FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

WIRELESS DOOR SENSOR

MODEL NUMBER: WST-220

FCC ID: XQC-WST220
IC: 9863B-WST220

REPORT NUMBER: 10382387-A

ISSUE DATE: 2014-07-03

Prepared for
ECOLINK INTELLIGENT TECHNOLOGY, INC.
2055 CORTE DEL NOGAL
CARLSBAD
CA, 92011, U.S.A.

Prepared by
UL LLC
1285 WALT WHITMAN RD.
MELVILLE, NY 11747, U.S.A.
TEL: (631) 271-6200
FAX: (877) 854-3577

NVLAP LAB CODE 100255-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	6/25/14	Initial Issue	M. Antola
A	7/3/14	Updated duty cycle result table	M. Antola

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UL LLC. FORM NO: CCSUP4701D
1285 WALT WHITMAN RD, MELVILLE, NY 11747, USA TEL: (631) 271-6200 FAX: (877) 854-3577

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ECOLINK INTELLIGENT TECHNOLOGY, INC.
2055 CORTE DEL NOGAL
CARLSBAD, CA, 92011, USA

EUT DESCRIPTION: WIRELESS DOOR SENSOR

MODEL: WST-220

SERIAL NUMBER: NON-SERIALIZED PRODUCTION UNIT

DATE TESTED: 6/23/14 – 6/24/14

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 8, Annex 1	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards, using test results reported in the test report documents referenced below and/or documentation furnished by the applicant. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations of these calculations. The results show that the equipment is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation, as described by the referenced documents. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL By:

Bob DeLisi
Program Manager
UL LLC

Tested By:

Mike Antola
Project Lead
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 1285 Walt Whitman Rd. Melville, NY 11747, USA.

UL Melville is accredited by NVLAP, Laboratory Code 100255-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/1002550.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.3 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.00 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a wireless door sensor for installation inside a door or wall as part of a security system or home automation system. The EUT operates at 433.92MHz and is powered from a 3Vdc lithium battery.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral loop PCB trace antenna, with a maximum gain of -15 dBi.

5.3. SOFTWARE AND FIRMWARE

The typical factory firmware installed in the EUT during testing was ESW1065-01-A01.HEX.

The firmware installed in the EUT to allow continuous transmit during testing was ESW1065-01-A01_TEST.HEX.

5.4. WORST-CASE CONFIGURATION AND MODE

The EUT was investigated in each of its three orthogonal axes. All radiated testing was performed in the worse-case axis, which was found to be the “y-axis”. See photos for details.

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

None

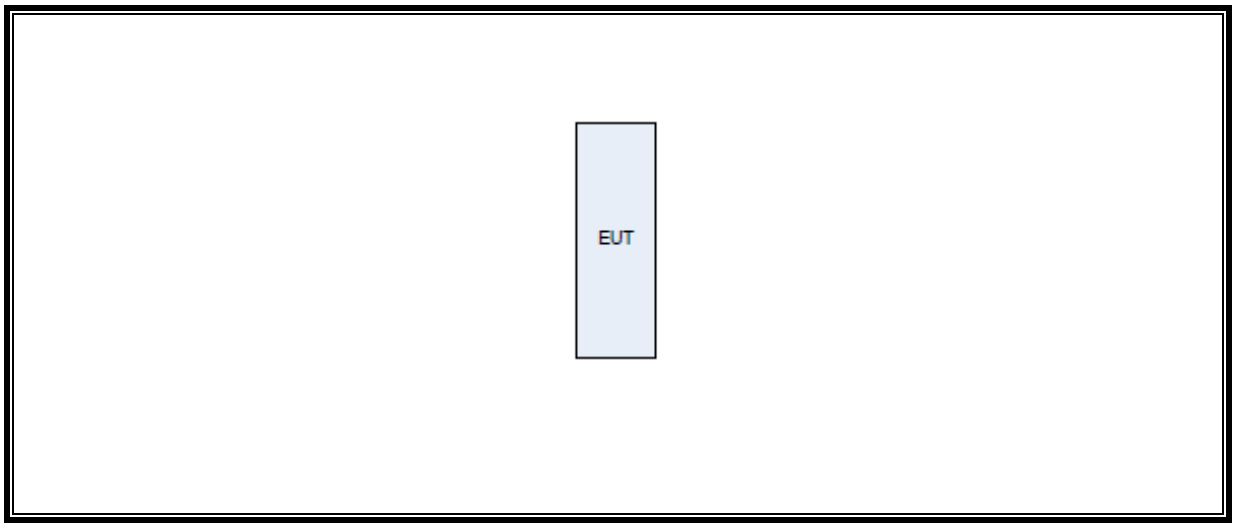
I/O CABLES

None

TEST SETUP

The EUT is a stand-alone device, which operated on a button push.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Radiated Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
9k-30MHz					
EMI Receiver	Rohde & Schwarz	ESCI7	75141	2014-01-29	2015-01-31
Loop Antenna	EMCO	6507	5A-288	2013-12-02	2014-12-02
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESCI7	75141	2014-01-29	2015-01-31
Hybrid Antenna	Sunol	JB-1	84106	2014-02-19	2015-02-19
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31
Above 1GHz (Band Optimized System)					
EMI Receiver	Rohde & Schwarz	ESIB40	34968	2014-04-09	2015-04-09
Horn Antenna (1-2 GHz)	EMCO	RGA-180	ME5-565	2013-09-05	2014-09-05
Horn Antenna (2-4 GHz)	ETS	3161-02 (22°)**	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03 (22°)**	48106	2007-09-27	See * below
Signal Path Controller	HP	11713A	50250	N/A	N/A
Gain Controller	HP	11713A	50251	N/A	N/A
RF Switch / Preamp Fixture	UL	BOMS1	50249	N/A	N/A
System Controller	UL	BOMS2	50252	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Multimeter	Fluke	83III	ME5B-305	2014-01-28	2015-01-31

Radiated Emissions					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date

* - Note: As allowed by the calibration standard ANSI C63.4 Section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration.
Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances.
** - Number in parentheses denotes antenna beam width.

Bench Tests					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Spectrum Analyzer	Agilent	E4446A	82277	2014-01-28	2015-01-31
EMI Receiver	Rohde & Schwarz	ESCI7	75141	2014-01-29	2015-01-31
Dipole Antenna	EMCO	3121C	9111-771	2014-01-10	2015-01-10

7. ANTENNA PORT TEST RESULTS

7.1. 20 dB AND 99% BW

LIMITS

FCC §15.231 (c)
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.

IC A1.1.3
For the purpose of Section A1.1, the 99% Bandwidth shall be no wider than 0.25% of the center frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

TEST PROCEDURE

ANSI C63.4

The transmitter output is connected to the spectrum analyzer.

20dB Bandwidth: The RBW is set to 100 KHz. The VBW is set to 300 KHz. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

99% Bandwidth: The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

No non-compliance noted:

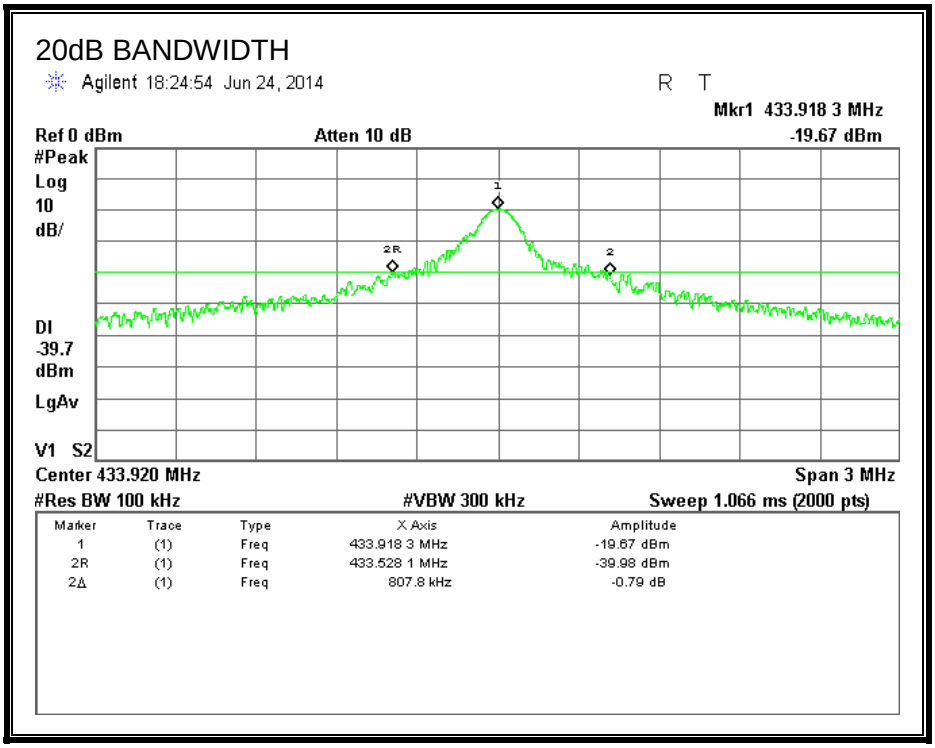
20dB Bandwidth

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
433.92	807.8	1084.8	-277

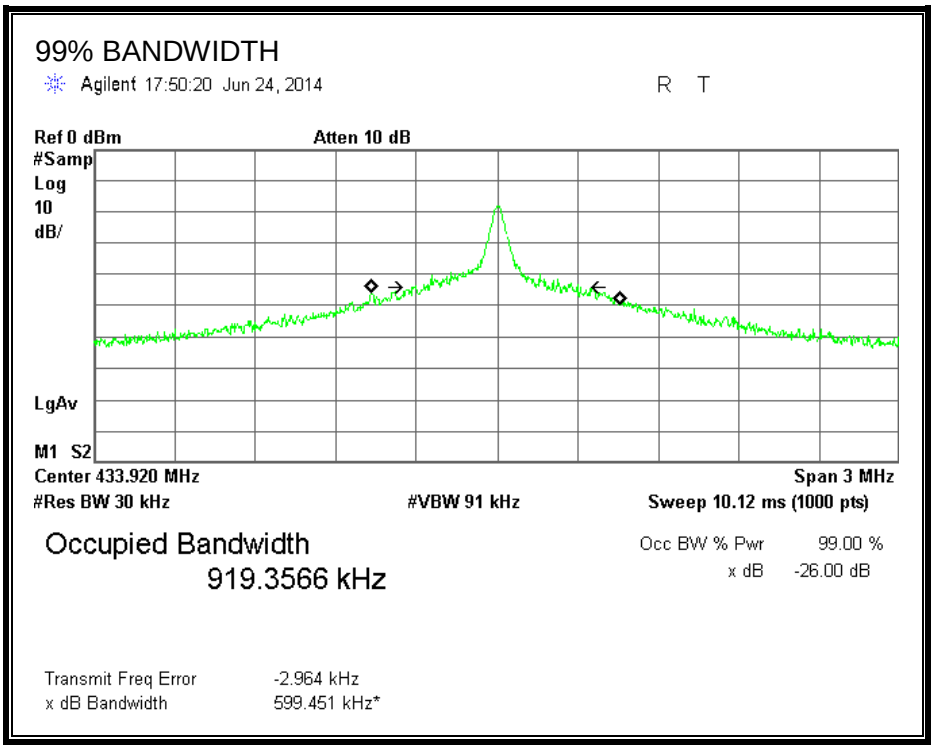
99% Bandwidth

Frequency (MHz)	99% Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
433.92	919.3566	1084.8	-165.4434

20dB BANDWIDTH



99% BANDWIDTH



7.2. DUTY CYCLE

LIMITS

FCC §15.35 (c)
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 exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 1 MHz and the VBW is set to 1 MHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in a 100 ms scan.

CALCULATION

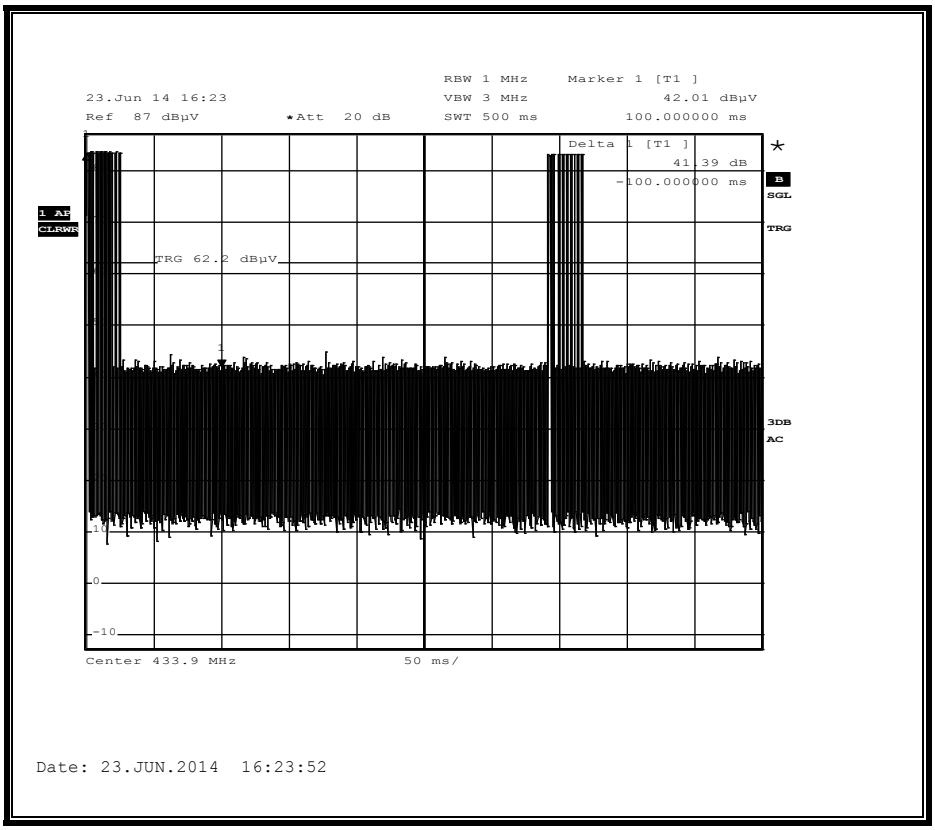
Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is
(# of long pulses * long pulse width) + (# of short pulses * short pulse width) / 100 or T

RESULTS

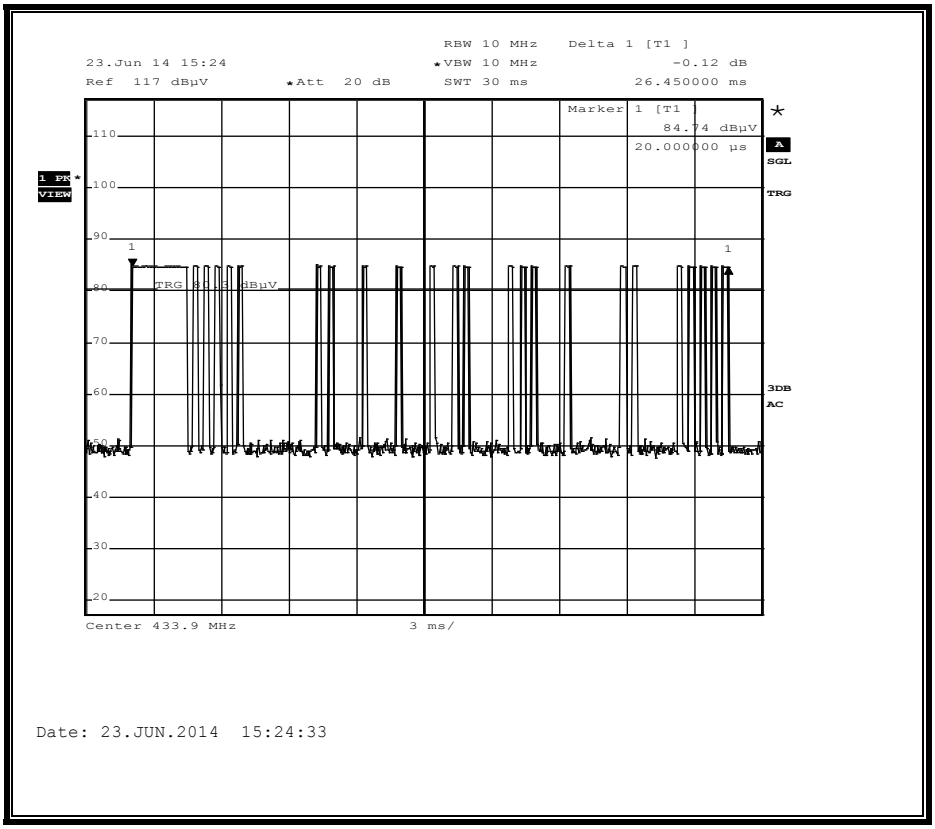
No non-compliance noted:

One Period (ms)	Long Pulse Width (ms)	# of Long Pulses	Medium Width (ms)	# of Medium Pulses	Short Width (ms)	# of Short Pulses	Duty Cycle	20*Log Duty Cycle (dB)
100	2.46	1	0.24	12	0.18	11	0.073	-22.71

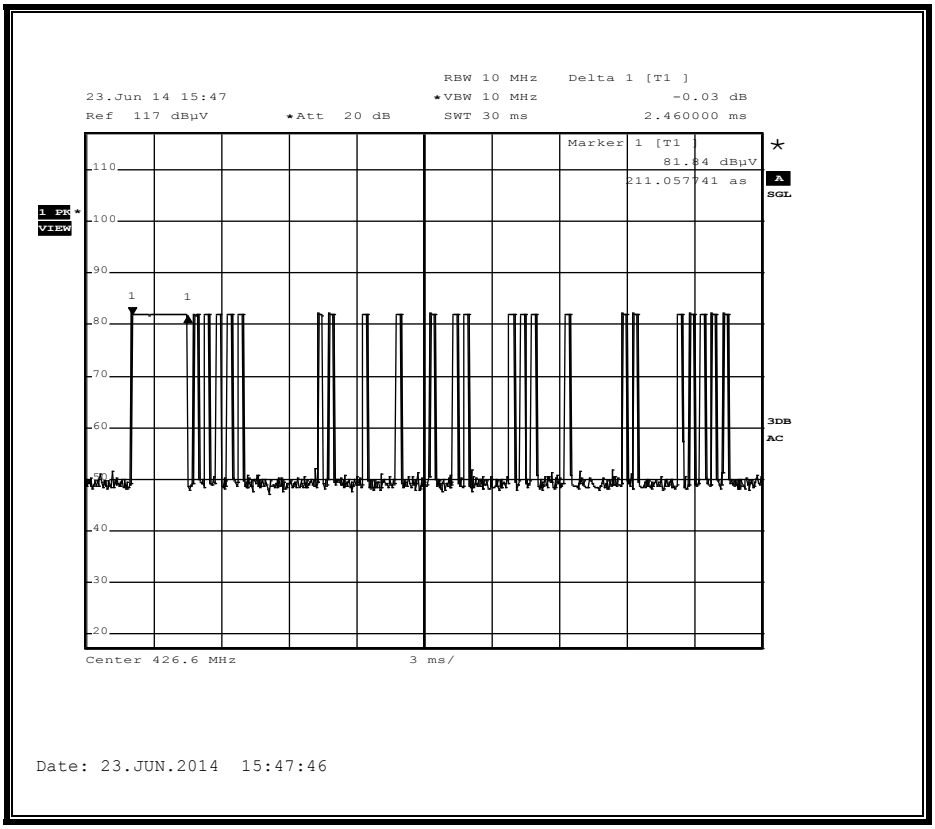
 # OF PERIOD IN A 100ms WINDOW



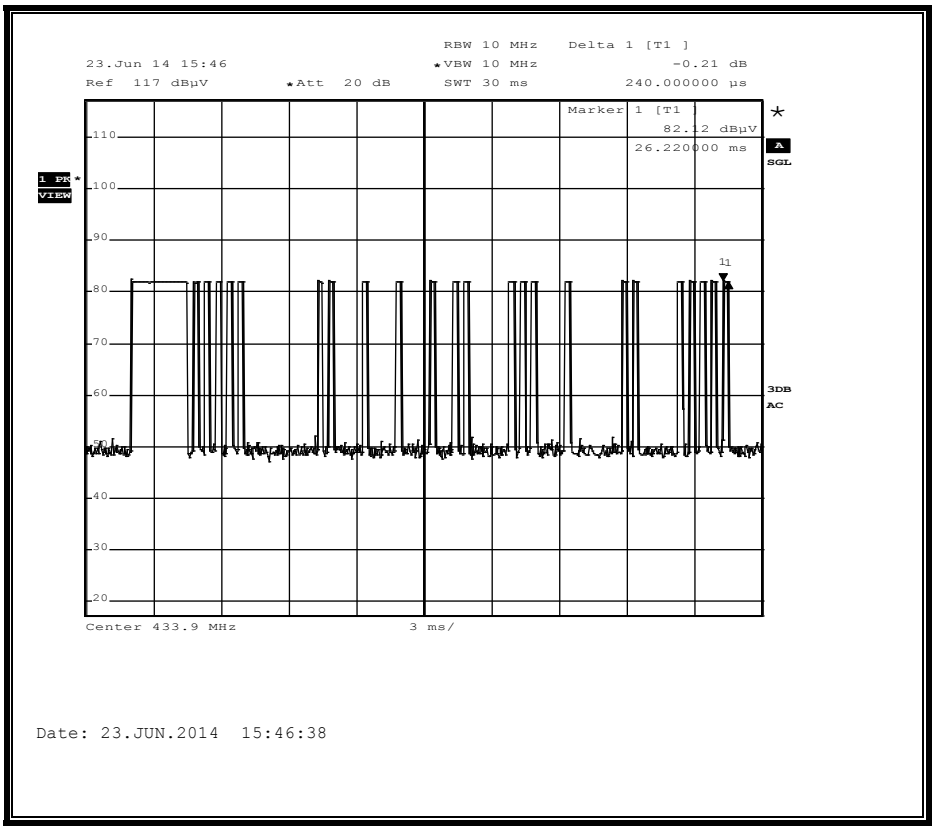
ONE PERIOD / NUMBER OF PULSES



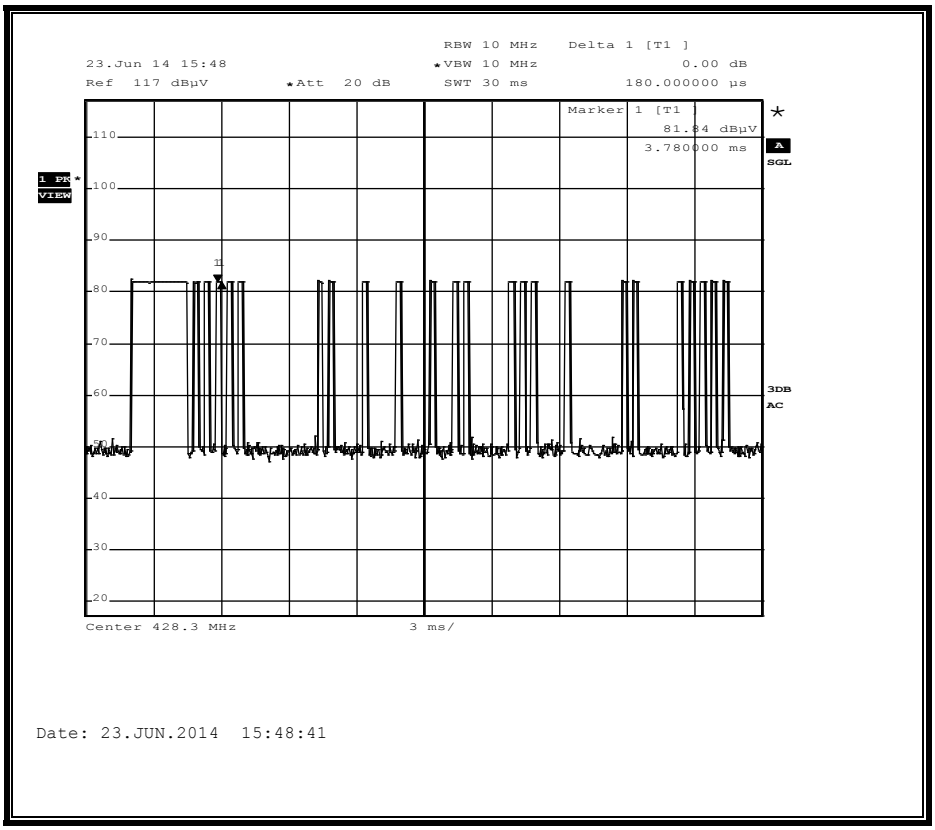
LONG PULSE WIDTH



MEDIUM PULSE WIDTH



SHORT PULSE WIDTH



7.3. TRANSMISSION TIME

LIMITS

FCC §15.231 (a) (2)

IC A1.1.1 (b)

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

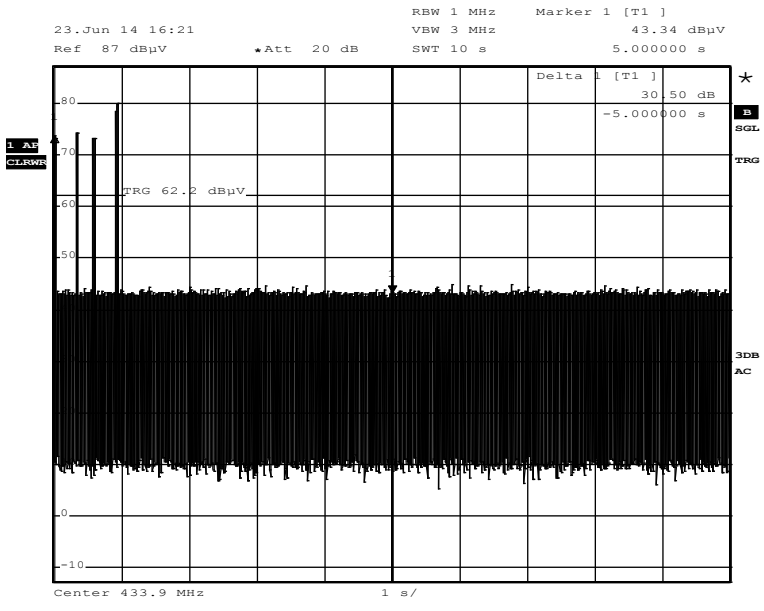
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 1 MHz and the VBW is set to 1 MHz. The sweep time is set to 10 seconds and the span is set to 0 Hz.

RESULTS

No non-compliance noted:

LESS THAN 5 SECONDS



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8. RADIATED EMISSION TEST RESULTS

8.1. TX RADIATED SPURIOUS EMISSION

LIMITS

FCC §15.231 (b)
IC A1.1.2
In addition to the provisions of § 15.205, the field strength of emissions from Intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental Frequency (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750[1]	125 to 375[1]
174 - 260	3,750	375
260 - 470	3,750 to 12,500[1]	375 to 1,250[1]
Above 470	12,500	1,250

[1] Linear interpolation

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 – 13.41	322 - 335.4		

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
2 Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

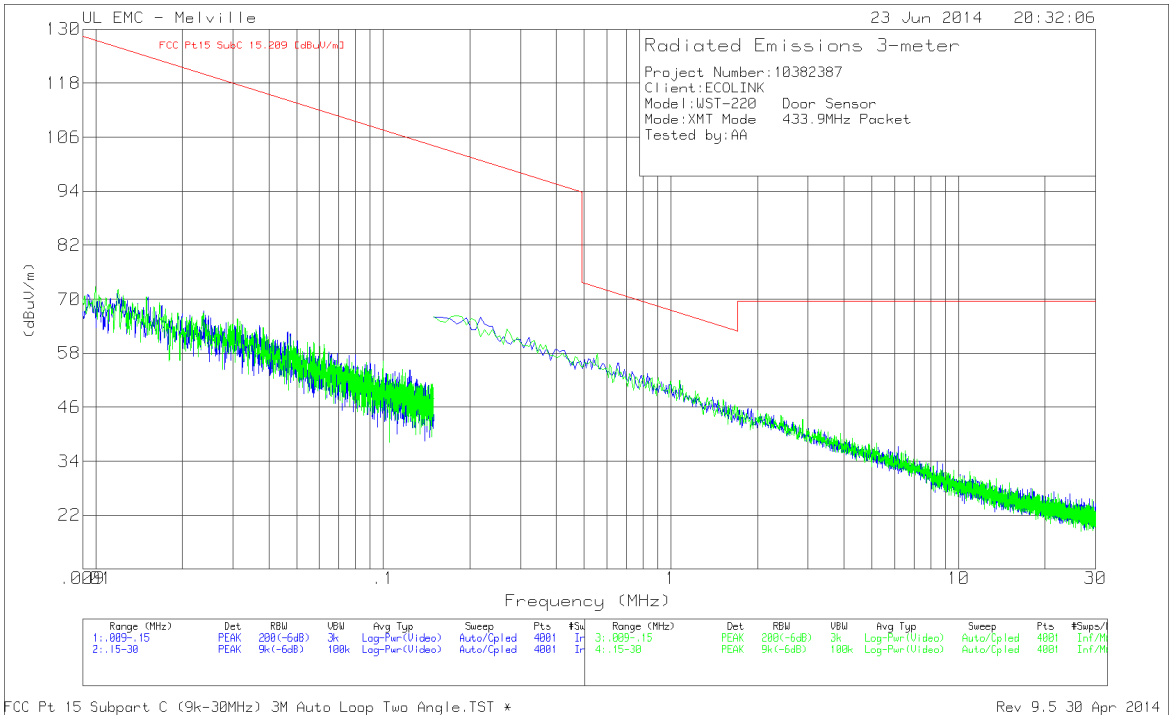
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and as appropriate for average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

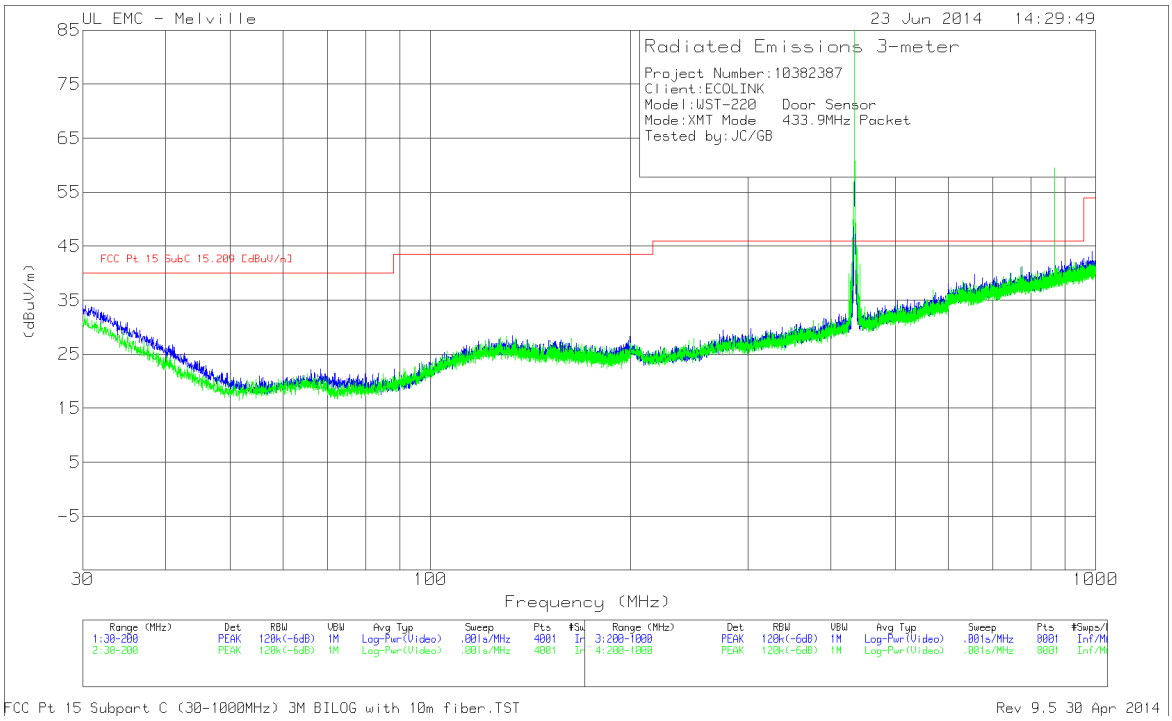
No non-compliance noted:

TX SPURIOUS EMISSION (9 kHz – 30 MHz)



Frequency (MHz)	Meter Reading (dBuV)	Det	AF-5A288 [dB/m]	GL-3M [dB]	Corrected Reading (dBuV/m)	FCC Pt15 SubC 15.209 [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
0.0152	43.36	PK	26.9	0.2	70.46	123.95	-53.49	0-360	100	H
0.04649	43.08	PK	19.4	0.2	62.68	114.25	-51.57	0-360	100	H
0.21717	49.47	PK	16.2	0.3	65.97	100.86	-34.89	0-360	100	H
0.65002	39.35	PK	16.2	0.3	55.85	71.35	-15.5	0-360	100	H
6.15772	20.22	PK	16.5	0.5	37.22	69.5	-32.28	0-360	100	H
24.45699	9.25	PK	16.8	0.7	26.75	69.5	-42.75	0-360	100	H

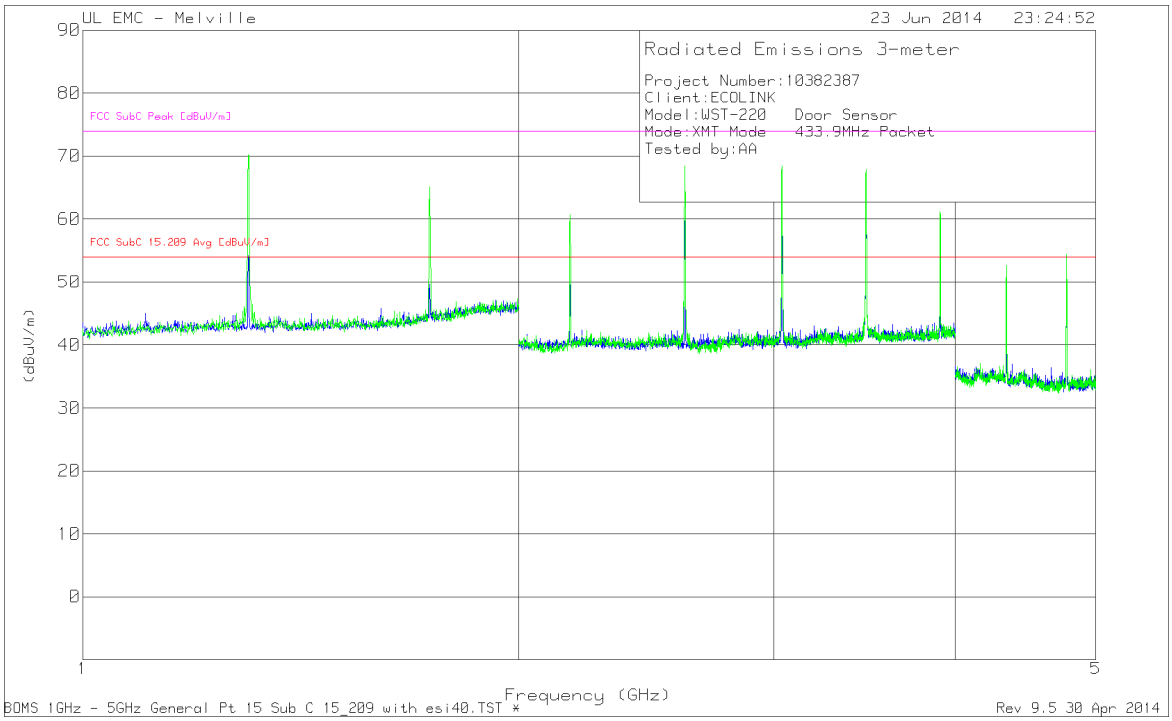
FUNDAMENTAL, HARMONICS AND TX SPURIOUS EMISSION (30 – 1000 MHz)



Frequency (MHz)	Meter Reading (dBuV)	Det	AF [dB/m]	GL [dB]	DCF [dB]	Corrected Peak Reading (dBuV/m)	Corrected Avg Reading (dBuV/m)	FCC Pt 15.231 Peak [dBuV/m]	Margin (dB)	FCC Pt 15.231 Avg [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
867.8406	31.28	PK	22.4	4.9	-22.71	58.58	35.87	80.8	-22.22	60.8	-24.93	213	101	H
867.8406	30.4	PK	22.4	4.9	-22.71	57.7	34.99	80.8	-23.1	60.8	-25.81	213	101	V
433.924	69.87	PK	17	3.2	-22.71	90.07	67.36	100.8	-10.73	80.8	-13.44	252	135	V
433.924	61.65	PK	17	3.2	-22.71	81.85	59.14	100.8	-18.95	80.8	-21.66	170	390	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

HARMONICS AND TX SPURIOUS EMISSIONS ABOVE 1GHz



HARMONICS AND TX SPURIOUS EMISSIONS ABOVE 1GHz (CONT)

Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	DCF (dB)	Corrected Peak Reading (dBuV/m)	Corrected Avg Reading (dBuV/m)	FCC Pt 15.209 [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
*1.302	75.72	PK	25.1	-44.76	-22.71	56.06	33.35	54	-20.65	74	-17.94	205	112	H
*1.302	90.2	PK	25.1	-44.76	-22.71	70.54	47.83	54	-6.17	74	-3.46	234	105	V
1.736	68.27	PK	26.2	-44.16	-22.71	50.31	27.6	54	-26.4	74	-23.69	350	109	H
1.736	85.93	PK	26.2	-44.16	-22.71	67.97	45.26	54	-8.74	74	-6.03	322	119	V
2.17	74.46	PK	21.4	-42.33	-22.71	53.53	30.82	54	-23.18	74	-20.47	86	388	H
2.169	83.69	PK	21.4	-42.32	-22.71	62.77	40.06	54	-13.94	74	-11.23	167	172	V
2.604	81.22	PK	21.3	-41.9	-22.71	60.62	37.91	54	-16.09	74	-13.38	338	225	H
2.604	89.28	PK	21.3	-41.9	-22.71	68.68	45.97	54	-8.03	74	-5.32	177	131	V
3.037	84.7	PK	21.6	-40.83	-22.71	65.47	42.76	54	-11.24	74	-8.53	0	342	H
3.037	88.25	PK	21.6	-40.83	-22.71	69.02	46.31	54	-7.69	74	-4.98	74	195	V
3.471	87.54	PK	22.2	-40.72	-22.71	69.02	46.31	54	-7.69	74	-4.98	131	240	H
3.471	89.01	PK	22.2	-40.72	-22.71	70.49	47.78	54	-6.22	74	-3.51	71	387	V
*3.905	81.39	PK	22.6	-40.88	-22.71	63.11	40.4	54	-13.6	74	-10.89	84	380	H
*3.905	86.41	PK	22.6	-40.88	-22.71	68.13	45.42	54	-8.58	74	-5.87	140	234	V
*4.339	77.74	PK	27.7	-53	-22.71	52.44	29.73	54	-24.27	74	-21.56	359	263	V
*4.339	79.97	PK	27.7	-53	-22.71	54.67	31.96	54	-22.04	74	-19.33	11	243	H
*4.773	83.93	PK	27.1	-53.92	-22.71	57.11	34.4	54	-19.6	74	-16.89	356	258	H
*4.773	85.36	PK	27.1	-53.92	-22.71	58.54	35.83	54	-18.17	74	-15.46	137	283	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector