FCC PART 15 SUBPART B & SUBPART C SECTION 15.249, RSS 210 and RSS GEN TEST REPORT

for

Garage Door Tilt Sensor
Model: TILT-ZWAVE5

Prepared for

ECOLINK INTELLIGENT TECHNOLOGY, INC
2055 CORTE DEL NOGAL
CARLSBAD, CA 92011

Prepared by: _____

HOWARD HUANG

Approved by: _____

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DATE: DECEMBER 9, 2019

	REPORT BODY	APPENDICES					TOTAL
		A	***B***	***C***	***D***	***E***	
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NVLAP TESTING
NVLAP LAB CODE 200527-0
ilac-MRA

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1	Plot Map and Layout of Test Site Below 1GHz
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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form except in full, without the written permission of Compatible Electronics.

This report must not be used by the client to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.

Device Tested:	Garage Door Tilt Sensor Model: TILT-ZWAVE5 S/N: None
Product Description:	The EUT is battery-powered device for home automation applications and will be installed on the garage door for notifications on garage door openings and closings. (Dimensions: 3” x 0.5” x 0.5”)
Modifications:	The EUT was not modified during the testing.
Manufacturer:	Ecolink Intelligent Technology, Inc. 2055 Corte Del Nogal Carlsbad, CA 92011
Test Dates:	December 2-3, 2019

NVLAP TESTING
NVLAP LAB CODE 200527-0

Test Specifications Covered by Accreditation:

EMI requirements

CFR Title 47, Part 15 Subpart B Sections 15.109, Subpart C Sections 15.205, 15.209, 15.249, RSS 210, Issue 9 (August 2016) + A1 (November 2017), and RSS Gen, Issue 5 Amendment 1 (March 2019)

Test Procedure: ANSI C63.4: 2014 & C63.10: 2013

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz.	The EUT does not connect to AC mains, therefore this test was deemed unnecessary and thus was not performed.
2	Radiated RF Emissions & Harmonics, 9 kHz – 10 GHz.	Complies with the limits of RSS-210, RSS-GEN, CFR Title 47 Part 15 Subpart B Section 15.109 & Subpart C Section 15.205, 15.209, & 15.249

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Garage Door Tilt Sensor Model: TILT-ZWAVE5. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 2014 and C63.10: 2013. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT (equipment under test) hereafter, are within the specification limits defined by RSS 210, Issue 9 (August 2016) + A1 (November 2017), and RSS Gen, Issue 5 Amendment 1 (March 2019), and the Code of Federal Regulations Title 47, Part 15 Subpart B sections, 15.109, & Part 15 Subpart C sections 15.205, 15.209 and 15.249.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The emissions tests described herein were performed at the test facility of Compatible Electronics, 20621 Pascal Way Lake Forest, California 92630.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

Ecolink Intelligent Technology, Inc.

David Shepard	Product Compliance/QA Specialist

Compatible Electronics, Inc.

Joey Madlangbayan	Product Safety Manager
Howard Huang	Test Technician

2.4 Date Test Sample was Received

The test sample was received on December 2, 2019.

2.5 Disposition of the Test Sample

The test sample remains at Compatible Electronics, Inc.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EMC	Electromagnetic Compatibility
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
NVLAP	National Voluntary Laboratory Accreditation Program
CFR	Code of Federal Regulations
PCB	Printed Circuit Board
TX	Transmit
RX	Receive
NCR	No Calibration Required
PSU	Power Supply Unit

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this Test Report.

SPEC	TITLE
RSS 210, Issue 9 (August 2016) + A1 (November 2017)	License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS GEN, Issue 5 Amendment 1 (March 2019)	General Requirements for Compliance of Radio Apparatus
CFR Title 47, Part 15	FCC Rules – Radio frequency devices (including digital devices)
ANSI C63.4 2014	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
ANSI C63.10: 2013	American National Standard for Testing Unlicensed Wireless Devices

4. DESCRIPTION OF TEST CONFIGURATION

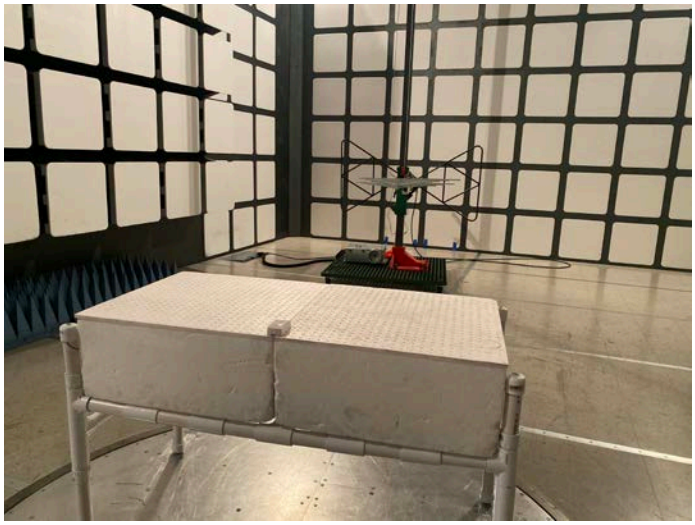
4.1 Description of Test Configuration

The Garage Door Tilt Sensor Model: TILT-ZWAVE5 (EUT) was setup in a standalone tabletop configuration. The EUT was tested in the following configuration seen in the image below.

The EUT was checked in the x-axis, y-axis, and z-axis. The EUT was tested with a full battery. The worst case orientation was deemed to be the y-axis. The EUT was continuously transmitting a data stream during testing and it was determined to be the worst case operating mode for emissions.

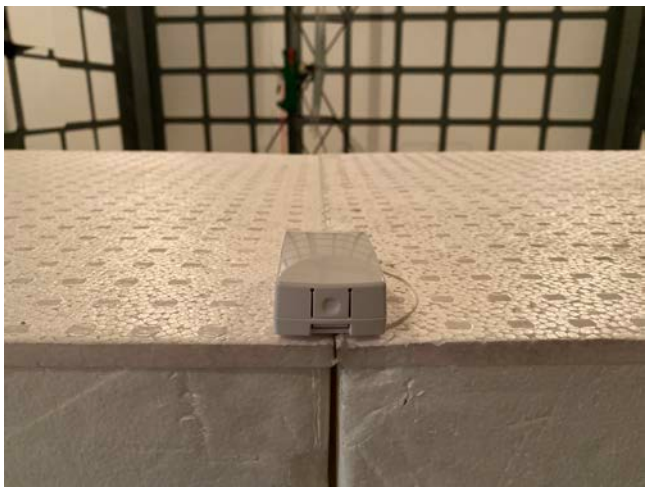
It was determined that the emissions were at their highest level when the EUT was transmitting in the configuration described above for Radiated Emissions. The final radiated data was taken in the above configuration. Please see Appendix E for the test data.

4.1.1 Photograph Test Configuration

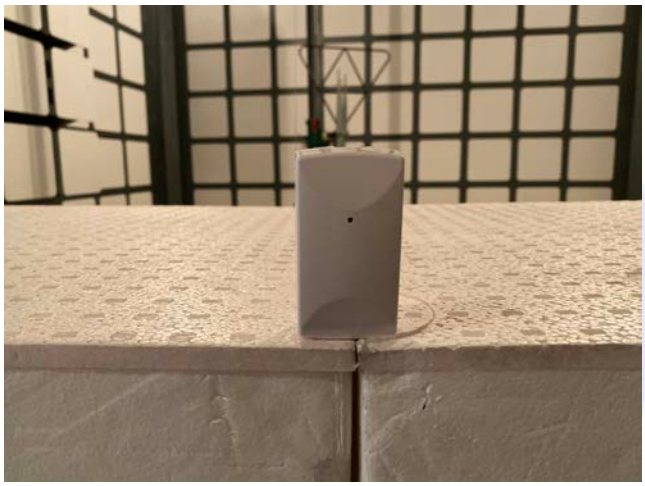


ANSI C63.4

ANSI C63.10



x-axis



y-axis

z-axis

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 Emissions Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Thermometer & Hygrometer	Davis Instruments	6312C	NONE	09/20/2018	09/20/2021
Computer	Compatible Electronics	NONE	NONE	NCR	NCR
EMI Receiver	Rohde & Schwarz	ESIB40	100172	03/22/2019	03/22/2020
EMI Receiver	Keysight Technologies	N9038A	MY56400077	06/20/2019	06/20/2020
Antenna, Loop	Com-Power	AL-130	121049	03/21/2019	03/21/2021
Antenna, CombiLog	Com-Power	AC-220	10030000	04/05/2019	04/05/2021
Antenna, Horn 1-18GHz	Com-Power	AH-118	10050054	01/25/2019	01/25/2021
Pre-Amp, 1-18GHz	Com-Power	PAM-118A	551034	01/28/2019	01/28/2020
Mast, Antenna Positioner	Sunol Science Corporation	TWR 95-4	020808-3	NCR	NCR
Turntable	Sunol Science Corporation	FM 2001	N/A	NCR	NCR
Mast and Turntable Controller	Sunol Science Corporation	SC104V	020808-1	NCR	NCR

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

All the radiated & conducted emissions measurements were performed in a semi-anechoic chamber.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 by 0.8-meter-high non-conductive table for below 1GHz which was placed on the ground plane. For above 1 GHz the EUT was mounted 1.5 meters high.

The EUT was not grounded.

6.3 Facility Environmental Characteristics

When applicable refer to the data sheets in Appendix E for the relative humidity, air temperature, and barometric pressure.

6.4 Measurement Uncertainty

"Compatible Electronics' U_{lab} value is less than U_{cispr}, thus based on this − compliance is deemed to occur if no measured disturbance exceeds the disturbance limit

$$u_c(y) = \sqrt{\sum_i c_i^2 \; u^2(x_i)}$$

Measurement		U_{cispr}	$U_{lab} = 2\,uc\,(y)$
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3,4 dB	2.88
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	6.3 dB	3.67
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz – 6 GHz)	5,2 dB	3.59
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5,5 dB	3.59
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26 GHz)	N/A	3.71

7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Number and Frequencies

The Z-Wave Tilt operates on one of 2 channels at a time, at 908.4 MHz and 916 MHz utilizing FSK/GFSK modulation.

8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

8.1 RF Emissions

8.1.1 Conducted Emissions Test

Test Results:

The EUT is battery powered and does not connect to the AC Mains; therefore, this test was deemed unnecessary and thus was not performed. Had this test been deemed applicable, it would have been performed as described below.

The EMI Receiver was used as a measuring meter. A 10-dB attenuation pad was used for the protection of the EMI Receiver input stage. All factors associated with attenuator and cables were recorded into the EMI Software Program accordingly to display the actual corrected measured level. The LISN output was connected to the input of the EMI Receiver. The output of the second LISN was terminated with 50-ohm termination. The effective measurement bandwidth used for the conducted emissions test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT received its power through the LISN, which was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The initial test data was taken in manual mode while scanning the frequency ranges of 0.15 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the spectrum analyzer span adjusted to 1 MHz.

The final data was collected under program control by the computer in several overlapping sweeps by running the EMI Receiver at a minimum scan rate of 10 seconds per octave.

8.1.2 Radiated Emissions (Spurious and Harmonics) Test

The EMI receiver was used as a measuring meter. The receiver was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the receiver records the highest measured reading over all the sweeps. Amplifiers were used to increase the sensitivity of the instrument. There was one Microwave Preamplifier used for frequencies above 1 GHz.

For spurious emissions, the quasi-peak detector was used for frequencies below 1GHz and the average detector was used for frequencies above 1 GHz.

For the Harmonic emissions, a linear average detector was used.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE (MHz)	TRANSDUCER	EFFECTIVE MEASUREMENT BANDWIDTH
.009 to .150	Active Loop Antenna	200 Hz
.150 to 30	Active Loop Antenna	9 kHz
30 to 1000	Combilog Antenna	100 kHz (120kHz for QP Measurements)
1000 to 10000	Horn Antenna	1 MHz

The TDK FAC-3 shielded test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.4 & ANSI C63.10. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters in both vertical and horizontal polarizations (for E field radiated field strength).

Test Results:

The EUT complies with the limits of RSS-210, RSS-GEN, CFR Title 47 Part 15 Subpart B section 15.109, & Part 15 Subpart C sections 15.205, 15.209 and 15.249.

8.1.3 Fundamental Field Strength

The Peak Transmit Radiated Field Strength was measured at a 3-meter test distance. The EMI Receiver was used to obtain the final test data. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with RSS-210 & Part 15 Subpart C, Section 15.249.

8.1.4 Emissions Radiated Outside of the Fundamental Frequency Band

The Band Edge measurement was measured using the EMI Receiver at a 3-meter test distance to obtain the final test data. The lower and upper channels were tuned during the low and high band edge tests. The final qualification data sheets are located in Appendix E.

Test Results:

The EUT complies with RSS-210 & Part 15 Subpart C, Section 15.205 & 15.249.

9. TEST PROCEDURE DEVIATIONS

There were no deviations from the test procedure.

10. CONCLUSIONS

The Garage Door Tilt Sensor Model: TILT-ZWAVE5 meets all of the relevant specification requirements defined in RSS 210, Issue 9 (August 2016) + A1 (November 2017), and RSS Gen, Issue 5 Amendment 1 (March 2019), and the Code of Federal Regulations Title 47, Part 15 Subpart B section, 15.109, & Subpart C sections 15.205, 15.209 and 15.249.

APPENDIX A

LABORATORY ACCREDITATIONS AND RECOGNITIONS

LABORATORY ACCREDITATIONS AND RECOGNITIONS

NVLAP TESTING
NVLAP LAB CODE 200527-0

ilac-MRA

For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025.

For the most up-to-date version of our scopes and certificates please visit

http://celectronics.com/quality/scope/

Quote from ISO-ILAC-IAF Communiqué on 17025:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 Quality Management Systems — Requirements."

Innovation, Science and Economic Development Canada Lab Code 2154C

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

There were no modifications made to the EUT during the testing.

APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	Garage Door Tilt Sensor Model: TILT-ZWAVE5 S/N: None

No additional models were tested.

APPENDIX D

DIAGRAMS, CHARTS, AND PHOTOS

FIGURE 1: PLOT MAP AND LAYOUT OF TEST SITE BELOW 1GHZ

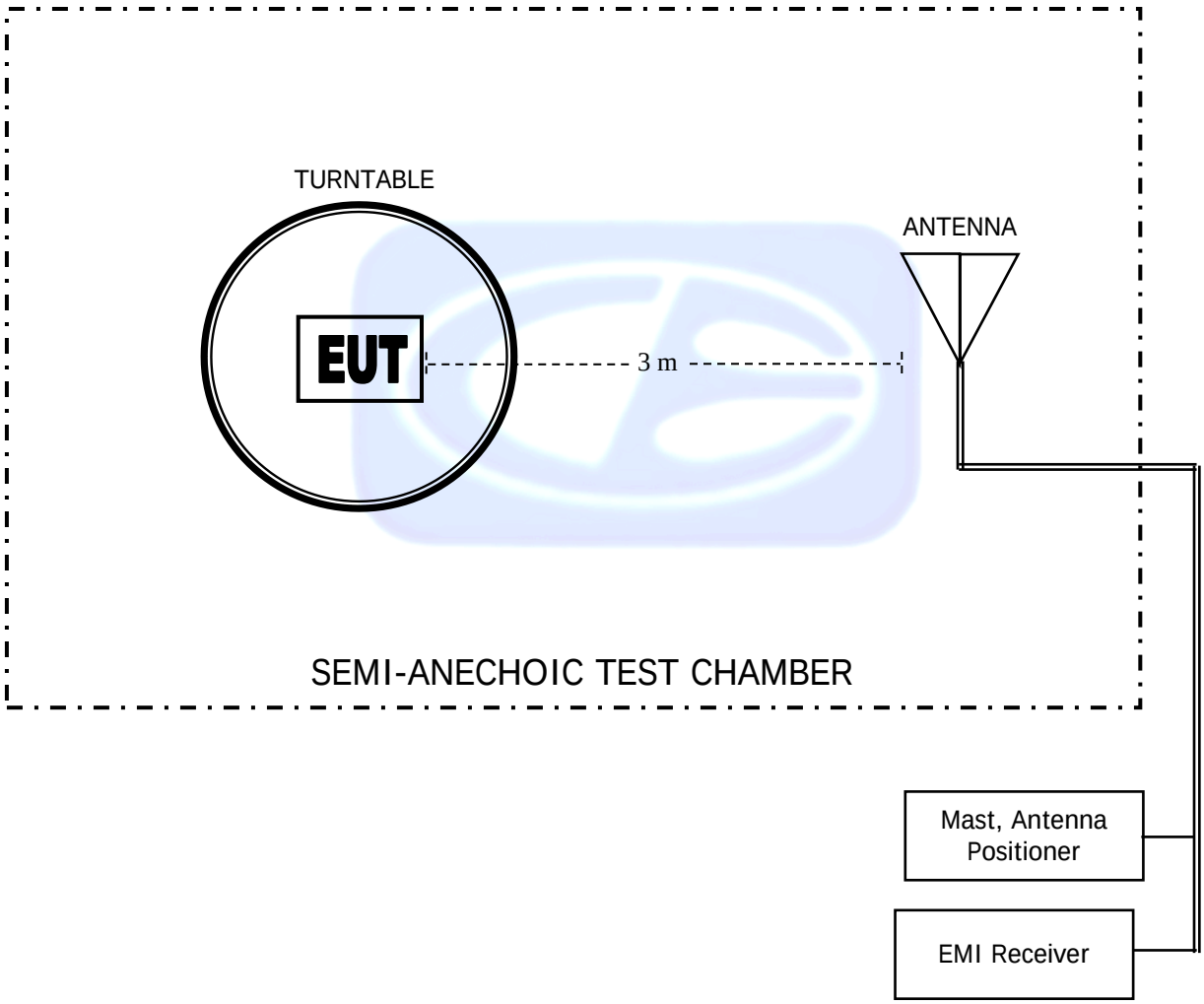
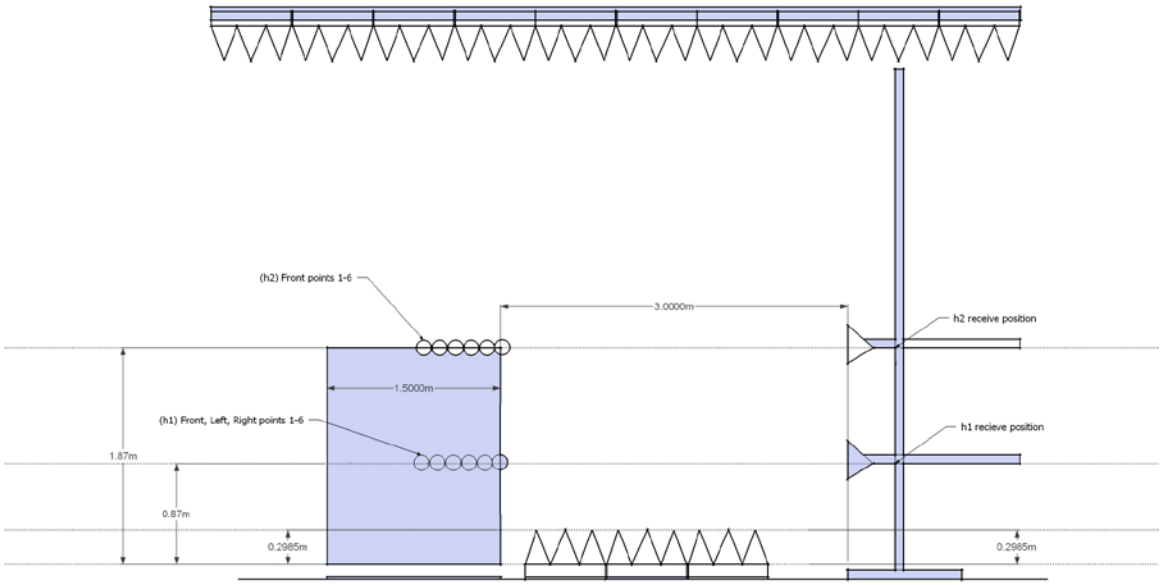


FIGURE 2: PLOT MAP AND LAYOUT OF TEST SITE ABOVE 1GHZ



COM-POWER AL-130

LOOP ANTENNA

S/N: 121049

CALIBRATION DUE: 03/21/2021

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)	FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	-35.2	16.3	**7.0**	-36.9	14.6
0.01	-35.7	15.7	**8.0**	-36.8	14.6
0.02	-36.6	14.8	**9.0**	-36.9	14.6
0.03	-35.8	15.6	**10.0**	-36.6	14.9
0.04	-36.4	15.1	**11.0**	-36.5	14.9
0.05	-37.0	14.5	**12.0**	-36.5	14.9
0.06	-36.8	14.7	**13.0**	-36.7	14.8
0.07	-37.0	14.4	**14.0**	-36.8	14.7
0.08	-37.1	14.4	**15.0**	-36.9	14.6
0.09	-36.9	14.5	**16.0**	-36.9	14.6
0.1	-37.3	14.1	**17.0**	-36.8	14.6
0.2	-37.3	14.1	**18.0**	-36.7	14.8
0.3	-37.4	14.0	**19.0**	-36.5	14.9
0.4	-37.4	14.0	**20.0**	-36.5	14.9
0.5	-37.2	14.2	**21.0**	-36.8	14.7
0.6	-37.2	14.2	**22.0**	-37.2	14.3
0.7	-37.2	14.2	**23.0**	-37.6	13.8
0.8	-37.2	14.2	**24.0**	-38.1	13.4
0.9	-37.2	14.3	**25.0**	-38.4	13.1
1.0	-36.9	14.5	**26.0**	-38.5	13.0
2.0	-36.9	14.6	**27.0**	-38.4	13.1
3.0	-36.9	14.6	**28.0**	-38.3	13.2
4.0	-36.8	14.7	**29.0**	-38.3	13.2
5.0	-36.8	14.6	**30.0**	-38.4	13.0
6.0	-36.9	14.6			

COM-POWER AC-220

COMBILOG ANTENNA

S/N: 10030000

CALIBRATION DUE: APRIL 5, 2021

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.0	**180**	14.7
35	21.0	**200**	15.1
40	20.4	**250**	16.7
45	19.6	**300**	18.2
50	18.4	**350**	19.1
60	14.9	**400**	20.7
70	11.7	**500**	22.0
80	11.6	**600**	24.5
90	13.2	**700**	24.5
100	14.3	**800**	26.1
120	15.6	**900**	27.0
140	14.3	**1000**	27.6
160	14.0		

COM-POWER AH-118A

HORN ANTENNA

S/N: 10050054

CALIBRATION DUE: JANUARY 25, 2021

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
700	25.81	**7500**	37.52
750	25.59	**8000**	37.91
800	25.05	**8500**	37.60
850	24.60	**9000**	37.91
900	24.14	**9500**	38.75
950	23.69	**10000**	38.85
1000	23.85	**10500**	38.84
1250	24.86	**11000**	39.05
1500	25.34	**11500**	39.60
1750	25.30	**12000**	39.87
2000	28.02	**12500**	40.16
2250	28.14	**13000**	40.17
2500	28.87	**13500**	40.59
3000	30.01	**14000**	40.63
3500	30.70	**14500**	40.55
4000	31.64	**15000**	42.53
4500	32.85	**15500**	40.85
5000	34.25	**16000**	41.28
5500	34.61	**16500**	41.35
6000	35.02	**17000**	41.43
6500	35.43	**17500**	42.50
7000	36.68	**18000**	43.51

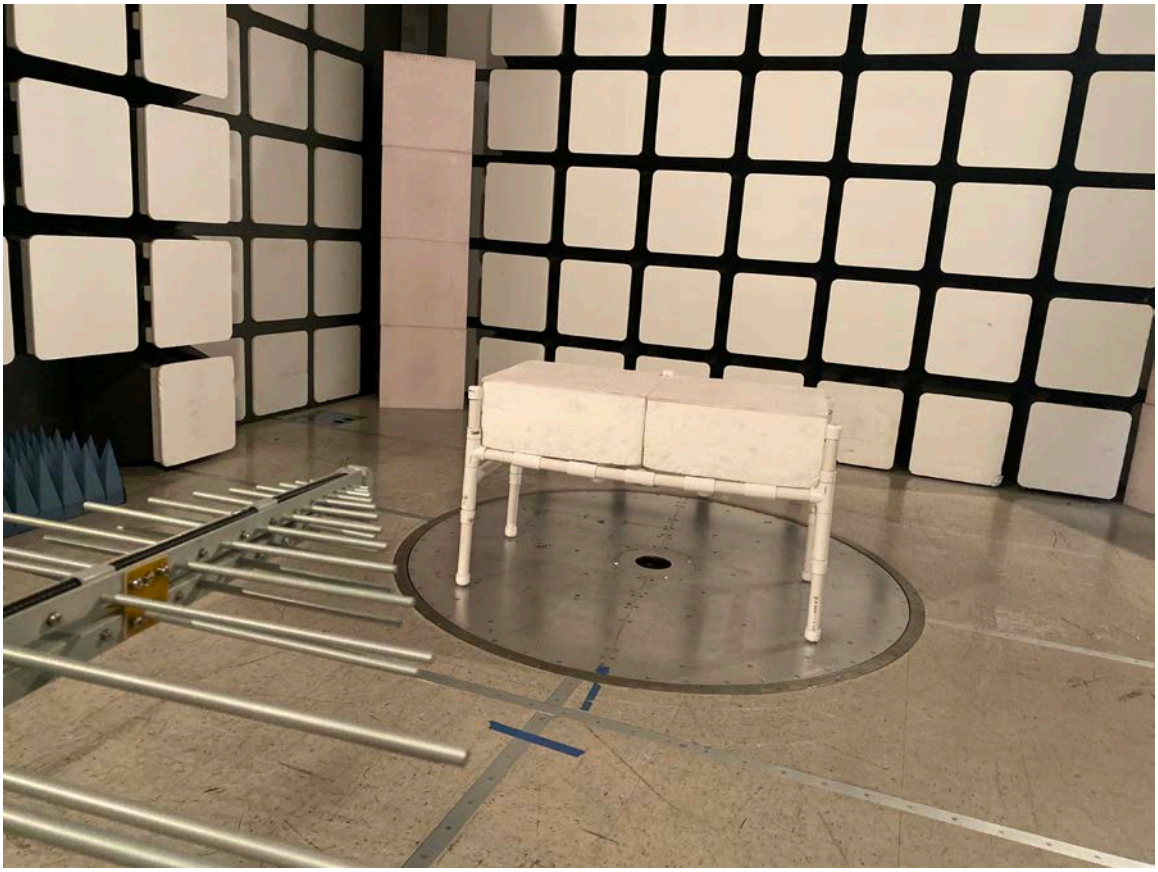
COM-POWER PAM-118A

1-18GHz - PREAMPLIFIER

S/N# 551034

CALIBRATION DUE: JANUARY 28, 2020

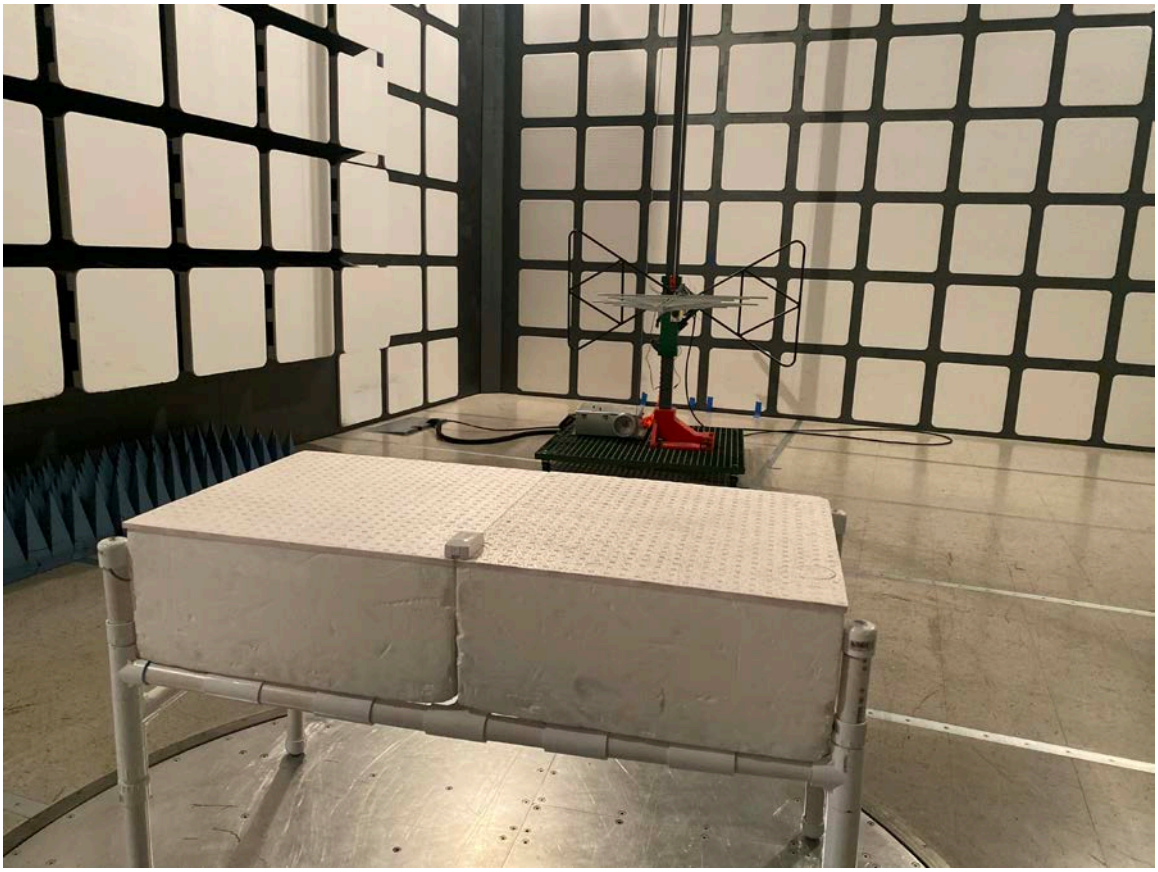
FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
500	39.68	**6000**	41.31
600	39.94	**6500**	41.35
700	39.99	**7000**	41.61
800	40.24	**7500**	41.72
900	39.93	**8000**	41.73
1000	40.44	**8500**	40.82
1250	40.63	**9000**	40.78
1500	40.80	**9500**	42.10
1750	41.00	**10000**	42.62
2000	41.35	**10500**	41.43
2250	41.60	**11000**	41.00
2500	41.82	**11500**	41.26
2750	42.08	**12000**	41.50
3000	42.33	**12500**	41.01
3250	42.50	**13000**	40.50
3500	42.59	**13500**	40.28
3750	42.64	**14000**	40.32
4000	42.60	**14500**	40.55
4250	42.42	**15000**	40.62
4500	42.20	**15500**	40.74
4750	42.04	**16000**	40.69
5000	41.88	**16500**	40.98
5250	41.69	**17000**	40.16
5500	41.59	**17500**	39.29
5750	41.44	**18000**	39.52



FRONT VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC
Garage Door Tilt Sensor
Model: TILT-ZWAVE5
FCC SUBPART C - RADIATED EMISSIONS < 1GHz

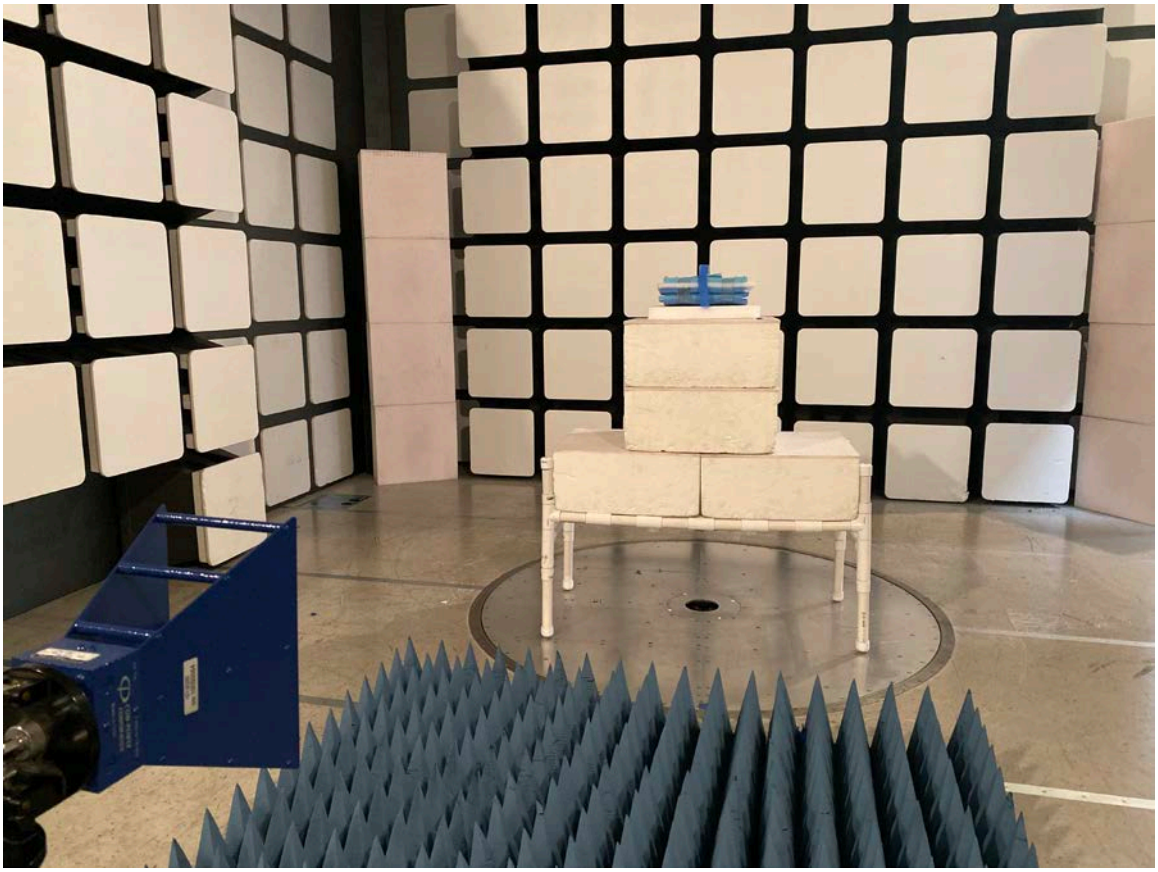
PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



REAR VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC
Garage Door Tilt Sensor
Model: TILT-ZWAVE5
FCC SUBPART C - RADIATED EMISSIONS < 1GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS



FRONT VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC
Garage Door Tilt Sensor
Model: TILT-ZWAVE5
FCC SUBPART C - RADIATED EMISSIONS > 1GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

ECOLINK INTELLIGENT TECHNOLOGY, INC
Garage Door Tilt Sensor
Model: TILT-ZWAVE5
FCC SUBPART C - RADIATED EMISSIONS > 1GHz

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

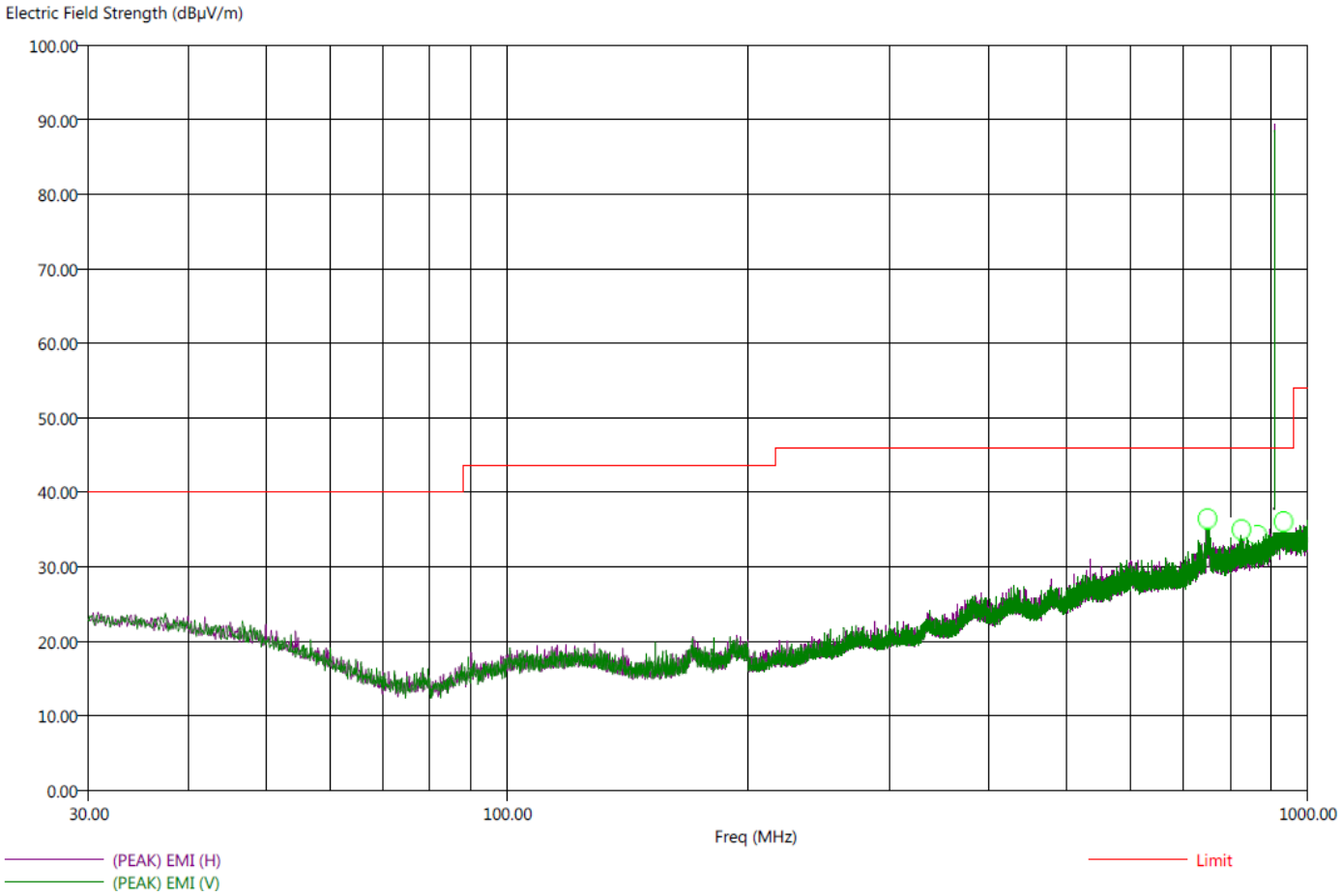
APPENDIX E

RADIATED EMISSIONS DATA SHEETS

Title: FCC 15.209
File: Radiated Pre-Scan 30-1000Mhz
Operator: Howard Huang
EUT Type: Garage Door Tilt Sensor / TILT-ZWAVE5
EUT Condition: Constant transmission at 908.42MHz
Comments: Company: Ecolink Intelligent Technology
Temp: 76f
Hum: 37%
Battery Powered

12/3/2019 11:02:49 AM
Sequence: Preliminary Scan

Compatible Electronics, Inc. FAC-3 (LAB R)



There were no radiated emissions below 30 MHz or spurious emissions above 1 GHz except the harmonics. This is worst case axis.

Title: FCC 15.209
File: Radiated Final-Scan 30-1000Mhz
Operator: Howard Huang
EUT Type: Garage Door Tilt Sensor / TILT-ZWAVE5
EUT Condition: Constant transmission at 908.42MHz
Comments: Company: Ecolink Intelligent Technology
Temp: 76f
Hum: 37%
Battery Powered

12/3/2019 11:25:17 AM
Sequence: Final Measurements

Compatible Electronics, Inc. FAC-3 (LAB R)

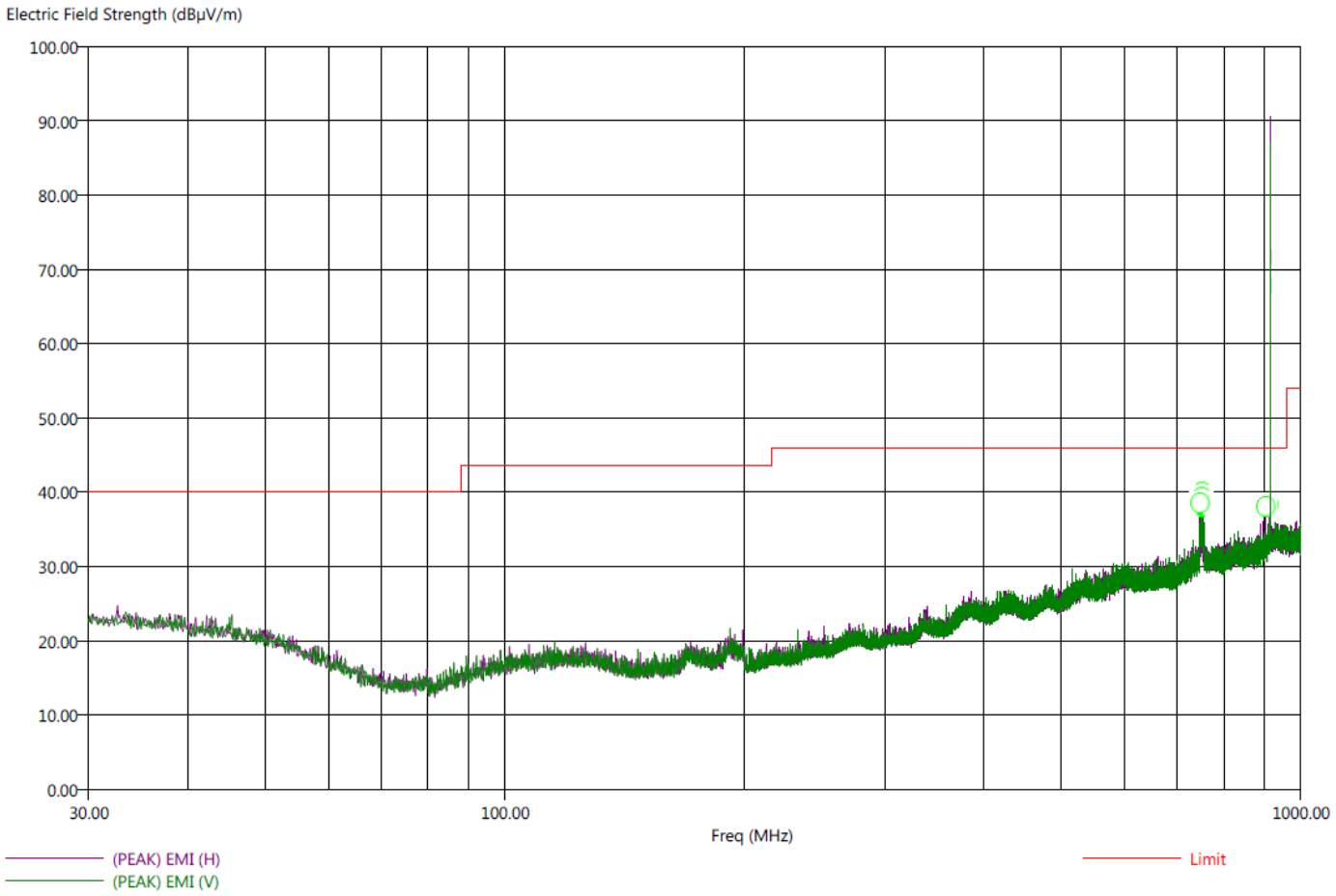
Freq (MHz)	(QP) Margin (dB)	(QP) EMI (dBµV/m)	(PEAK) EMI (dBµV/m)	Limit (dBµV/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable (dB)
749.50	-16.10	29.90	38.91	46.00	H	11.75	160.53	26.30	2.68
749.90	-16.22	29.78	41.01	46.00	V	281.50	290.26	26.30	2.68
751.30	-15.85	30.15	39.19	46.00	V	288.25	264.29	26.30	2.68
826.90	-16.89	29.11	34.52	46.00	H	238.00	398.86	26.69	2.84
865.70	-16.90	29.10	34.17	46.00	H	322.50	261.31	26.30	2.93
933.40	-14.83	31.17	36.14	46.00	V	10.25	142.20	28.16	3.04

There were no radiated emissions below 30 MHz or spurious emissions above 1 GHz except the harmonics. This is worst case axis.

Title: FCC 15.209
File: Radiated Pre-Scan 30-1000Mhz
Operator: Howard Huang
EUT Type: Garage Door Tilt Sensor / TILT-ZWAVE5
EUT Condition: Constant transmission at 916 MHz
Comments: Company: Ecolink Intelligent Technology
Temp: 76f
Hum: 37%
Battery Powered

12/3/2019 11:41:31 AM
Sequence: Preliminary Scan

Compatible Electronics, Inc. FAC-3 (LAB R)



Title: FCC 15.209
File: Radiated Final-Scan 30-1000Mhz
Operator: Howard Huang
EUT Type: Garage Door Tilt Sensor / TILT-ZWAVE5
EUT Condition: Constant transmission at 916MHz
Comments: Company: Ecolink Intelligent Technology
Temp: 76f
Hum: 37%
Battery Powered

12/3/2019 12:04:41 PM
Sequence: Final Measurements

Compatible Electronics, Inc. FAC-3 (LAB R)

Freq (MHz)	(QP) Margin (dB)	(QP) EMI (dBµV/m)	(PEAK) EMI (dBµV/m)	Limit (dBµV/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable (dB)
747.50	-13.31	32.69	39.95	46.00	V	0.75	261.49	26.30	2.67
750.90	-12.32	33.68	41.85	46.00	V	38.50	382.02	26.30	2.68
751.50	-11.10	34.90	40.22	46.00	V	55.75	399.88	26.30	2.68
752.50	-13.36	32.64	40.86	46.00	V	349.50	166.92	26.30	2.68
904.10	-14.79	31.21	36.08	46.00	H	96.75	142.14	27.10	2.99
912.10	-11.79	34.21	38.61	46.00	H	47.25	154.80	27.50	3.00

FUNDAMENTAL & HARMONICS

DATA SHEETS

FUNDAMENTAL FIELD STRENGTH

FCC 15.249
Company:Ecolink Intelligent Technology, Inc.
EUT: GARAGE DOOR TILT SENSOR
Model: TILT-ZWAVE5

Date: 12/02/2019
Lab:R
Tested By: Howard Huang

Compatible Electronics, Inc. FAC-3

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV/m)	Margin (dB)	Detector	Table (deg)	Tower (m)	Comments
908.42	88.17	H	93.97	-5.80	Peak	190.00	170.68	Y Axis
908.42	89.01	V	93.97	-4.96	Peak	135.25	146.80	Y Axis
916.00	88.70	H	93.97	-5.27	Peak	206.25	172.83	Y Axis
916.00	89.16	V	93.97	-4.81	Peak	123.75	145.49	Y Axis

Test distance
3 meter

HARMONICS LOW CHANNEL HORIZONTAL

FCC 15.249

Company: Ecolink Intelligent Technology, LLC
EUT: GARAGE DOOR TILT SENSOR
Model: TILT-ZWAVE5

Date: 12/02/2019
Lab: R
Tested By: Howard Huang

Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak /Avg	Table Angle (deg)	Ant. Height (m)	Comments
1816.8	52.09	73.98	-21.89	Peak	113.00	170	X-Axis
1816.8	47.70	53.98	-6.28	Avg	113.00	170	X-Axis
1816.8	46.50	73.98	-27.48	Peak	83.75	192	Y-Axis
1816.8	41.60	53.98	-12.38	Avg	83.75	192	Y-Axis
1816.8	47.35	73.98	-26.63	Peak	179.50	169	Z-Axis
1816.8	42.23	53.98	-11.75	Avg	179.50	169	Z-Axis
2725.3	39.00	73.98	-34.98	Peak	280.00	184	X-Axis
2725.3	31.40	53.98	-22.58	Avg	280.00	184	X-Axis
2725.3		73.98		Peak			No Emission Found
2725.3		53.98		Avg			Y-Axis
2725.3	38.21	73.98	-35.77	Peak	151.25	165	Z-Axis
2725.3	29.58	53.98	-24.40	Avg	151.25	165	Z-Axis
3633.7		73.98		Peak			No Emissions Found
3633.7		53.98		Avg			No Emissions Found
4542.1	38.48	73.98	-35.50	Peak	303.75	183	X-Axis
4542.1	31.10	53.98	-22.88	Avg	303.75	183	X-Axis
4542.1	46.30	73.98	-27.68	Peak	183.25	154	Y-Axis
4542.1	38.20	53.98	-15.78	Avg	183.25	154	Y-Axis
4542.1	44.01	73.98	-29.97	Peak	153.00	165	Z-Axis
4542.1	35.00	53.98	-18.98	Avg	153.00	165	Z-Axis
5450.5		73.98		Peak			No Emission Found
5450.5		53.98		Avg			X-Axis
5450.5	42.78	73.98	-31.20	Peak	95.75	150	Y-Axis
5450.5	30.00	53.98	-23.98	Avg	95.75	150	Y-Axis
5450.5	41.44	73.98	-32.54	Peak	248.75	200	Z-Axis
5450.5	29.54	53.98	-24.44	Avg	248.75	200	Z-Axis
6358.9		73.98	-73.98	Peak			No Emission Found
6358.9		53.98	-53.98	Avg			X-Axis
6358.9	47.10	73.98	-26.88	Peak	180.50	211	Y-Axis
6358.9	35.50	53.98	-18.48	Avg	180.50	211	Y-Axis
6358.9	44.09	73.98	-29.89	Peak	140.25	180	Z-Axis
6358.9	32.36	53.98	-21.62	Avg	140.25	180	Z-Axis

Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak /Avg	Table Angle (deg)	Ant. Height (m)	Comments
7267.4	51.80	73.98	-22.18	Peak	137.00	106	X-Axis
7267.4	39.20	53.98	-14.78	Avg	137.00	106	X-Axis
7267.4	54.00	73.98	-19.98	Peak	43.50	105	Y-Axis
7267.4	41.50	53.98	-12.48	Avg	43.50	105	Y-Axis
7267.4	53.60	73.98	-20.38	Peak	199.50	110	Z-Axis
7267.4	40.30	53.98	-13.68	Avg	199.50	110	Z-Axis
8175.8	59.10	73.98	-14.88	Peak	159.00	148	X-Axis
8175.8	47.23	53.98	-6.75	Avg	159.00	148	X-Axis
8175.8	57.70	73.98	-16.28	Peak	219.50	104	Y-Axis
8175.8	45.50	53.98	-8.48	Avg	219.50	104	Y-Axis
8175.8	57.30	73.98	-16.68	Peak	339.50	132	Z-Axis
8175.8	44.40	53.98	-9.58	Avg	339.50	132	Z-Axis
9084.2	55.32	73.98	-18.66	Peak	123.75	140	X-Axis
9084.2	41.60	53.98	-12.38	Avg	123.75	140	X-Axis
9084.2	54.00	73.98	-19.98	Peak	42.00	100	Y-Axis
9084.2	40.36	53.98	-13.62	Avg	42.00	100	Y-Axis
9084.2	56.20	73.98	-17.78	Peak	7.75	157	Z-Axis
9084.2	42.69	53.98	-11.29	Avg	7.75	157	Z-Axis

Test distance
3 meter

HARMONICS LOW CHANNEL VERTICAL

FCC 15.249

Company: Ecolink Intelligent Technology, LLC Date: 12/02/2019
EUT: GARAGE DOOR TILT SENSOR Lab: R
Model: TILT-ZWAVE5 Tested By: Howard Huang

Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak /Avg	Table Angle (deg)	Ant. Height (m)	Comments
1816.8	48.10	73.98	-25.88	Peak	214.25	159	X-Axis
1816.8	43.40	53.98	-10.58	Avg	214.25	159	X-Axis
1816.8	55.50	73.98	-18.48	Peak	165.00	145	Y-Axis
1816.8	51.19	53.98	-2.79	Avg	165.00	145	Y-Axis
1816.8	51.60	73.98	-22.38	Peak	260.00	160	Z-Axis
1816.8	47.18	53.98	-6.80	Avg	260.00	160	Z-Axis
2725.3		73.98		Peak			No Emission Found
2725.3		53.98		Avg			X-Axis
2725.3	42.00	73.98	-31.98	Peak	159.75	136	Y-Axis
2725.3	36.00	53.98	-17.98	Avg	159.75	136	Y-Axis
2725.3	40.85	73.98	-33.13	Peak	145.25	140	Z-Axis
2725.3	34.17	53.98	-19.81	Avg	145.25	140	Z-Axis
3633.7		73.98		Peak			No Emissions Found
3633.7		53.98		Avg			No Emissions Found
4542.1		73.98	-73.98	Peak			No Emission Found
4542.1		53.98	-53.98	Avg			X-Axis
4542.1	41.20	73.98	-32.78	Peak	259.25	200	Y-Axis
4542.1	31.50	53.98	-22.48	Avg	259.25	200	Y-Axis
4542.1	46.65	73.98	-27.33	Peak	192.75	131	Z-Axis
4542.1	39.10	53.98	-14.88	Avg	192.75	131	Z-Axis
5450.5		73.98	-73.98	Peak			No Emission Found
5450.5		53.98	-53.98	Avg			X-Axis
5450.5	40.16	73.98	-33.82	Peak	93.00	176	Y-Axis
5450.5	27.70	53.98	-26.28	Avg	93.00	176	Y-Axis
5450.5	40.00	73.98	-33.98	Peak	81.00	184	Z-Axis
5450.5	28.50	53.98	-25.48	Avg	81.00	184	Z-Axis
6358.9		73.98	-73.98	Peak			No Emission Found
6358.9		53.98	-53.98	Avg			X-Axis
6358.9	46.20	73.98	-27.78	Peak	174.75	164	Y-Axis
6358.9	34.60	53.98	-19.38	Avg	174.75	164	Y-Axis
6358.9	46.70	73.98	-27.28	Peak	212.00	139	Z-Axis
6358.9	35.00	53.98	-18.98	Avg	212.00	139	Z-Axis

7267.4	52.30	73.98	-21.68	Peak	189.50	99	X-Axis
7267.4	39.00	53.98	-14.98	Avg	189.50	99	X-Axis
7267.4	52.00	73.98	-21.98	Peak	95.75	100	Y-Axis
7267.4	38.60	53.98	-15.38	Avg	95.75	100	Y-Axis
7267.4	52.30	73.98	-21.68	Peak	251.00	194	Z-Axis
7267.4	39.60	53.98	-14.38	Avg	251.00	194	Z-Axis
8175.8	54.90	73.98	-19.08	Peak	76.75	100	X-Axis
8175.8	42.60	53.98	-11.38	Avg	76.75	100	X-Axis
8175.8	58.20	73.98	-15.78	Peak	95.50	100	Y-Axis
8175.8	45.30	53.98	-8.68	Avg	95.50	100	Y-Axis
8175.8	57.20	73.98	-16.78	Peak	203.25	194	Z-Axis
8175.8	44.60	53.98	-9.38	Avg	203.25	194	Z-Axis
9084.2	52.40	73.98	-21.58	Peak	76.50	100	X-Axis
9084.2	38.50	53.98	-15.48	Avg	76.50	100	X-Axis
9084.2	55.05	73.98	-18.93	Peak	95.00	100	Y-Axis
9084.2	41.60	53.98	-12.38	Avg	95.00	100	Y-Axis
9084.2	52.80	73.98	-21.18	Peak	269.75	194	Z-Axis
9084.2	39.10	53.98	-14.88	Avg	269.75	194	Z-Axis

Test distance
3 meter

HARMONICS HIGH CHANNEL HORIZONTAL

FCC 15.249

Company: Ecolink Intelligent Technology, LLC
EUT: GARAGE DOOR TILT SENSOR
Model: TILT-ZWAVE5

Date: 12/02/2019
Lab: R
Tested By: Howard Huang

Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak / Avg	Table Angle (deg)	Ant. Height (m)	Comments
1832.0	51.30	73.98	-22.68	Peak	83.00	173	X-Axis
1832.0	49.76	53.98	-4.22	Avg	83.00	173	X-Axis
1832.0	43.30	73.98	-30.68	Peak	62.75	190	Y-Axis
1832.0	41.00	53.98	-12.98	Avg	62.75	190	Y-Axis
1832.0	43.62	73.98	-30.36	Peak	196.00	163	Z-Axis
1832.0	41.22	53.98	-12.76	Avg	196.00	163	Z-Axis
2748.0		73.98		Peak			No Emissions Found
2748.0		53.98		Avg			No Emissions Found
3664.0		73.98		Peak			No Emissions Found
3664.0		53.98		Avg			No Emissions Found
4580.0	41.00	73.98	-32.98	Peak	307.25	142	X-Axis
4580.0	34.40	53.98	-19.58	Avg	307.25	142	X-Axis
4580.0	44.35	73.98	-29.63	Peak	163.25	155	Y-Axis
4580.0	39.60	53.98	-14.38	Avg	163.26	155	Y-Axis
4580.0	43.10	73.98	-30.88	Peak	148.25	185	Z-Axis
4580.0	37.18	53.98	-16.80	Avg	148.25	185	Z-Axis
5496.0	42.91	73.98	-31.07	Peak	36.50	167	X-Axis
5496.0	32.98	53.98	-21.00	Avg	36.50	167	X-Axis
5496.0	43.61	73.98	-30.37	Peak	58.00	154	Y-Axis
5496.0	33.73	53.98	-20.25	Avg	58.00	154	Y-Axis
5496.0	44.00	73.98	-29.98	Peak	124.00	179	Z-Axis
5496.0	33.78	53.98	-20.20	Avg	124.00	179	Z-Axis
6412.0	46.48	73.98	-27.50	Peak	159.75	175	X-Axis
6412.0	38.70	53.98	-15.28	Avg	159.75	175	X-Axis
6412.0	45.05	73.98	-28.93	Peak	229.50	119	Y-Axis
6412.0	35.36	53.98	-18.62	Avg	229.50	119	Y-Axis
6412.0	43.67	73.98	-30.31	Peak	157.75	154	Z-Axis
6412.0	32.20	53.98	-21.78	Avg	157.75	154	Z-Axis
7328.0	51.00	73.98	-22.98	Peak	116.50	178	X-Axis
7328.0	41.02	53.98	-12.96	Avg	116.50	178	X-Axis
7328.0	53.00	73.98	-20.98	Peak	43.50	119	Y-Axis

7328.0	44.10	53.98	-9.88	Avg	43.50	119	Y-Axis
7328.0	52.02	73.98	-21.96	Peak	199.50	173	Z-Axis
7328.0	42.20	53.98	-11.78	Avg	199.50	173	Z-Axis
8244.0	56.70	73.98	-17.28	Peak	143.25	176	X-Axis
8244.0	49.20	53.98	-4.78	Avg	143.25	176	X-Axis
8244.0	55.01	73.98	-18.97	Peak	215.00	134	Y-Axis
8244.0	47.56	53.98	-6.42	Avg	215.00	134	Y-Axis
8244.0	54.90	73.98	-19.08	Peak	3.50	170	Z-Axis
8244.0	46.84	53.98	-7.14	Avg	3.50	170	Z-Axis
9160.0	46.59	73.98	-27.39	Peak	170.00	157	X-Axis
9160.0	37.00	53.98	-16.98	Avg	170.00	157	X-Axis
9160.0	45.79	73.98	-28.19	Peak	230.00	167	Y-Axis
9160.0	35.88	53.98	-18.10	Avg	230.00	167	Y-Axis
9160.0	47.03	73.98	-26.95	Peak	73.25	123	Z-Axis
9160.0	36.44	53.98	-17.54	Avg	73.25	123	Z-Axis

Test distance
3 meter

HARMONICS HIGH CHANNEL VERTICAL

FCC 15.249

Company: Ecolink Intelligent Technology, LLC
EUT: GARAGE DOOR TILT SENSOR
Model: TILT-ZWAVE5

Date: 12/02/2019
Lab: R
Tested By: Howard Huang

Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak / Avg	Table Angle (deg)	Ant. Height (m)	Comments
1832.0	40.45	73.98	-33.53	Peak	9.75	160	X-Axis
1832.0	37.47	53.98	-16.51	Avg	9.75	160	X-Axis
1832.0	54.58	73.98	-19.40	Peak	140.00	141	Y-Axis
1832.0	53.25	53.98	-0.73	Avg	140.00	141	Y-Axis
1832.0	51.39	73.98	-22.59	Peak	108.00	168	Z-Axis
1832.0	49.84	53.98	-4.14	Avg	108.00	168	Z-Axis
2748.0		73.98	-73.98	Peak			No Emission Found
2748.0		53.98	-53.98	Avg			X-Axis
2748.0	40.28	73.98	-33.70	Peak	140.00	138	Y-Axis
2748.0	35.74	53.98	-18.24	Avg	140.00	138	Y-Axis
2748.0	38.75	73.98	-35.23	Peak	232.25	168	Z-Axis
2748.0	32.18	53.98	-21.80	Avg	232.25	168	Z-Axis
3664.0		73.98		Peak			No Emissions Found
3664.0		53.98		Avg			No Emissions Found
4580.0	41.40	73.98	-32.58	Peak	185.00	191	X-Axis
4580.0	35.13	53.98	-18.85	Avg	185.00	191	X-Axis
4580.0	38.53	73.98	-35.45	Peak	145.50	157	Y-Axis
4580.0	30.10	53.98	-23.88	Avg	145.50	157	Y-Axis
4580.0	44.59	73.98	-29.39	Peak	177.50	180	Z-Axis
4580.0	39.38	53.98	-14.60	Avg	177.50	180	Z-Axis
5496.0	43.00	73.98	-30.98	Peak	213.25	199	X-Axis
5496.0	31.80	53.98	-22.18	Avg	213.25	199	X-Axis
5496.0	42.58	73.98	-31.40	Peak	209.50	124	Y-Axis
5496.0	31.21	53.98	-22.77	Avg	209.50	124	Y-Axis
5496.0	42.23	73.98	-31.75	Peak	276.00	144	Z-Axis
5496.0	31.39	53.98	-22.59	Avg	276.00	144	Z-Axis
6412.0	41.75	73.98	-32.23	Peak	5.75	216	X-Axis
6412.0	30.67	53.98	-23.31	Avg	5.75	216	X-Axis
6412.0	45.30	73.98	-28.68	Peak	158.25	169	Y-Axis
6412.0	35.95	53.98	-18.03	Avg	158.25	169	Y-Axis
6412.0	45.00	73.98	-28.98	Peak	221.50	144	Z-Axis
6412.0	35.56	53.98	-18.42	Avg	221.50	144	Z-Axis

7328.0	52.30	73.98	-21.68	Peak	240.00	210	X-Axis
7328.0	42.30	53.98	-11.68	Avg	240.00	210	X-Axis
7328.0	52.10	73.98	-21.88	Peak	333.25	146	Y-Axis
7328.0	42.39	53.98	-11.59	Avg	333.25	146	Y-Axis
7328.0	52.00	73.98	-21.98	Peak	224.00	187	Z-Axis
7328.0	42.27	53.98	-11.71	Avg	224.00	187	Z-Axis
8244.0	53.02	73.98	-20.96	Peak	271.75	199	X-Axis
8244.0	44.10	53.98	-9.88	Avg	271.75	199	X-Axis
8244.0	56.00	73.98	-17.98	Peak	125.25	173	Y-Axis
8244.0	48.35	53.98	-5.63	Avg	125.25	173	Y-Axis
8244.0	55.68	73.98	-18.30	Peak	212.25	194	Z-Axis
8244.0	47.38	53.98	-6.60	Avg	212.25	194	Z-Axis
9160.0	46.09	73.98	-27.89	Peak	86.50	142	X-Axis
9160.0	35.60	53.98	-18.38	Avg	86.50	142	X-Axis
9160.0	48.66	73.98	-25.32	Peak	87.25	144	Y-Axis
9160.0	39.70	53.98	-14.28	Avg	87.25	144	Y-Axis
9160.0	45.94	73.98	-28.04	Peak	262.00	144	Z-Axis
9160.0	36.18	53.98	-17.80	Avg	262.00	144	Z-Axis
7328.0	52.30	73.98	-21.68	Peak	240.00	210	X-Axis

Test distance
3 meter

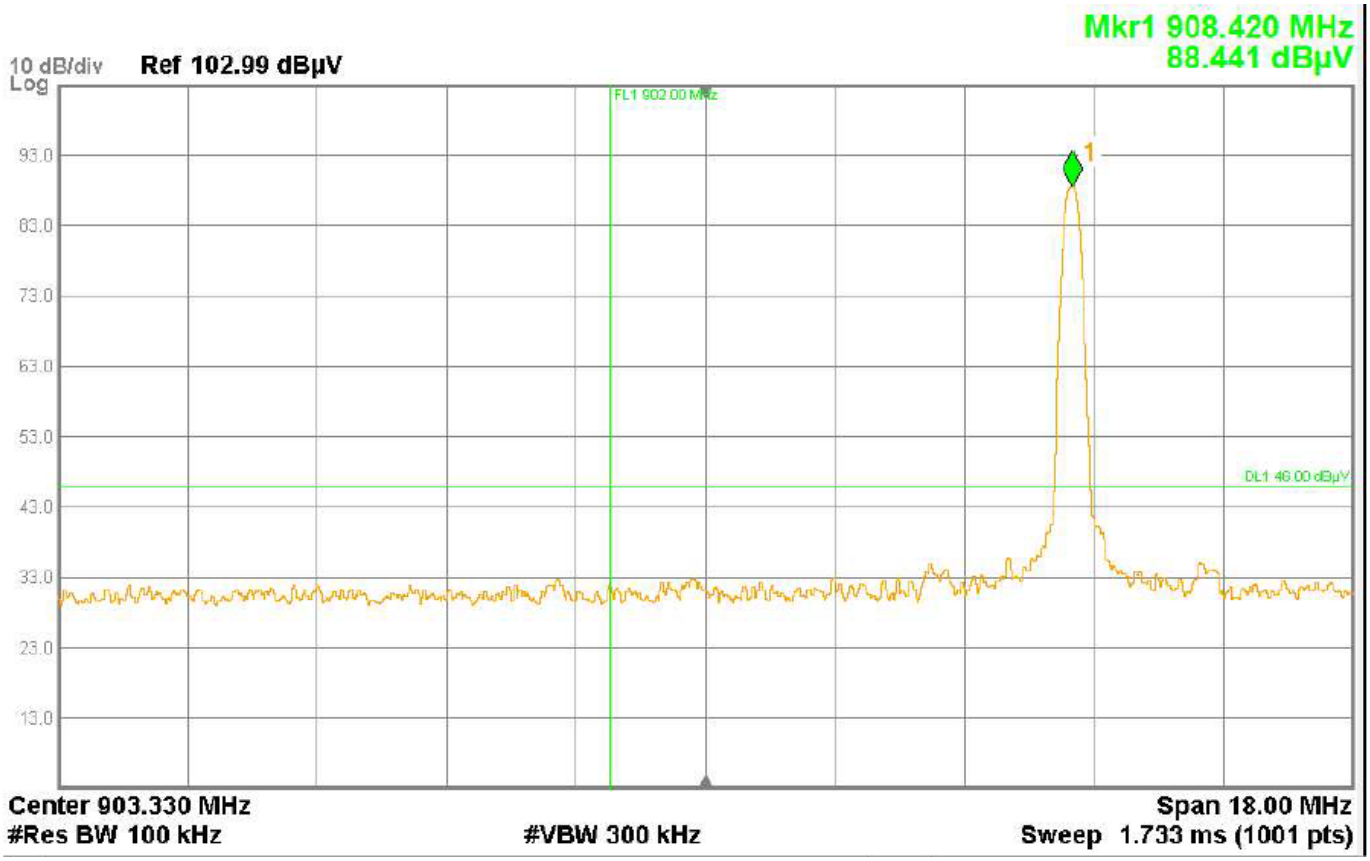
EMISSIONS RADIATED OUTSIDE OF THE FUNDAMENTAL FREQUENCY BAND

DATA SHEETS

LOWER BAND EDGE

FCC 15.249

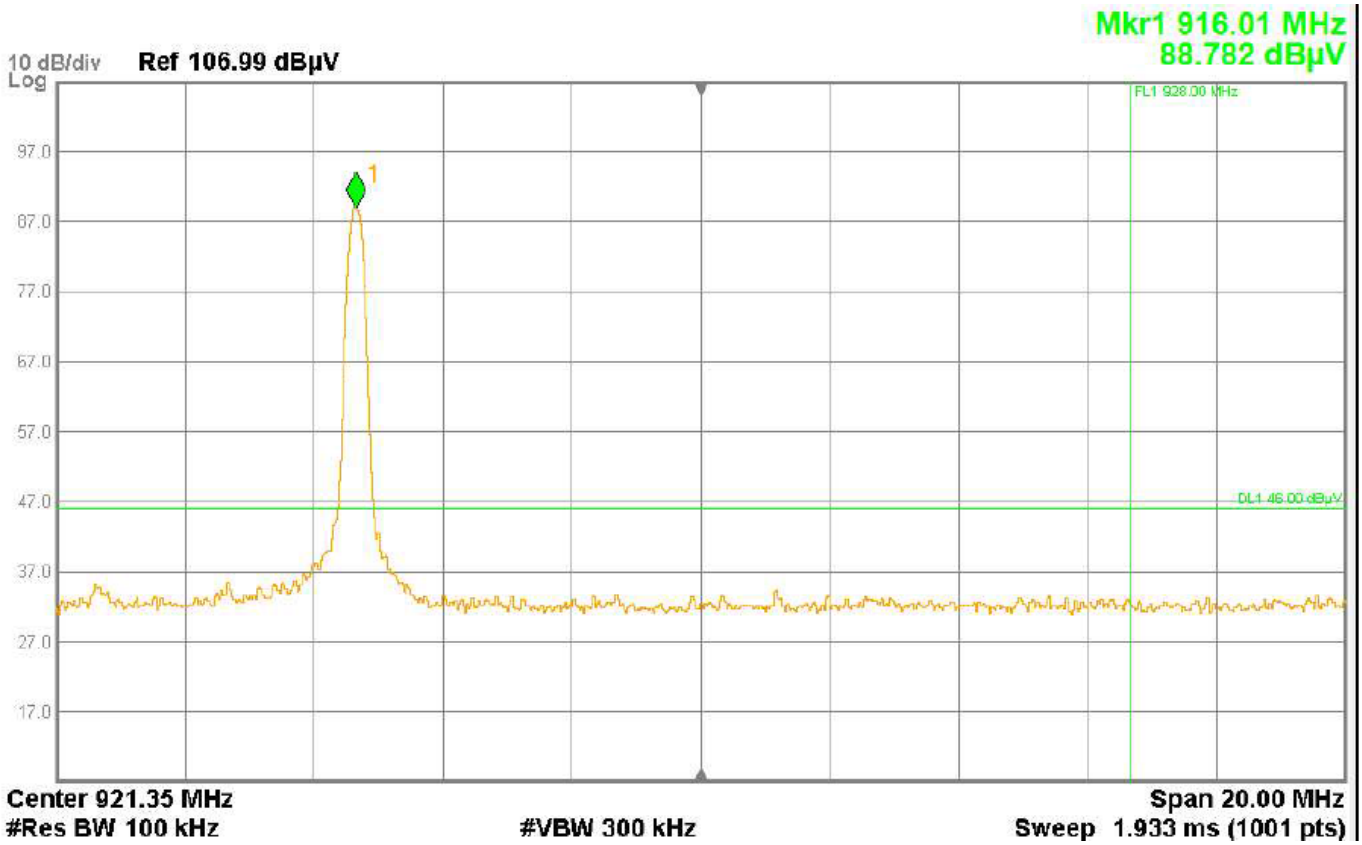
Company:	Ecolink Intelligent Technology, LLC	Date:	12/03/2019
EUT:	GARAGE DOOR TILT SENSOR	Lab:	R
Model:	TILT-ZWAVE5	Test ENG:	Howard Huang



UPPER BAND EDGE

FCC 15.249

Company:	Ecolink Intelligent Technology, LLC	Date:	12/03/2019
EUT:	GARAGE DOOR TILT SENSOR	Lab:	R
Model:	TILT-ZWAVE5	Test ENG:	Howard Huang



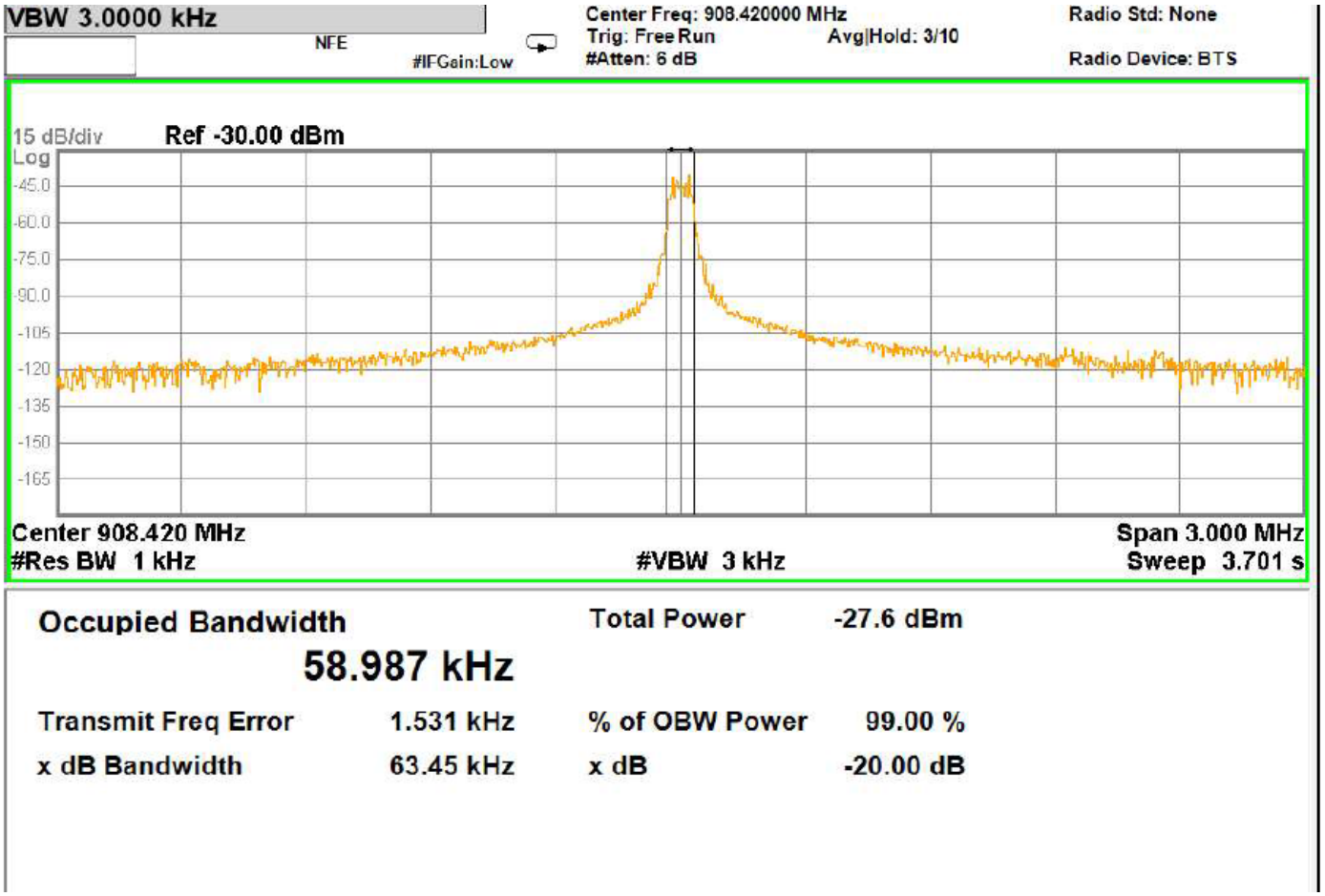
99% OCCUPIED BANDWIDTH

DATA SHEETS

OCCUPIED BANDWIDTH-LOW CHANNEL

RSS-GEN & RSS210

Company:	Ecolink Intelligent Technology, LLC	Date:	12/03/2019
EUT:	GARAGE DOOR TILT SENSOR	Lab:	P
Model:	TILT-ZWAVE5	Tested By:	Howard Huang

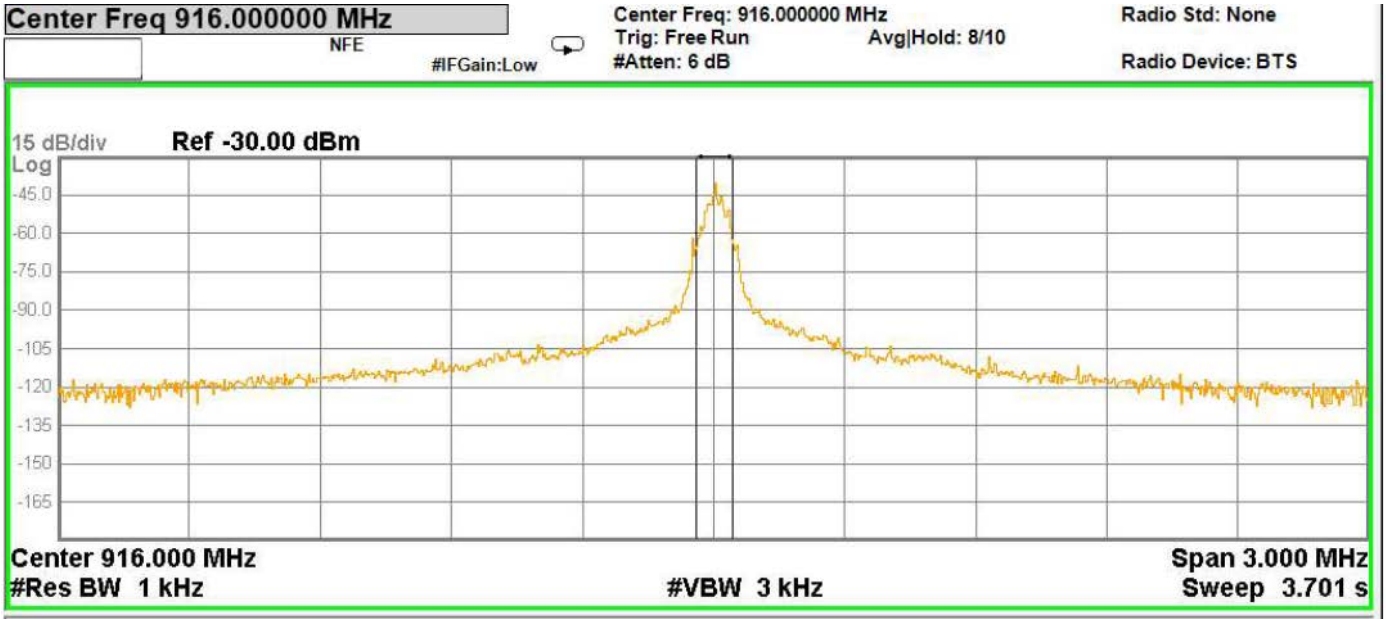


Occupied Bandwidth		Total Power	-27.6 dBm
58.987 kHz			
Transmit Freq Error	1.531 kHz	% of OBW Power	99.00 %
x dB Bandwidth	63.45 kHz	x dB	-20.00 dB

OCCUPIED BANDWIDTH-HIGH CHANNEL

RSS-GEN & RSS210

Company:	Ecolink Intelligent Technology, LLC	Date:	12/03/2019
EUT:	GARAGE DOOR TILT SENSOR	Lab:	R
Model:	TILT-ZWAVE5	Tested By:	Howard Huang



Occupied Bandwidth		Total Power	-29.9 dBm
74.436 kHz			
Transmit Freq Error	4.458 kHz	% of OBW Power	99.00 %
x dB Bandwidth	71.14 kHz	x dB	-20.00 dB