.6	59.79	0	14.5	3.01	0	Pk	
319.5	57.3	75.9	-18.6	59.79	0	14.5	3.01	-20	Av	
639	45.4	75.9	-30.5	20.5	0	19.6	5.3	0	Pk	
639	25.4	55.9	-30.5	20.5	0	19.6	5.3	-20	Av	
958.5	0.62	75.9	-75.3	15.5	45.78	25.2	5.7	0	Pk	
958.5	-19.38	55.9	-75.3	15.5	45.78	25.2	5.7	-20	Av	
1278	21.11	75.9	-54.8	34.73	45.52	25.84	6.06	0	Pk	
1278	1.11	55.9	-54.8	34.73	45.52	25.84	6.06	-20	Av	
1597.5	33.24	74.0	-40.8	42.71	45.33	27.75	8.11	0	Pk	✓
1597.5	13.24	54.0	-40.8	42.71	45.33	27.75	8.11	-20	Av	✓
1917	27.29	75.9	-48.6	35.25	44.83	28.76	8.11	0	Pk	
1917	7.29	55.9	-48.6	35.25	44.83	28.76	8.11	-20	Av	
2236.5	31.5	74.0	-42.5	35.72	44.36	29.96	10.18	0	Pk	✓
2236.5	11.5	54.0	-42.5	35.72	44.36	29.96	10.18	-20	Av	✓
2551	33.72	75.9	-42.2	36.7	44.3	31.14	10.18	0	Pk	
2551	13.72	55.9	-42.2	36.7	44.3	31.14	10.18	-20	Av	
2870.5	35.1	74.0	-38.9	36.32	43.84	32.44	10.18	0	Pk	✓
2870.5	15.1	54.0	-38.9	36.32	43.84	32.44	10.18	-20	Av	✓
3190	43.58	75.9	-32.3	44.76	43.5	32.14	10.18	0	Pk	
3190	23.58	55.9	-32.3	44.76	43.5	32.14	10.18	-20	Av	
Detectors/Bandwidths (Det/RBW/VBW)= (120kHz/300kHz) (1 MHz/3MHz)										

Notes: DCF is stand for Duty Cycle factor  
 Quasi FS – (Final) Quasi Peak Field Strength  
 RA – Receiver (quasi peak) Amplitude  
 AG – Preamp Gain  
 AF – Antenna Factor  
 CF – Cable Factor  
 DCF- Duty Cycle Factor

**Calculation:** FS=RA+AF+CF0-AG+DCF

Test Result:

(\*)The EUT PASSED Radiated Emission test with 18.6 dB Av margin at 319.5 MHz

Deviations, Additions, or Exclusions: NONE

**6.17 Test Data:**

Test: Radiated Emissions  
 Frequency Range: 30 MHz to 5000 MHz  
 Limits: FCC Part 15.231(b)  
 Measurement Distance: 3 meters

Measurement Uncertainty: 4.2 dB  
 Power Input: Battery Operated  
 EUT: WST-221  
 Test Mode: Transmitting continuously

FCC Part 15.231 ( Z-Position-Horizontal Polarization)										
Frequency MHz	FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB	Detector Pk/Av	Restricted ✓
319.5	78.25	95.9	-17.7	60.74	0	14.5	3.01	0	Pk	
319.5	58.25	75.9	-17.7	60.74	0	14.5	3.01	-20	Av	
639	44.9	75.9	-31.0	20	0	19.6	5.3	0	Pk	
639	24.9	55.9	-31.0	20	0	19.6	5.3	-20	Av	
958.5	0.66	75.9	-75.2	15.54	45.78	25.2	5.7	0	Pk	
958.5	-19.34	55.9	-75.2	15.54	45.78	25.2	5.7	-20	Av	
1278	20.78	75.9	-55.1	34.4	45.52	25.84	6.06	0	Pk	
1278	0.78	55.9	-55.1	34.4	45.52	25.84	6.06	-20	Av	
1597.5	29	74.0	-45.0	38.47	45.33	27.75	8.11	0	Pk	✓
1597.5	9	54.0	-45.0	38.47	45.33	27.75	8.11	-20	Av	✓
1917	26.33	75.9	-49.6	34.29	44.83	28.76	8.11	0	Pk	
1917	6.33	55.9	-49.6	34.29	44.83	28.76	8.11	-20	Av	
2236.5	32.49	74.0	-41.5	36.71	44.36	29.96	10.18	0	Pk	✓
2236.5	12.49	54.0	-41.5	36.71	44.36	29.96	10.18	-20	Av	✓
2551	33.65	75.9	-42.3	36.63	44.3	31.14	10.18	0	Pk	
2551	13.65	55.9	-42.3	36.63	44.3	31.14	10.18	-20	Av	
2870.5	34.69	74.0	-39.3	35.91	43.84	32.44	10.18	0	Pk	✓
2870.5	14.69	54.0	-39.3	35.91	43.84	32.44	10.18	-20	Av	✓
3190	34.37	75.9	-41.5	35.55	43.5	32.14	10.18	0	Pk	
3190	14.37	55.9	-41.5	35.55	43.5	32.14	10.18	-20	Av	
Detectors/Bandwidths (Det/RBW/VBW)= (120kHz/300kHz) (1 MHz/3MHz)										

Notes: DCF is stand for Duty Cycle factor  
 Quasi FS – (Final) Quasi Peak Field Strength  
 RA – Receiver (quasi peak) Amplitude  
 AG – Preamp Gain  
 AF – Antenna Factor  
 CF – Cable Factor  
 DCF- Duty Cycle Factor  
**Calculation:** FS=RA+AF+CF-AG+DCF

Test Result: (\*)The EUT PASSED Radiated Emission test with 17.7 dB Av margin at 319.5 MHz.

Deviations, Additions, or Exclusions: NONE



**6.18 Test Data:**

Test: Radiated Emissions  
 Frequency Range: 30 MHz to 5000 MHz  
 Limits: FCC Part 15.231(b)  
 Measurement Distance: 3 meters

Measurement Uncertainty: 4.2 dB  
 Power Input: Battery Operated  
 EUT: WST-221  
 Test Mode: Transmitting continuously

FCC Part 15.231 ( Z-Position-Vertical Polarization)										
Frequency MHz	FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	AG dB	AF dB(1/m)	CF dB	DCF dB	Detector Pk/Av	Restricted ✓
319.5	86.02	95.9	-9.9	68.51	0	14.5	3.01	0	Pk	
319.5	66.02	75.9	-9.9	68.51	0	14.5	3.01	-20	Av	
639	44.84	75.9	-31.1	19.94	0	19.6	5.3	0	Pk	
639	24.84	55.9	-31.1	19.94	0	19.6	5.3	-20	Av	
958.5	8.88	75.9	-67.0	23.76	45.78	25.2	5.7	0	Pk	
958.5	-11.12	55.9	-67.0	23.76	45.78	25.2	5.7	-20	Av	
1278	20.35	75.9	-55.6	33.97	45.52	25.84	6.06	0	Pk	
1278	0.35	55.9	-55.6	33.97	45.52	25.84	6.06	-20	Av	
1597.5	36.53	74.0	-37.5	46	45.33	27.75	8.11	0	Pk	✓
1597.5	16.53	54.0	-37.5	46	45.33	27.75	8.11	-20	Av	✓
1917	32.46	75.9	-43.4	40.42	44.83	28.76	8.11	0	Pk	
1917	12.46	55.9	-43.4	40.42	44.83	28.76	8.11	-20	Av	
2236.5	32.17	74.0	-41.8	36.39	44.36	29.96	10.18	0	Pk	✓
2236.5	12.17	54.0	-41.8	36.39	44.36	29.96	10.18	-20	Av	✓
2551	32.68	75.9	-43.2	35.66	44.3	31.14	10.18	0	Pk	
2551	12.68	55.9	-43.2	35.66	44.3	31.14	10.18	-20	Av	
2870.5	35.31	74.0	-38.7	36.53	43.84	32.44	10.18	0	Pk	✓
2870.5	15.31	54.0	-38.7	36.53	43.84	32.44	10.18	-20	Av	✓
3190	39.38	75.9	-36.5	40.56	43.5	32.14	10.18	0	Pk	
3190	19.38	55.9	-36.5	40.56	43.5	32.14	10.18	-20	Av	
Detectors/Bandwidths (Det/RBW/VBW)=( 120kHz/300kHz) (1 MHz/3MHz)										

Notes: DCF is stand for Duty Cycle factor  
 Quasi FS – (Final) Quasi Peak Field Strength  
 RA – Receiver (quasi peak) Amplitude  
 AG – Preamp Gain  
 AF – Antenna Factor  
 CF – Cable Factor  
 DCF- Duty Cycle Factor

**Calculation:** FS=RA+AF+CF-AG+DCF

Test Result: (\*)The EUT PASSED Radiated Emission test with 9.9 dB Av margin at 319.5 MHz.

Deviations, Additions, or Exclusions: NONE

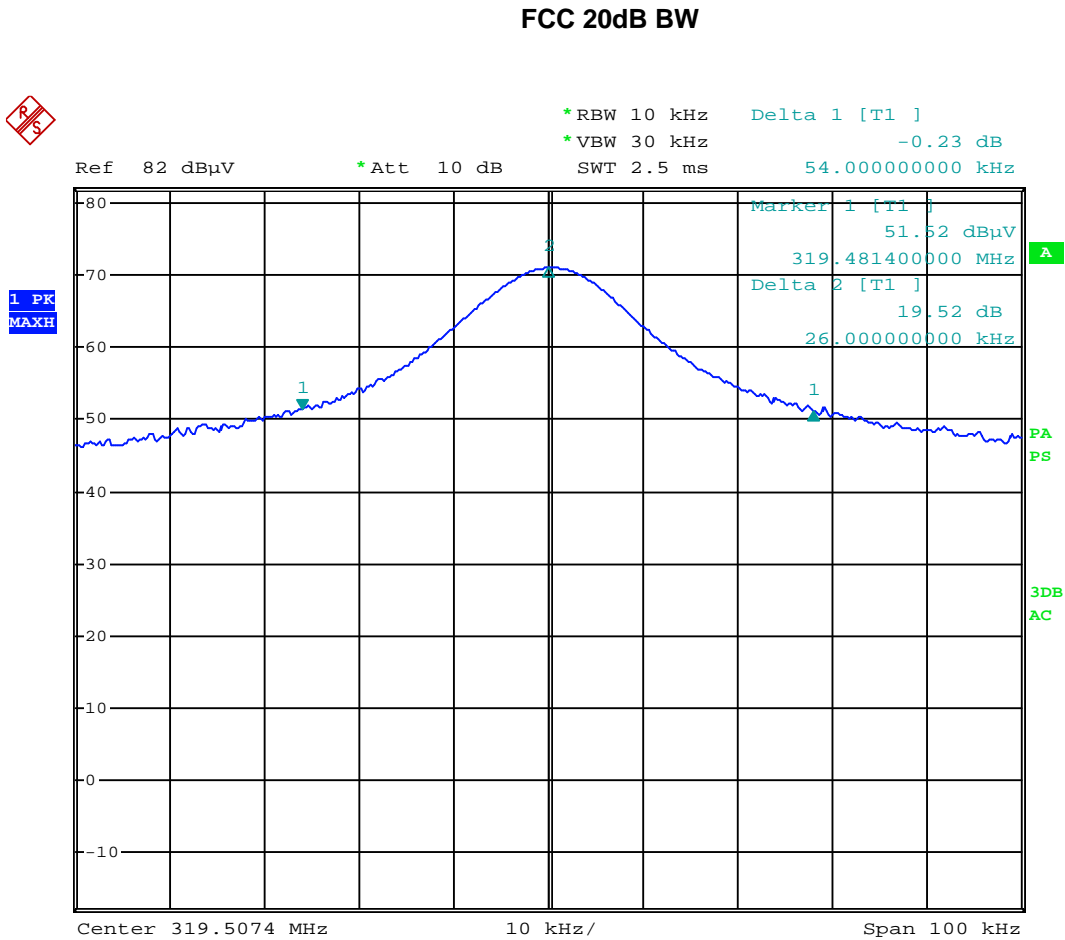
### 6.19 Occupied Bandwidth:

The 15.231(c) emission bandwidth requirement: No wider than 0.25% of the fundamental frequency of 319.50 MHz. Limit is 798.75 kHz.

The worst-case (widest) emission bandwidth at -20 dB from the reference level is 54 kHz.

#### Test Results: Pass

The following plot shows the emission bandwidth of the transmitter:



20dB OBW, WST-221

Date: 7.AUG.2014 10:17:16

### 6.20 99% Occupied Bandwidth per RSS-210 A1.1.3:

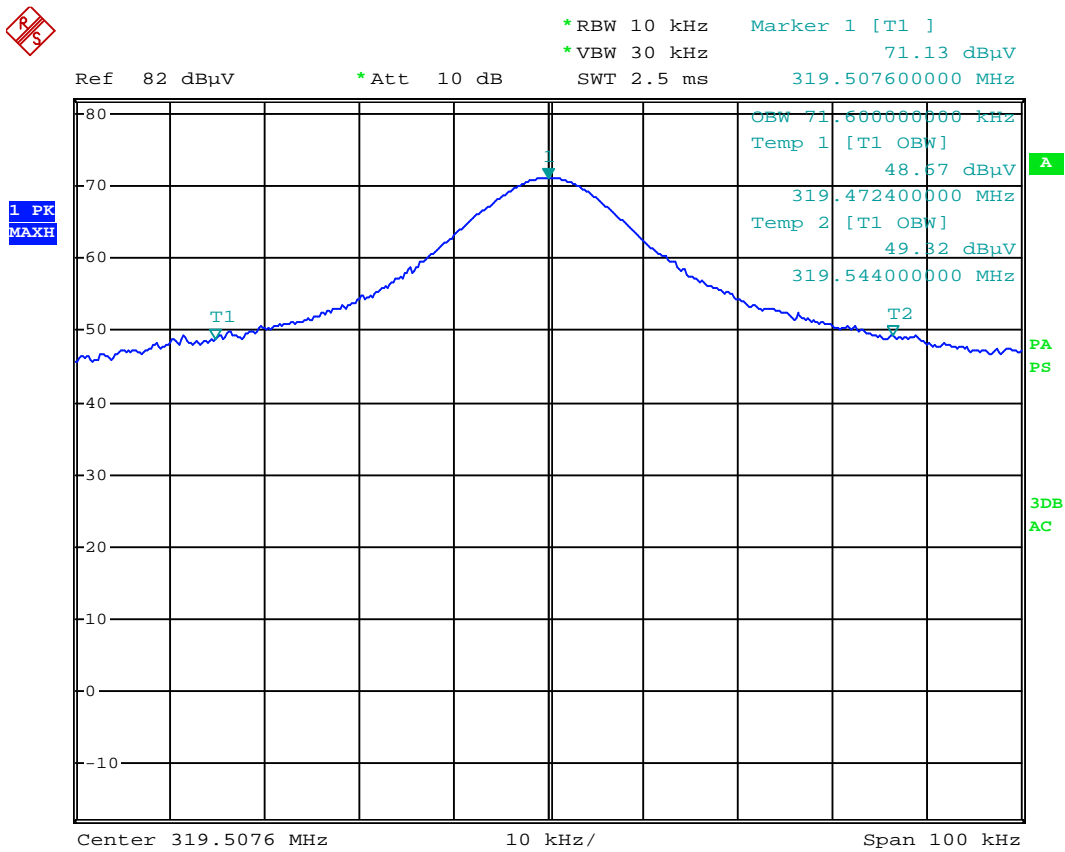
Industry Canada Occupied Bandwidth measured at 99% must be no wider than 0.25% of the fundamental frequency of 319.5 MHz. Limit is 798.75kHz.

The worst-case (widest) emission 99% occupied bandwidth is 71.6 kHz.

#### Test Result: Pass

The following plot shows the emission bandwidth of the transmitter:

IC 99% OBW



99% OBW, WST-221

Date: 7.AUG.2014 10:14:49

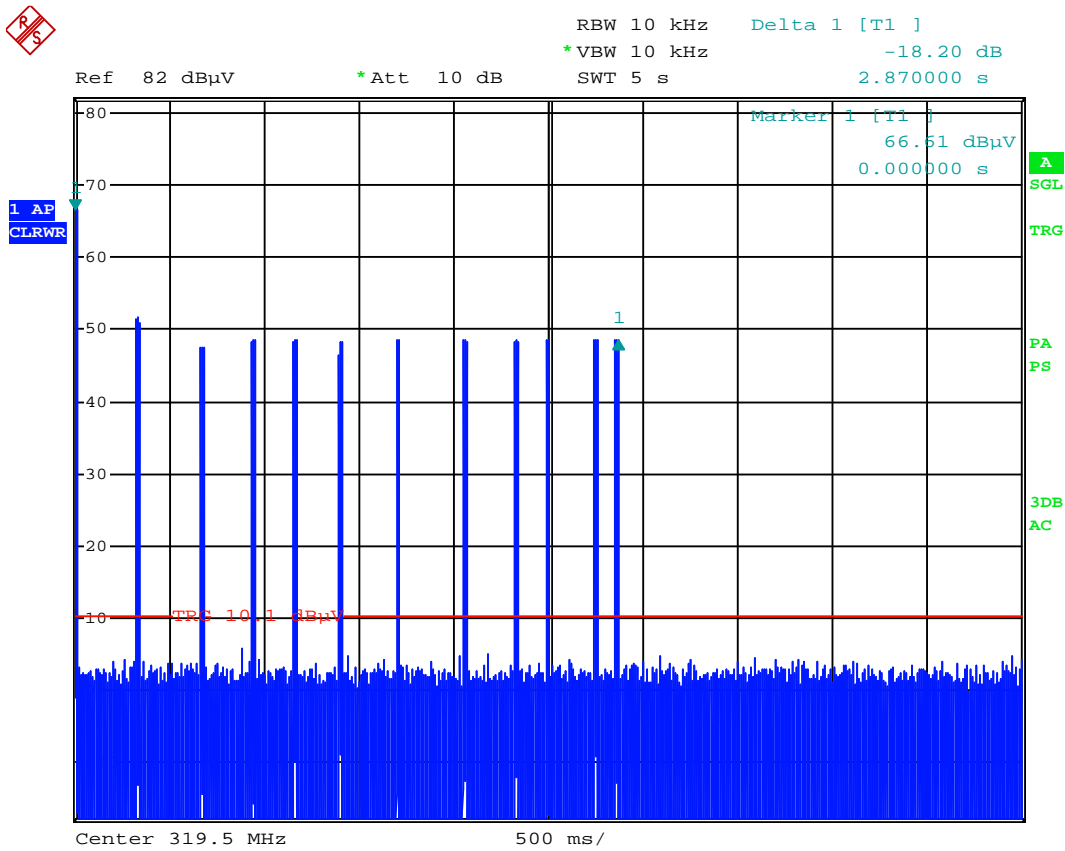
6.21 Transmitter Deactivation Time:

FCC Rule 15.231(a) and RSS-210 A1.1.1  
Maximum allowed deactivation time: 5 Seconds

Manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Results: Pass

Recessed door sensor stopped transmitting within not more than 5 seconds of being released. Actual time = 2.87 seconds.



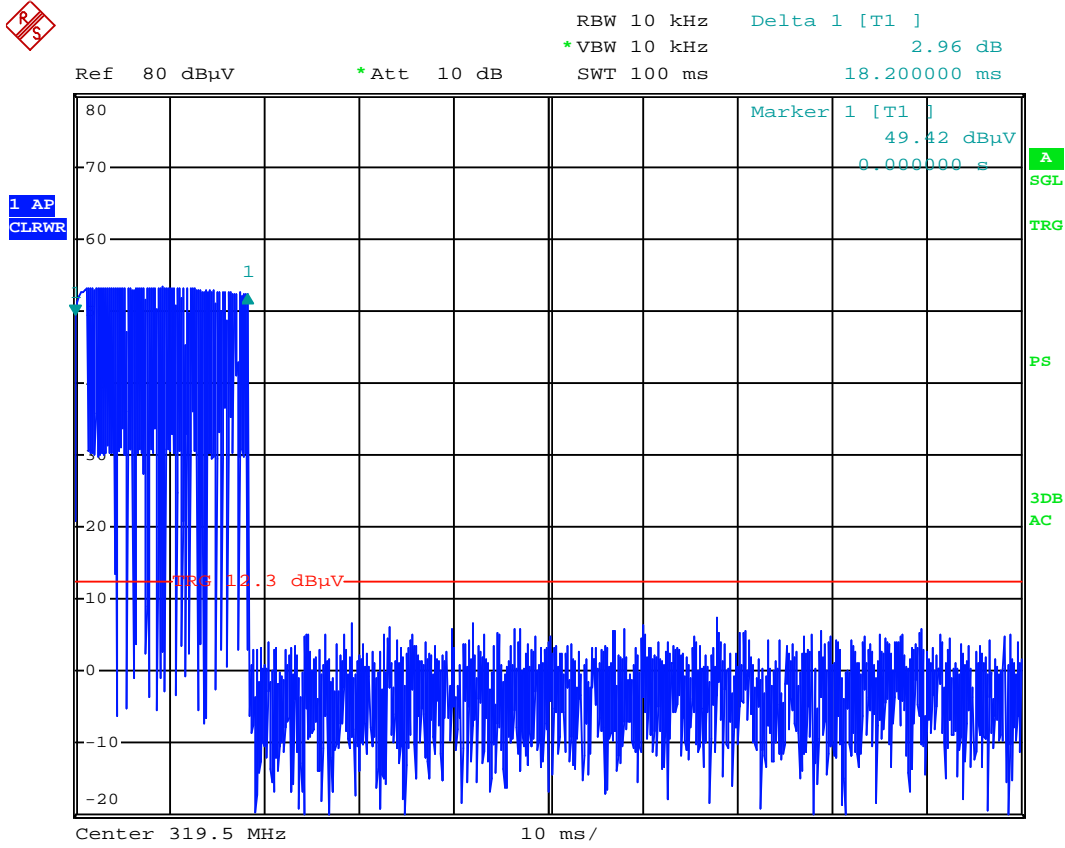
Tx Deactivation, WST-221

Date: 7.AUG.2014 10:50:11

### 6.22 Duty Cycle Time Graphs:

Duty Cycle Measurement over a 100 ms period, with measurements taken at each individual unique pulse occurred throughout the pulse train.

Entire Pulse Train:

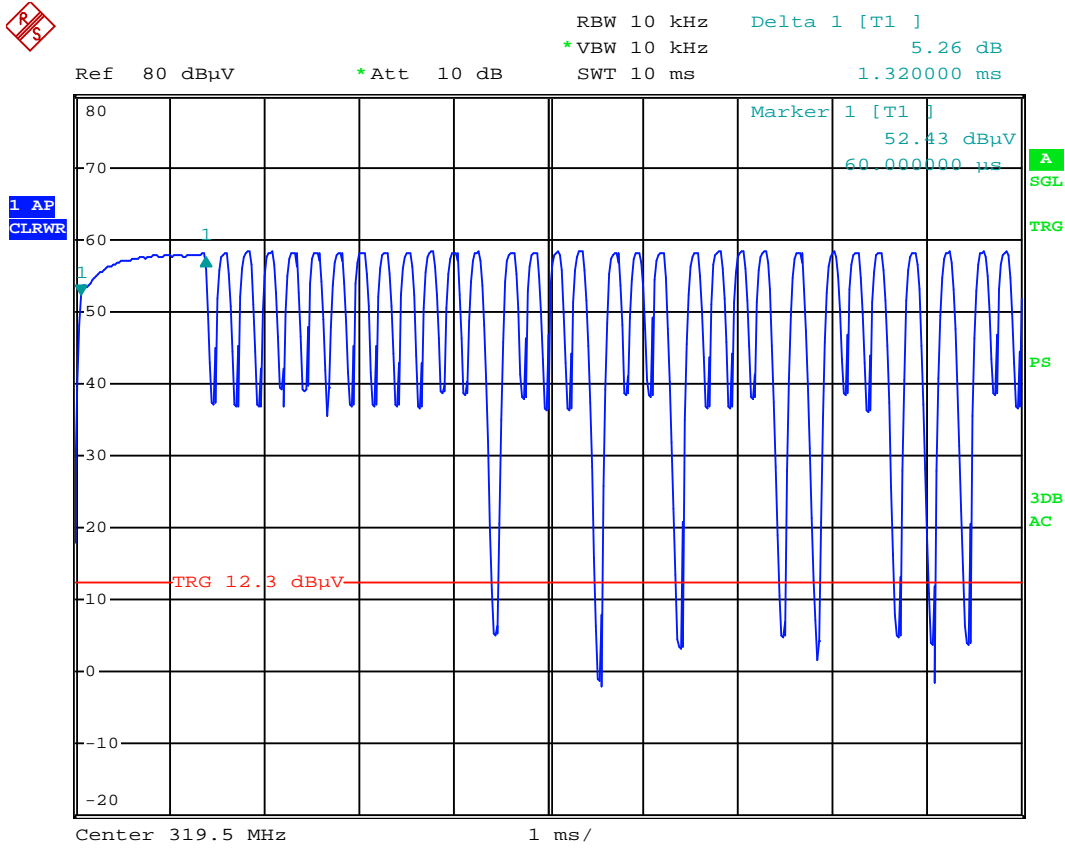


Duty Cycle, WST-221

Date: 7.AUG.2014 12:48:02

6.23 Duty Cycle Time Graphs:

Sub Pulse 1:

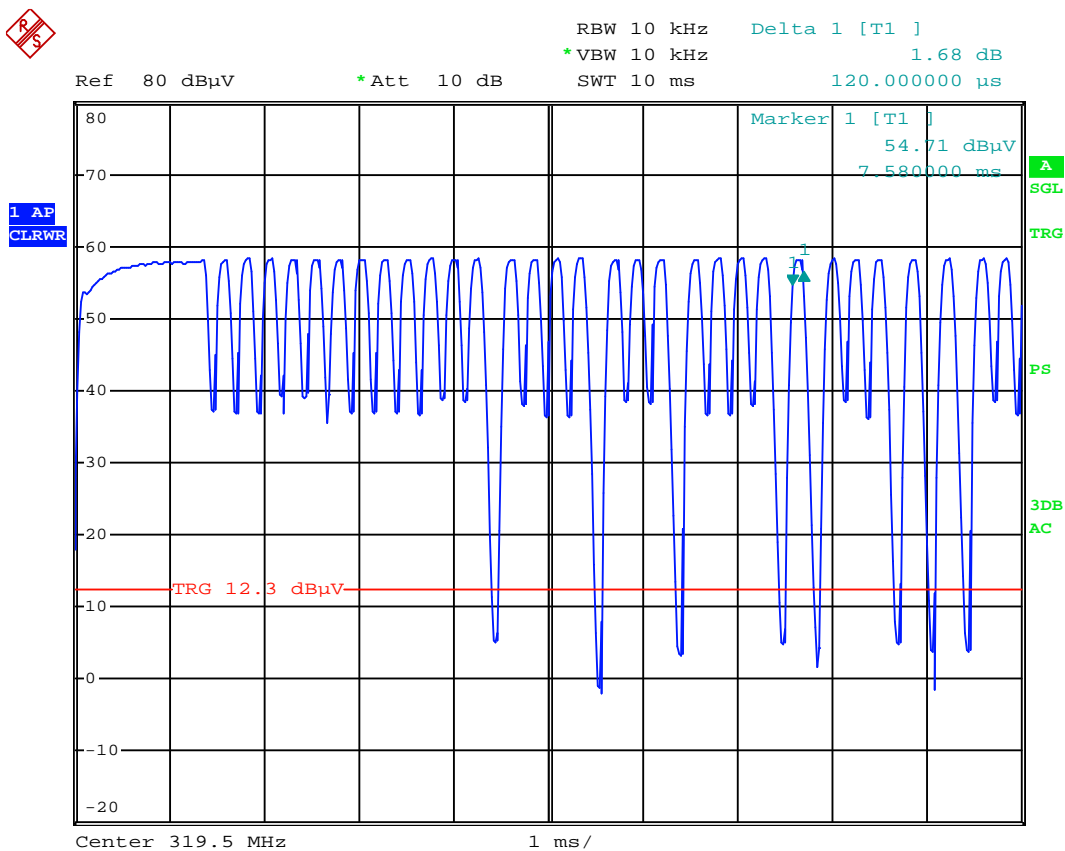


Duty Cycle, WST-221

Date: 7.AUG.2014 12:50:28

### 6.24 Duty Cycle Time Graphs:

Sub Pulse 2:

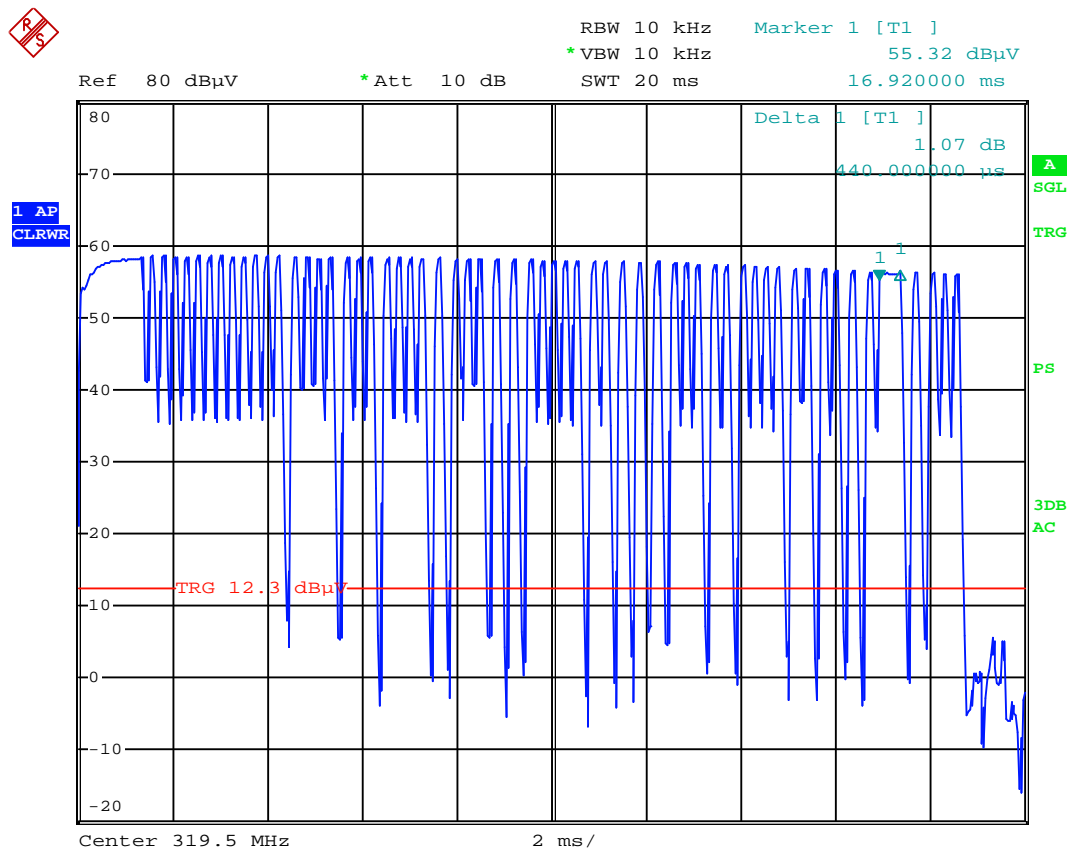


Duty Cycle, WST-221

Date: 7.AUG.2014 12:51:48

### 6.25 Duty Cycle Time Graphs:

Sub Pulse 3:



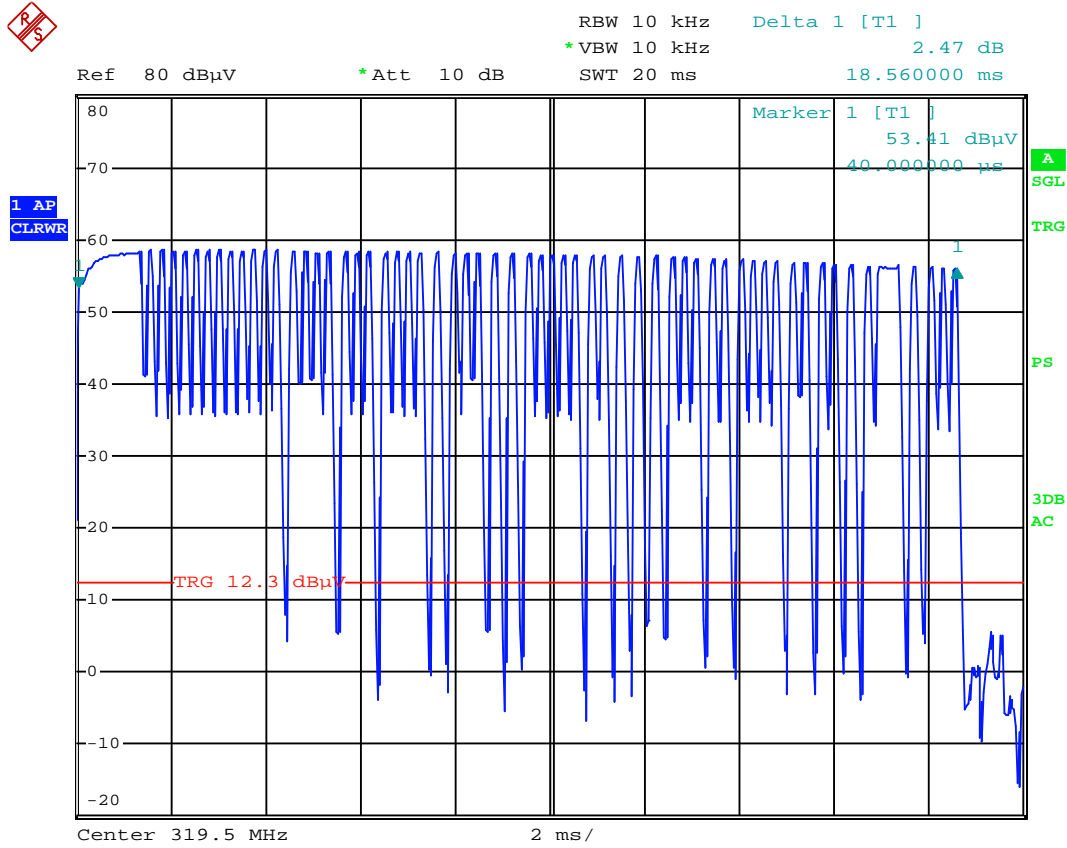
Duty Cycle, WST-221

Date: 7.AUG.2014 12:55:53



### 6.26 Duty Cycle Time Graphs:

Zoom Pulse Train:



Duty Cycle, WST-221

Date: 7.AUG.2014 12:54:07

**6.27 Duty Cycle Time Graphs:**

Duty Cycle Calculation

Sample Calculation:

If  $T \leq 0.1$  second, calculate the Duty Cycle correction factor as  $20\text{Log}(t/T)$ .If  $T > 0.1$  second, calculate the Duty Cycle correction factor as  $20\text{Log}(t/0.1)$ **Result:**

The duty cycle was calculated by measuring one pulse train in a 100 ms period.

Sub-Pulse	Duration (ms)	Number of pulses	Sub-Pulse "On Time" (ms)
1	1.3	1	1.3
2	.12	58	6.96
3	.44	1	.44

Total On Time =  $t = 8.7$  msTotal Period Time =  $T = 100$  ms**Duty Cycle Factor = DCF =  $20\text{log}(t/T) = 20\text{log}(8.7 \text{ ms}/100 \text{ ms}) = -21.2 \text{ dB}$ .****Maximum applied DCF to radiated emissions data = -20 dB**

**7 AC Mains Conducted Emissions (FCC Part 15.207)**

<b>Date:</b>	N/A	<b>Result: N/A</b>
<b>Tested by:</b>	N/A	
<b>Standard:</b>	FCC Part 15.207	
<b>Test Point:</b>	Line 1 and Line 2	
<b>Operation mode:</b>	See Section 4.1	
<b>Note:</b>	Not Applicable. EUT is battery operated	

**7.1 Results:**

- ❖ Not Applicable. The EUT is battery Operated.

**8 Revision History**

Revision Number	Revision Contents	Date	Prepared By	Reviewed By
None				



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## Test Verification of Conformity

On the basis of the tests undertaken, the sample(s) of the below product have been found to comply with the requirements of the referenced specifications at the time the tests were carried out.

**Applicant Name & Address** : Ecolink  
2055 Corte Del Nogal  
Carlsbad, CA 92011 USA

**Product(s) Tested** : Recessed Door Sensor

**Ratings and principal characteristics** : Battery Operated

**Model(s)** : WST-221

**Relevant Standard(s)/Specification(s)** : FCC Part 15.231, Subpart C  
Industry Canada RSS 210 Issue 8, December 2010

**FCC ID** : XQC-WST221  
**IC ID** : 9863B-WST221

**Verification Issuing Office Name & Address** : Intertek Testing Services NA, Inc.  
25800 Commercentre Drive  
Lake Forest, CA 92630 USA

**Date of Test(s)** : 08/05/2014 to 08/20/2014

**Verification/Report Number(s)** : 101773309LAX-001b

**NOTE: This verification is part of the full test report(s) and should be read in conjunction with it.**

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<b>Name:</b>	<b>Meak Nget</b>
<b>Signature</b>	
<b>Position:</b>	<b>EMC Engineering Supervisor</b>
<b>Date:</b>	<b>August 29, 2014</b>

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SD 12.3.1 (4/29/08) Mandatory