


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

for


**500 SERIES Z-WAVE WALL SWITCH
Model: WS15Z5-1**

Prepared for

NORTEK SECURITY & CONTROL
1950 CAMINO VIDA ROBLE, SUITE 150
CARLSBAD, CA 92008

Prepared by: 

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Approved by: 

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DATE: NOVEMBER 10, 2016

	REPORT BODY	APPENDICES					TOTAL
		A	B	C	D	E	
PAGES	18	2	2	2	14	23	61

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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 unless done so in full with the written permission of Compatible Electronics.

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

Device Tested: 500 SERIES Z-WAVE WALL SWITCH
Model: WS15Z5-1
S/N: None

Product Description: The EUT is a Z-Wave Plus 15A 120V 500 SERIES Z-WAVE WALL SWITCH with energy monitoring.

Modifications: The EUT was not modified in order to comply with specifications.

Manufacturer: Nortek Security & Control
1950 Camino Vida Roble, Suite 150
Carlsbad, CA 92008

Test Date: November 10 & 14, 2016

Test Specifications Covered by Accreditation:



EMI requirements

CFR Title 47, Part 15 Subpart B Sections 15.107, 15.109, Subpart C Sections 15.205, 15.207, 15.209, 15.249, RSS 247, and RSS Gen

Test Procedure: ANSI C63.4 & C63.10



SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz.	Complies with the limits of RSS-210, RSS-GEN, CFR Title 47 Part 15 Subpart B, Section 15.107 and Subpart C Sections 15.207
2	Radiated RF Emissions & Harmonics, 9 kHz – 10,000 MHz.	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



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1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the 500 Series Z-Wave Wall Switch Model: WS15Z5-1. The EMI measurements were performed according to the measurement procedure described in ANSI C63.10. 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, RSS-GEN, and the Code of Federal Regulations Title 47, Part 15 Subpart B sections 15.107, 15.109, & Part 15 Subpart C sections 15.205, 15.207, 15.209 and 15.249.



2. ADMINISTRATIVE DATA

2.1 Location of Testing

The 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

Nortek

Josh Hansen Regulatory Engineer

Compatible Electronics, Inc.

Matt Harrison Lab Manager
Torey Oliver Test Engineer

2.4 Date Test Sample was Received

The test sample was received on November 10, 2016.

2.5 Disposition of the Test Sample

The test sample remains at Compatible Electronics, Inc. as of the date of this test report.

2.6 Abbreviations and Acronyms

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

RF	Radio Frequency
EMI	Electromagnetic Interference
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



3. APPLICABLE DOCUMENTS

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

SPEC	TITLE
RSS 210	License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS GEN	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 500 Series Z-Wave Wall Switch Model: WS15Z5-1 (EUT) was setup in a tabletop configuration. The EUT was connected to the resistive loads via its power connector. The EUT is a wall mounted device so it was tested in the x-axis as seen below. The EUT was continuously transmitting a data stream during transmit tests and continuously receiving during receive tests.

The voltage was varied $\pm 15\%$; the transmitting signal amplitude and frequency did not vary.

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



4.1.2 *Cable Construction and Termination*

Cable 1

This is a 1-meter, un-shielded power cable. It is connecting the EUT to the load fixture. It has a IEC connector at the fixture end and is hardwired into the EUT. The cable was not bundled.



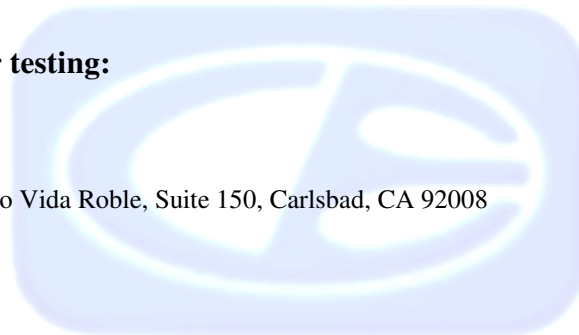
5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT**5.1 EUT and Accessory List**

#	EQUIPMENT TYPE	MANU-FACTURER	MODEL	SERIAL NUMBER
1	500 SERIES Z-WAVE WALL SWITCH (EUT)	NORTEK	WS15Z5-1	NONE
2	LOAD FIXTURE	GENERIC	GENERIC	NONE
3	RESISTIVE LOADS (x3)	GENERIC	500W (AT 120V)	NONE
4	LIGHT BULB	GENERAL ELECTRIC	300W	NONE

5.2 Software used for testing:

Version: 1.05

Location: 1950 Camino Vida Roble, Suite 150, Carlsbad, CA 92008



5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Computer	Compatible Electronics	NONE	NONE	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESIB40	100219	09/13/2016	09/13/2017
Antenna, Loop	Com Power	AL-130	121049	12/06/2013	12/06/2016
Antenna, CombiLog	Com Power	AC-220	25857	05/19/2016	05/19/2017
Antenna, Horn 1-18GHz	Com Power	AH-118	071225	05/17/2016	05/17/2017
Pre-Amp, 1-18GHz	Com Power	PAM-118A	551033	04/18/2016	04/18/2017
Notch Filter	AMTI Microwave Circuits	N03019-01	3709-01 DC0415	03/01/2016	03/01/2017
Mast, Antenna Positioner	Sunol Science Corporation	TWR 95-4	020808-3	N/A	N/A
Antenna Mast	Sunol Science Corporation	TWR 95-4	020808-3	N/A	N/A
Turntable	Sunol Science Corporation	FM 2001	N/A	N/A	N/A
Mast and Turntable Controller	Sunol Science Corporation	SC104V	020808-1	N/A	N/A
LISN	Com-Power	LI-150	191935	03/17/2016	03/17/2017
Power Supply	Chroma	61511	615114800078	N.C.R.	N.C.R.



6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and the figures in Appendix D of this report for test location.

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 grounded thru the power cord.

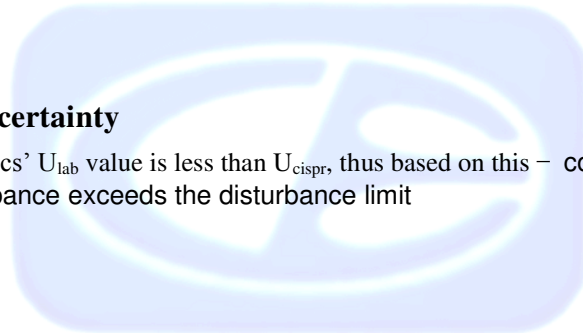
6.3 Facility Environmental Characteristics

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}	$U_{lab} = 2 u_c(y)$
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3,6 dB	2.88
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	5,2 dB	4.04



7. CHARACTERISTICS OF THE TRANSMITTER

7.1 Channel Number and Frequencies

There are 2 operating channels and the EUT uses FSK modulation.

1 == 908.4 MHz = Power Level set to 43

2 == 916.0 MHz = Power Level set to 41

7.2 Antenna

The antenna is made up of a wire located on the PCB.



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*

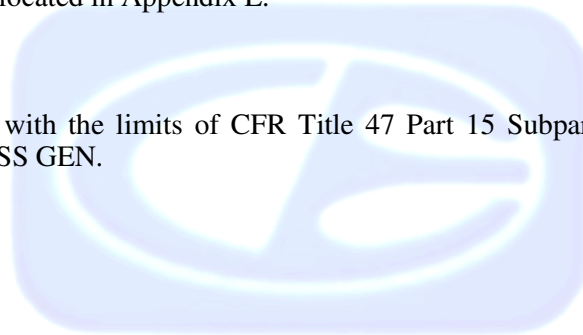
The EMI receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. The LISN output was measured using the EMI receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this 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 63.4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the computer software. The final qualification data is located in Appendix E.

Test Results:

The EUT complies with the limits of CFR Title 47 Part 15 Subpart B section 15.107, Subpart C section 15.207, & RSS GEN.



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
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

The test procedures were not deviated from throughout all tests.

10. CONCLUSIONS

The 500 Series Z-Wave Wall Switch Model: WS15Z5-1 meets all of the relevant specification requirements defined in RSS-210, RSS-GEN, and the Code of Federal Regulations Title 47, Part 15 Subpart B section 15.107, 15.109, & Subpart C sections 15.205, 15.207, 15.209 and 15.249.



APPENDIX A

***LABORATORY ACCREDITATIONS AND
RECOGNITIONS***



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LABORATORY ACCREDITATIONS AND RECOGNITIONS



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."

IC OAT's Test Site Registration Number: 2154C-1



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APPENDIX B

MODIFICATIONS TO THE EUT



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MODIFICATIONS TO THE EUT

There were no modifications were made during testing



APPENDIX C

***ADDITIONAL MODELS COVERED
UNDER THIS REPORT***



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ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

500 SERIES Z-WAVE WALL SWITCH
MODEL: WS15Z5-1
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

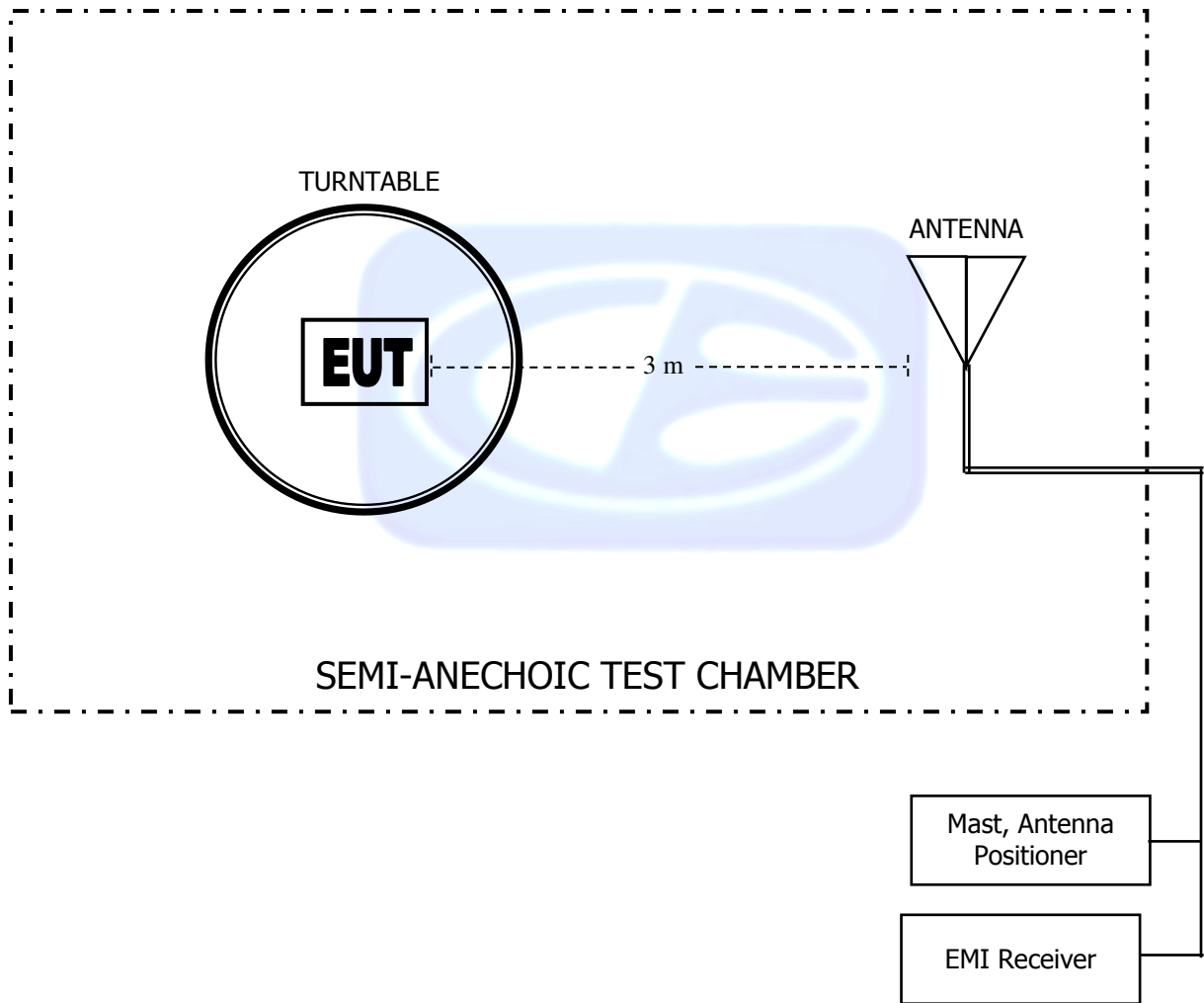


FIGURE 2: PLOT MAP AND LAYOUT OF TEST SITE ABOVE 1GHZ

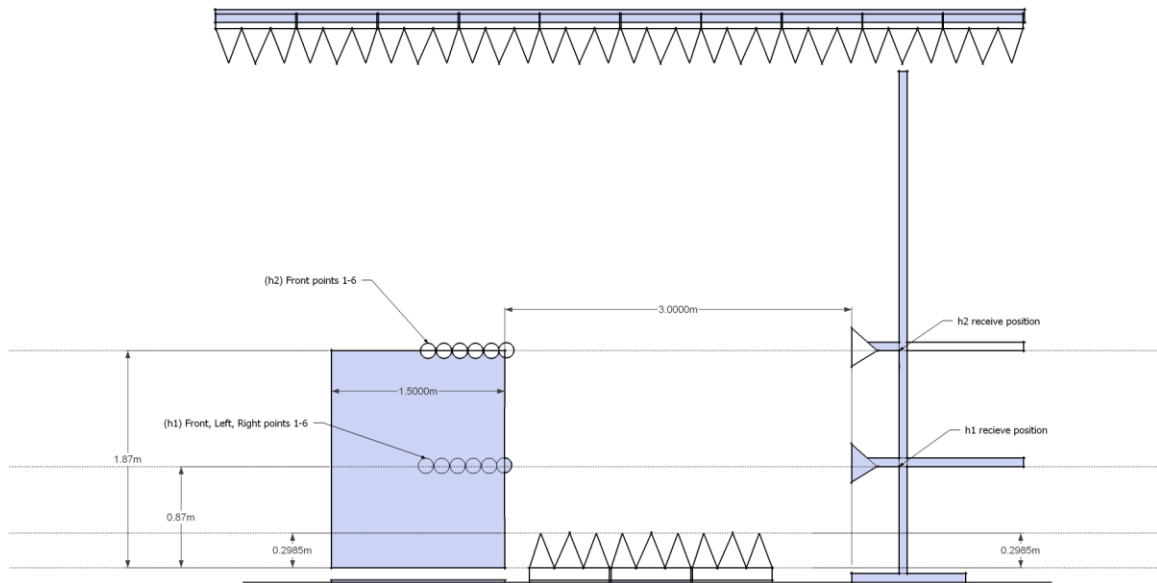
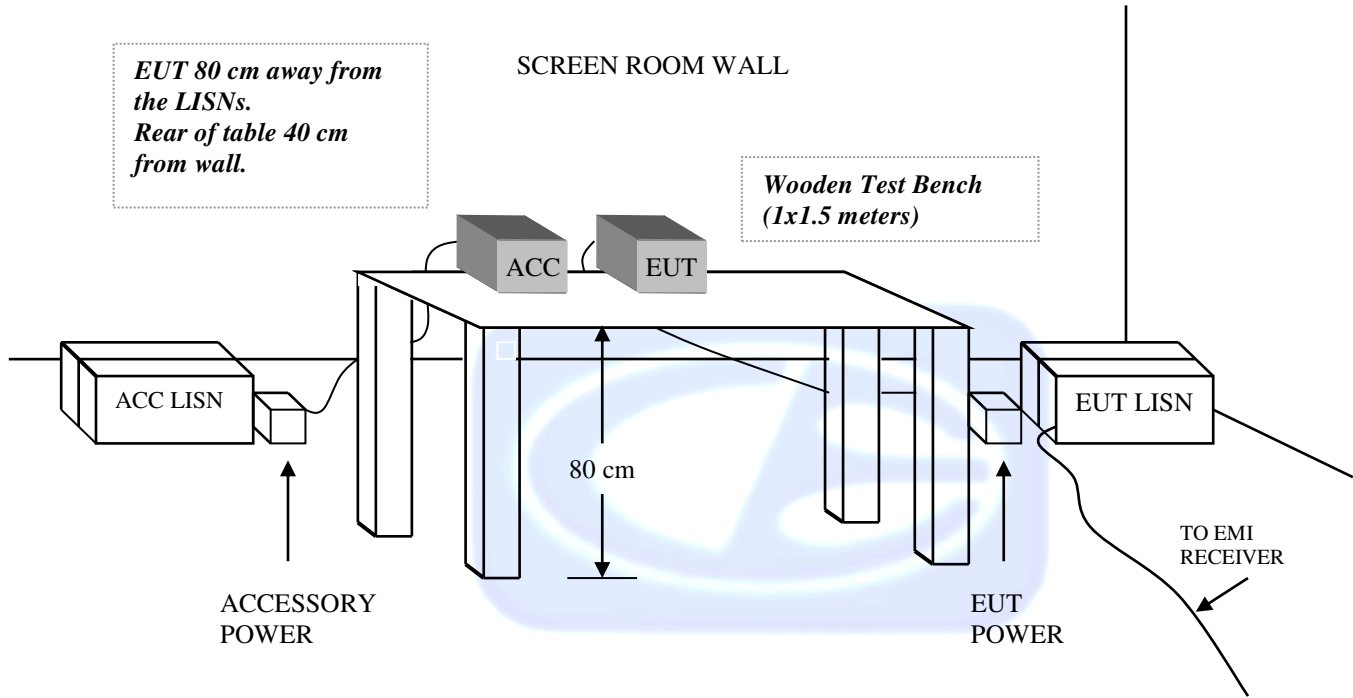


FIGURE 3: CONDUCTED EMISSIONS TEST SETUP



COM-POWER AL-130**LOOP ANTENNA**

S/N: 121049

CALIBRATION DUE: DECEMBER 6, 2016

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)	FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009	-34.64	16.86	0.8	-36.32	15.18
0.01	-34.78	16.72	0.9	-36.22	15.28
0.02	-35.91	15.59	1.0	-36.22	15.28
0.03	-35.48	16.02	2.0	-35.91	15.59
0.04	-35.82	15.68	3.0	-35.91	15.59
0.05	-36.49	15.01	4.0	-36.01	15.49
0.06	-36.30	15.20	5.0	-35.80	15.70
0.07	-36.43	15.07	6.0	-36.00	15.50
0.08	-36.30	15.20	7.0	-35.90	15.60
0.09	-36.39	15.11	8.0	-35.70	15.80
0.1	-36.41	15.09	9.0	-35.70	15.80
0.2	-36.61	14.89	10.0	-35.60	15.90
0.3	-36.63	14.87	15.0	-36.52	14.98
0.4	-36.52	14.99	20.0	-35.75	15.75
0.5	-36.63	14.87	25.0	-37.78	13.72
0.6	-36.62	14.88	30.0	-38.62	12.88
0.7	-36.53	14.97			



COM-POWER AC-220**LAB R - COMBILOG ANTENNA**

S/N: 25857

CALIBRATION DUE: MAY 19, 2017

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.5	160	13.3
35	22.5	180	15.0
40	23.0	200	14.6
45	21.5	250	16.5
50	21.3	300	18.1
60	18.2	400	19.4
70	13.2	500	20.6
80	11.6	600	21.6
90	11.9	700	23.7
100	12.6	800	26.0
120	15.1	900	26.6
140	15.2	1000	28.5



COM-POWER AH-118**HORN ANTENNA**

S/N: 071250

CALIBRATION DUE: MAY 17, 2017

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
1000	24.40	9500	39.11
1500	25.61	10000	39.38
2000	28.71	10500	39.55
2500	29.09	11000	39.66
3000	30.24	11500	40.28
3500	30.94	12000	40.26
4000	31.77	12500	40.64
4500	32.29	13000	41.33
5000	33.70	13500	41.74
5500	34.28	14000	41.52
6000	34.83	14500	41.80
6500	35.07	15000	43.51
7000	36.79	15500	41.03
7500	37.45	16000	40.88
8000	37.67	16500	40.18
8500	37.75	17000	42.59
9000	38.15	17500	44.49
		18000	45.27



COM-POWER PAM-118A**1-18GHz - PREAMPLIFIER**

S/N: 551033

CALIBRATION DUE: MAY 17, 2017

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
500	41.06	5500	40.63
1000	41.06	6000	40.18
1100	41.12	6500	40.33
1200	41.09	7000	39.97
1300	41.20	7500	40.45
1400	41.28	8000	39.83
1500	41.34	8500	39.79
1600	41.37	9000	39.71
1700	41.43	9500	39.80
1800	41.47	10000	41.07
1900	41.53	11000	40.05
2000	41.59	12000	40.21
2500	41.87	13000	40.61
3000	42.13	14000	39.09
3500	42.21	15000	39.36
4000	42.22	16000	38.32
4500	41.53	17000	38.32
5000	41.16	18000	36.85





FRONT VIEW

NORTEK

500 SERIES Z-WAVE WALL SWITCH

Model: WS15Z5-1

FCC SUBPART B & C - RADIATED EMISSIONS < 1GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**





REAR VIEW

NORTEK

500 SERIES Z-WAVE WALL SWITCH

Model: WS15Z5-1

FCC SUBPART B & C - RADIATED EMISSIONS < 1GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**





FRONT VIEW

NORTEK

500 SERIES Z-WAVE WALL SWITCH

Model: WS15Z5-1

FCC SUBPART B & C - RADIATED EMISSIONS > 1GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**





REAR VIEW

NORTEK
500 SERIES Z-WAVE WALL SWITCH
Model: WS15Z5-1
FCC SUBPART B & C - RADIATED EMISSIONS > 1GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



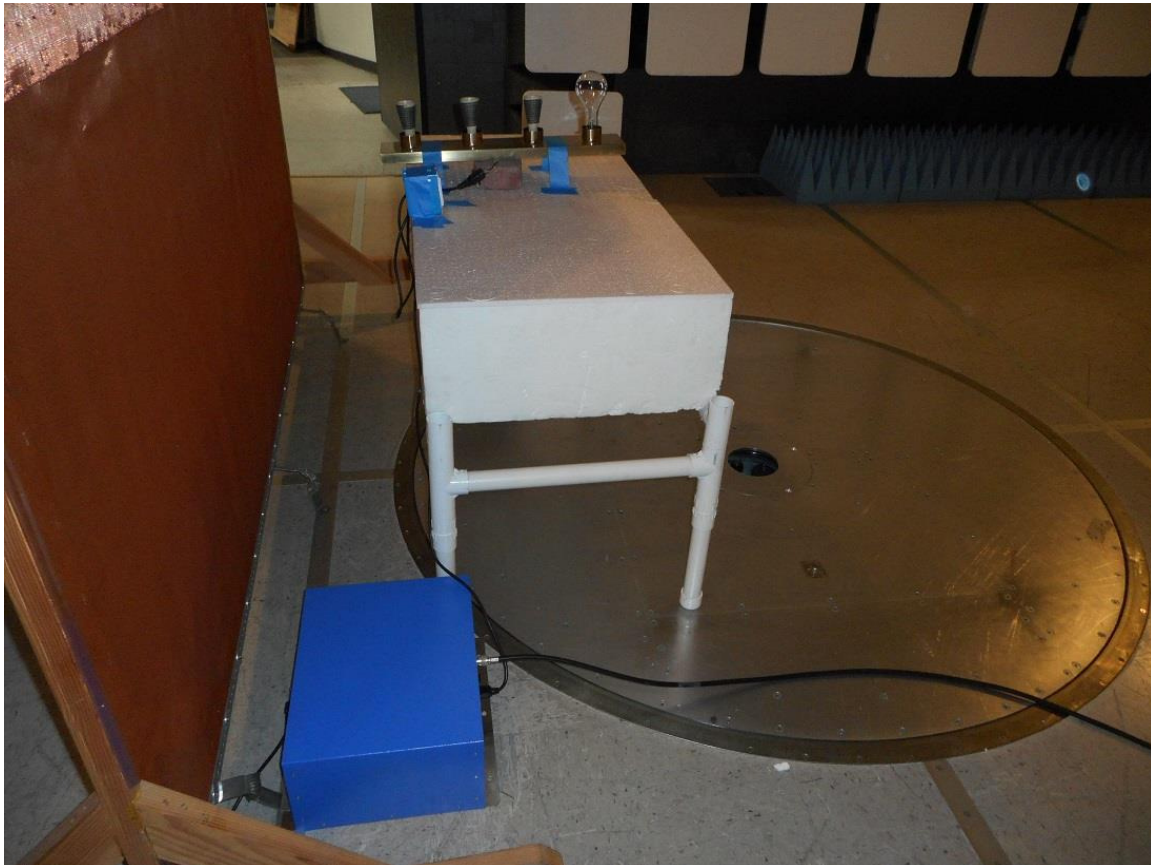


FRONT VIEW

NORTEK
500 SERIES Z-WAVE WALL SWITCH
Model: WS15Z5-1
FCC SUBPART B & C - CONDUCTED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**





REAR VIEW

NORTEK
500 SERIES Z-WAVE WALL SWITCH
Model: WS15Z5-1
FCC SUBPART B & C - CONDUCTED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



APPENDIX E

RADIATED EMISSIONS DATA SHEETS



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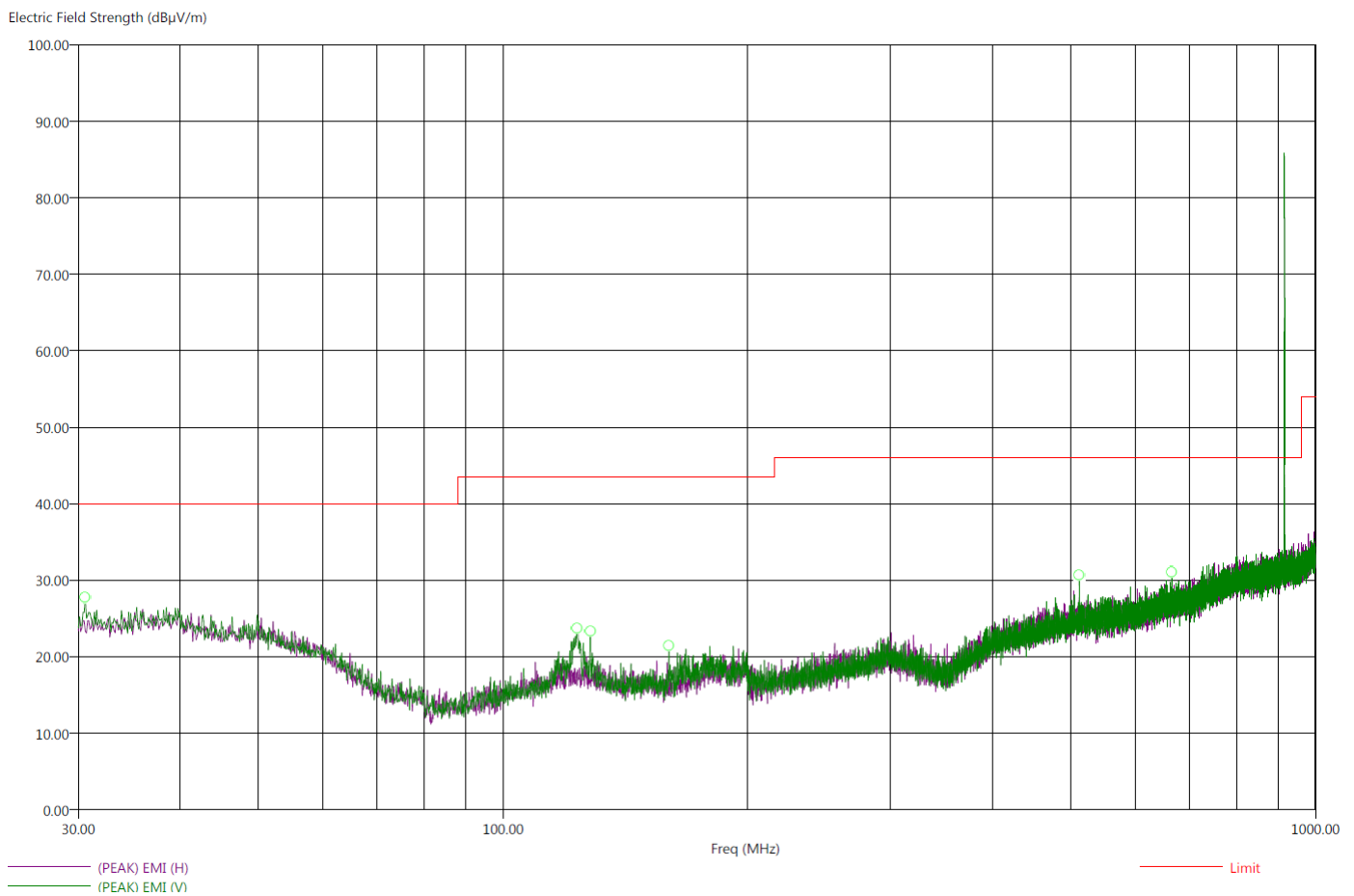
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19121 El Toro Road
Silverado, CA 92676
(949) 589-0700

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

Title: FCC 15.209
 File: Radiated Pre-Scan 30-1000Mhz_916.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Transmitting @ 916MHz.
 Comments: Connected to Load.
 Temp: 74f
 Hum: 46%
 120V 60Hz

11/14/2016 9:39:25 AM
 Sequence: Preliminary Scan

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



**There were no radiated emissions other than harmonics found below 30 MHz or above 1GHz.
 This is worst case channel.**



Brea Division
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 Brea, CA 92823
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Agoura Division
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 (818) 597-0600

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 19121 El Toro Road
 Silverado, CA 92676
 (949) 589-0700

Lake Forest Division
 20621 Pascal Way
 Lake Forest, CA 92630
 (949) 587-0400

Title: FCC 15.209
File: Radiated Final 30-1000Mhz_916.set
Operator: Matt Harrison
EUT Type: WS15Z5-1.
EUT Condition: Transmitting @ 916MHz.
Comments: Connected to Load.
Temp: 74f
Hum: 46%
120V 60Hz

11/14/2016 9:48:20 AM
Sequence: Final Measurements

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

Freq (MHz)	(QP) Margin (dB)	(QP) EMI (dB μ V/m)	(PEAK) EMI (dB μ V/m)	Limit (dB μ V/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable(dB)
30.60	-19.21	20.79	26.45	40.00	V	28.00	131.40	22.50	0.28
123.20	-25.58	17.94	24.68	43.52	V	147.00	152.65	15.16	0.88
128.00	-21.09	22.43	26.49	43.52	V	183.75	100.65	14.87	0.91
160.00	-24.41	19.11	23.31	43.52	V	26.50	104.83	13.30	1.11
512.00	-17.06	28.94	32.65	46.00	V	171.25	127.16	21.45	2.07
665.30	-20.96	25.04	30.64	46.00	V	358.75	133.79	23.43	2.37

*There were no radiated emissions other than harmonics found below 30 MHz or above 1GHz.
This is worst case channel.*



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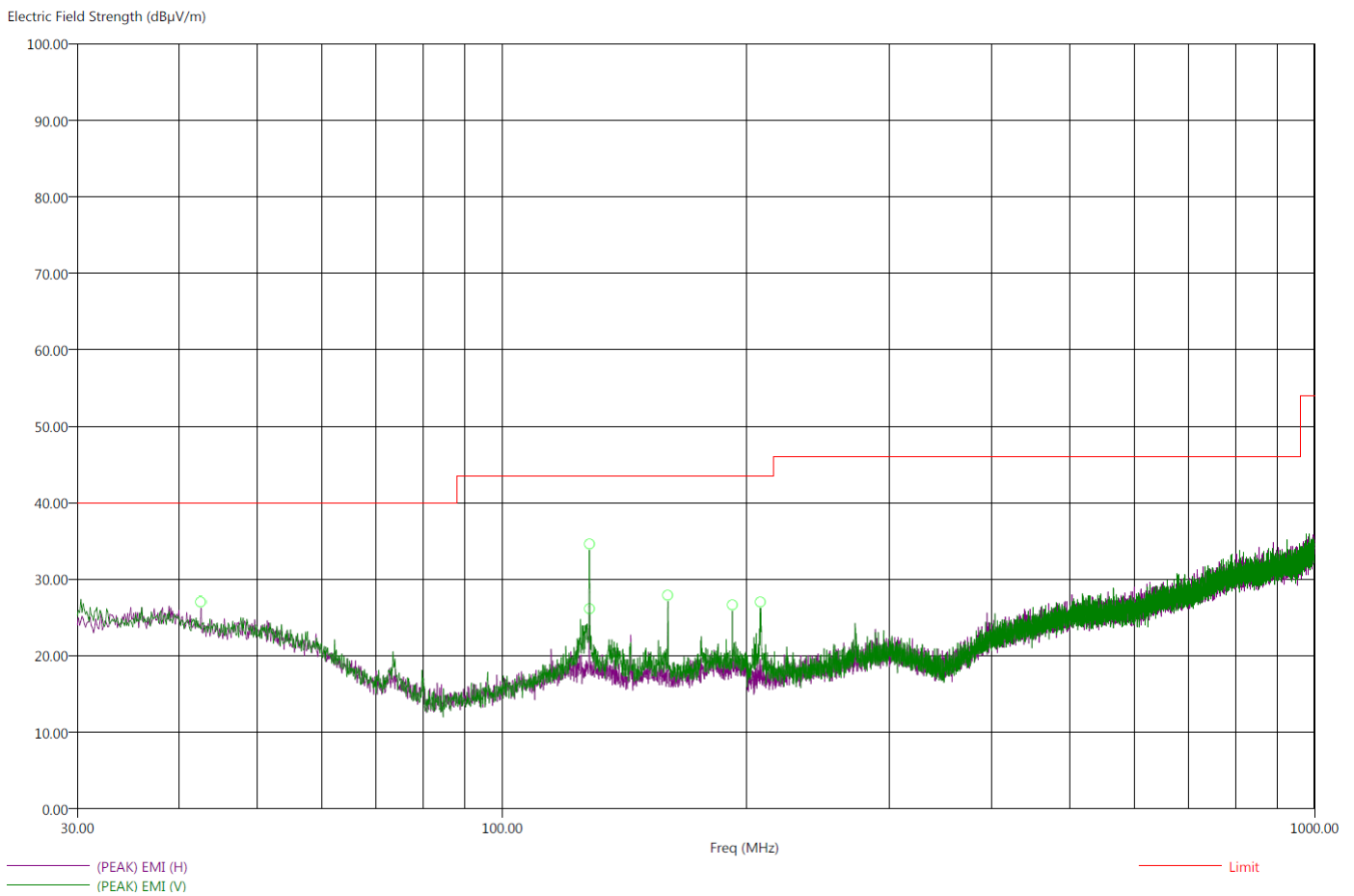
Silverado Division
19121 El Toro Road
Silverado, CA 92676
(949) 589-0700

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

Title: FCC 15.209
File: Radiated Pre-Scan 30-1000Mhz_Rx.set
Operator: Matt Harrison
EUT Type: WS15Z5-1.
EUT Condition: Receiving @ 916MHz.
Comments: Connected to Load.
Temp: 74f
Hum: 46%
120V 60Hz

11/14/2016 10:21:58 AM
Sequence: Preliminary Scan

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



There were no radiated emissions other than harmonics found below 30 MHz or above 1GHz.



Title: FCC 15.209
File: Radiated Final 30-1000Mhz_Rx.set
Operator: Matt Harrison
EUT Type: WS15Z5-1.
EUT Condition: Transmitting @ 916MHz.
Comments: Connected to Load.
Temp: 74f
Hum: 46%
120V 60Hz

11/14/2016 10:33:32 AM
Sequence: Final Measurements

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

Freq (MHz)	(QP) Margin (dB)	(QP) EMI (dB μ V/m)	(PEAK) EMI (dB μ V/m)	Limit (dB μ V/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable(dB)
42.60	-19.55	20.45	26.86	40.00	H	195.25	244.53	22.23	0.44
128.10	-17.59	25.93	29.08	43.52	H	119.25	240.59	14.87	0.91
128.10	-9.22	34.30	36.27	43.52	V	154.75	105.31	14.87	0.91
160.00	-15.81	27.71	30.54	43.52	V	354.25	110.56	13.30	1.11
192.00	-19.00	24.52	28.12	43.52	V	0.00	132.05	14.76	1.19
208.10	-19.90	23.62	30.57	43.52	V	1.75	115.16	14.93	1.21

There were no radiated emissions other than harmonics found below 30 MHz or above 1GHz.



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CONDUCTED EMISSIONS

DATA SHEETS



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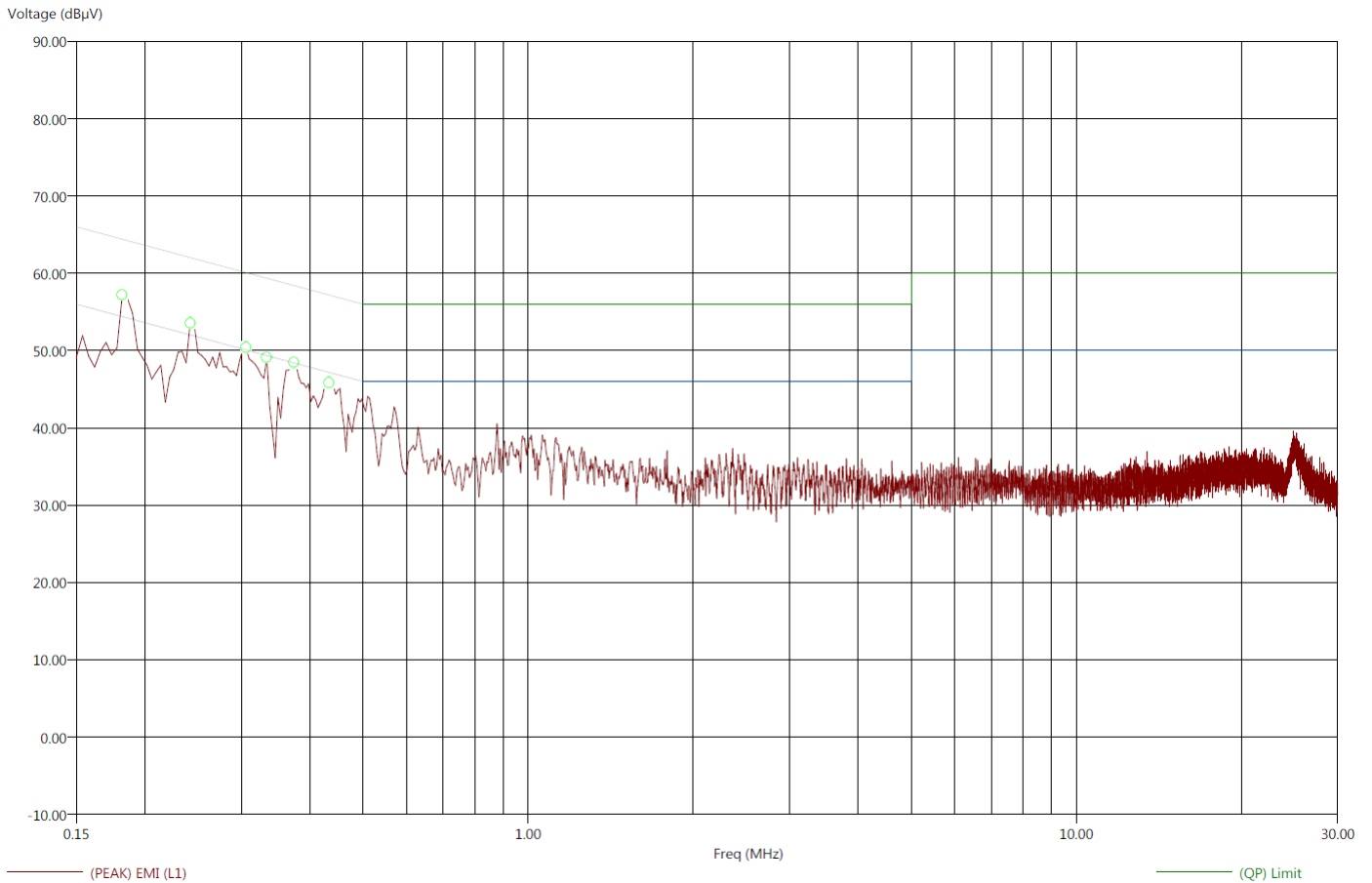
Silverado Division
19121 El Toro Road
Silverado, CA 92676
(949) 589-0700

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

Title: FCC 15.207
File: Conducted Pre-Line_916.set
Operator: Matt Harrison
EUT Type: WS15Z5-1.
EUT Condition: Transmitting 916MHz
Comments: Connected to Load.
Temp: 73f
Hum: 44%
120V 60Hz

11/14/2016 11:35:10 AM
Sequence: Preliminary Scan

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



This is worst case channel.



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Lake Forest Division
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Lake Forest, CA 92630
(949) 587-0400

Title: FCC 15.207
 File: Conducted Final-Line_916.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Transmitting 916 MHz
 Comments: Connected to Load.
 Temp: 73f
 Hum: 44%
 120V 60Hz

11/14/2016 11:37:44 AM
 Sequence: Final Measurements

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

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dB V)	(QP) EMI (dB V)	(PEAK) EMI (dB V)	(AVG) Limit (dB V)	(QP) Limit (dB V)	Transducer (dB)	Cable (dB)
0.18	-5.66	-9.89	48.73	54.51	58.01	54.39	64.39	0.29	0.04
0.24	-5.25	-11.36	46.78	50.67	54.64	52.03	62.03	0.18	0.03
0.31	-5.18	-12.01	44.90	48.07	50.94	50.08	60.08	0.08	0.03
0.33	-8.41	-14.18	40.94	45.17	50.37	49.35	59.35	0.05	0.02
0.37	-4.04	-11.37	44.37	47.04	49.62	48.41	58.41	0.03	0.02
0.43	-4.58	-11.91	42.59	45.27	48.02	47.18	57.18	0.03	0.01

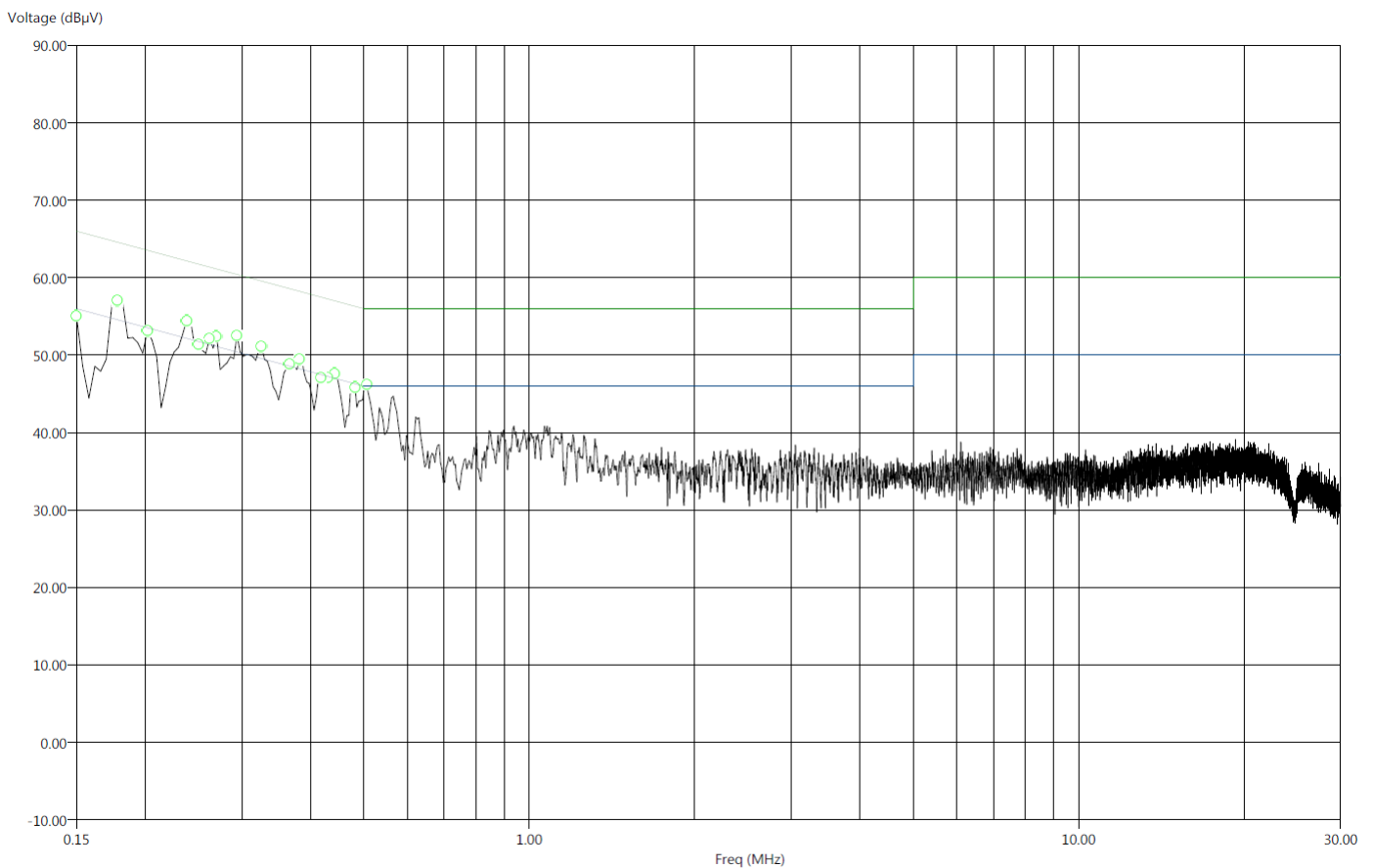
This is worst case channel.



Title: FCC 15.207
 File: Conducted Pre-Neutral_916.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Transmitting 916MHz
 Comments: Connected to Load.
 Temp: 73f
 Hum: 44%
 120V 60Hz

11/14/2016 11:41:29 AM
 Sequence: Preliminary Scan

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



This is worst case channel.



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 Silverado, CA 92676
 (949) 589-0700

Lake Forest Division
 20621 Pascal Way
 Lake Forest, CA 92630
 (949) 587-0400

Title: FCC 15.207
 File: Conducted Final-Neutral_916.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Transmitting 916 MHz
 Comments: Connected to Load.
 Temp: 73f
 Hum: 44%
 120V 60Hz

11/14/2016 11:43:59 AM
 Sequence: Final Measurements

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

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dB V)	(QP) EMI (dB V)	(PEAK) EMI (dB V)	(AVG) Limit (dB V)	(QP) Limit (dB V)	Transducer (dB)	Cable (dB)
0.15	-13.62	-14.22	42.38	51.78	59.00	56.00	66.00	0.37	0.03
0.18	-6.22	-10.52	48.36	54.06	57.64	54.58	64.58	0.30	0.03
0.20	-7.11	-11.99	46.41	51.54	54.66	53.53	63.53	0.25	0.04
0.24	-5.59	-11.62	46.57	50.55	54.95	52.17	62.17	0.18	0.03
0.25	-4.01	-10.43	47.75	51.33	54.52	51.76	61.76	0.17	0.03
0.26	-5.30	-11.81	46.06	49.56	53.39	51.37	61.37	0.15	0.03
0.27	-7.58	-13.98	43.54	47.14	53.36	51.12	61.12	0.13	0.03
0.29	-7.90	-13.84	42.51	46.57	51.61	50.41	60.41	0.10	0.03
0.33	-4.57	-11.62	44.98	47.93	51.05	49.55	59.55	0.06	0.02
0.37	-4.77	-12.00	43.82	46.60	49.33	48.59	58.59	0.03	0.02
0.38	-3.35	-10.66	44.89	47.57	50.14	48.24	58.24	0.03	0.02
0.42	-9.40	-14.28	38.09	43.21	47.85	47.49	57.49	0.03	0.02
0.43	-4.42	-11.64	42.83	45.62	49.05	47.25	57.25	0.03	0.01
0.44	-4.03	-11.02	42.99	46.00	48.64	47.02	57.02	0.03	0.01
0.48	-9.00	-14.77	37.30	41.54	45.99	46.30	56.30	0.03	0.01
0.51	-5.39	-12.10	40.61	43.90	46.28	46.00	56.00	0.03	0.01

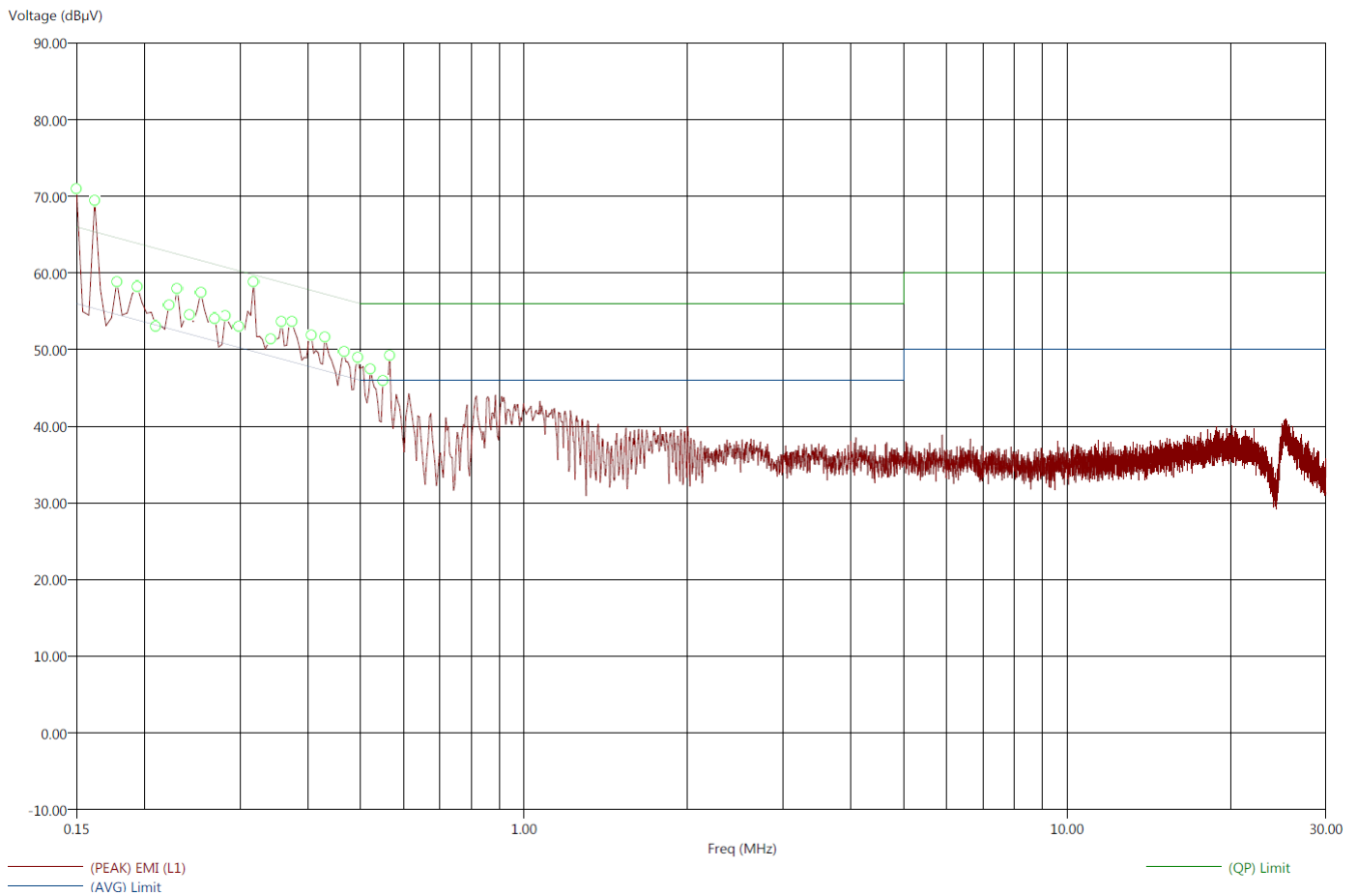
This is worst case channel.



Title: FCC 15.207
File: Conducted Pre-Line_RX.set
Operator: Matt Harrison
EUT Type: WS15Z5-1.
EUT Condition: Receive Mode.
Comments: Connected to Load.
Temp: 73f
Hum: 44%
120V 60Hz

11/14/2016 11:03:28 AM
Sequence: Preliminary Scan

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



This is worst case channel.



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19121 El Toro Road
Silverado, CA 92676
(949) 589-0700

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

Title: FCC 15.207
 File: Conducted Final-Line_Rx.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Receive Mode.
 Comments: Connected to Load.
 Temp: 73f
 Hum: 44%
 120V 60Hz

11/14/2016 11:07:19 AM
 Sequence: Final Measurements

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

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dB V)	(QP) EMI (dB V)	(PEAK) EMI (dB V)	(AVG) Limit (dB V)	(QP) Limit (dB V)	Transducer (dB)	Cable (dB)
0.15	-6.63	-8.01	49.37	57.99	69.81	56.00	66.00	0.40	0.03
0.16	-7.76	-10.72	47.60	54.64	68.91	55.36	65.36	0.37	0.03
0.18	-5.99	-6.51	48.59	58.07	65.57	54.58	64.58	0.33	0.03
0.19	-4.15	-8.90	49.72	54.97	64.26	53.86	63.86	0.30	0.04
0.21	-5.67	-7.80	47.53	55.40	60.07	53.21	63.21	0.27	0.04
0.22	-6.97	-11.13	45.77	51.61	59.11	52.74	62.74	0.24	0.04
0.23	-5.78	-10.51	46.67	51.94	60.73	52.45	62.45	0.23	0.04
0.24	-3.55	-8.70	48.48	53.33	56.80	52.03	62.03	0.21	0.03
0.25	-3.49	-8.48	48.14	53.14	57.43	51.63	61.63	0.19	0.03
0.27	-5.18	-10.19	45.93	50.93	57.54	51.12	61.12	0.16	0.03
0.28	-6.41	-10.27	44.34	50.49	61.26	50.76	60.76	0.15	0.03
0.30	-3.98	-9.13	46.32	51.17	54.90	50.30	60.30	0.12	0.03
0.32	-3.15	-8.44	46.61	51.32	54.49	49.76	59.76	0.10	0.02
0.34	-6.52	-10.32	42.63	48.83	52.86	49.15	59.15	0.07	0.02
0.36	-4.16	-8.53	44.61	50.24	53.31	48.77	58.77	0.06	0.02
0.37	-3.31	-8.34	45.11	50.07	53.21	48.41	58.41	0.06	0.02
0.41	-6.03	-9.85	41.70	47.88	52.11	47.73	57.73	0.07	0.02
0.43	-4.09	-8.69	43.17	48.56	51.47	47.25	57.25	0.07	0.01
0.47	-6.47	-10.31	40.12	46.28	50.29	46.58	56.58	0.07	0.01
0.49	-6.45	-10.57	39.65	45.53	48.87	46.10	56.10	0.07	0.01
0.52	-7.45	-11.53	38.55	44.47	47.96	46.00	56.00	0.07	0.01
0.55	-9.68	-13.37	36.32	42.63	46.50	46.00	56.00	0.07	0.01
0.57	-8.68	-12.57	37.32	43.43	46.76	46.00	56.00	0.07	0.02

This is worst case channel.



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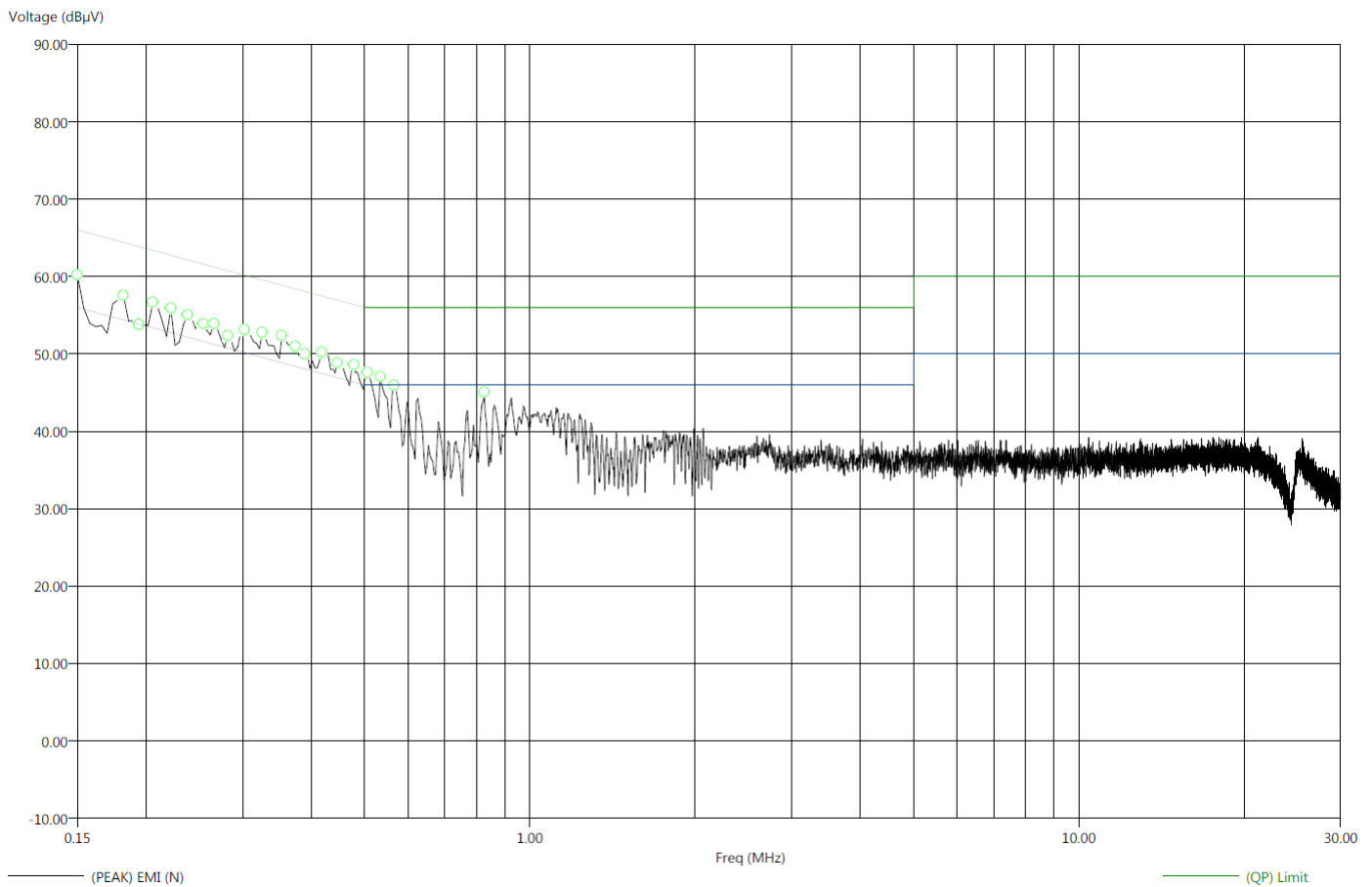
Silverado Division
 19121 El Toro Road
 Silverado, CA 92676
 (949) 589-0700

Lake Forest Division
 20621 Pascal Way
 Lake Forest, CA 92630
 (949) 587-0400

Title: FCC 15.207
 File: Conducted Pre-Neutral_Rx.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Receive Mode.
 Comments: Connected to Load.
 Temp: 73f
 Hum: 44%
 120V 60Hz

11/14/2016 11:17:01 AM
 Sequence: Preliminary Scan

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



This is worst case channel.



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Lake Forest Division
 20621 Pascal Way
 Lake Forest, CA 92630
 (949) 587-0400

Title: FCC 15.207
 File: Conducted Final-Neutral_Rx.set
 Operator: Matt Harrison
 EUT Type: WS15Z5-1.
 EUT Condition: Receive Mode.
 Comments: Connected to Load.
 Temp: 73f
 Hum: 44%
 120V 60Hz

11/14/2016 11:21:14 AM
 Sequence: Final Measurements

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

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dB V)	(QP) EMI (dB V)	(PEAK) EMI (dB V)	(AVG) Limit (dB V)	(QP) Limit (dB V)	Transducer (dB)	Cable (dB)
0.15	-7.27	-9.53	48.73	56.47	59.98	56.00	66.00	0.37	0.03
0.18	-6.14	-9.85	48.25	54.54	62.79	54.39	64.39	0.29	0.04
0.19	-4.67	-9.41	49.20	54.45	59.53	53.86	63.86	0.27	0.04
0.21	-5.45	-9.82	47.91	53.54	62.04	53.37	63.37	0.24	0.04
0.22	-6.99	-11.34	45.75	51.41	56.85	52.74	62.74	0.21	0.04
0.24	-4.83	-9.42	47.34	52.74	56.74	52.17	62.17	0.18	0.03
0.25	-3.55	-8.64	48.08	52.99	62.69	51.63	61.63	0.16	0.03
0.27	-4.34	-9.04	46.90	52.20	55.76	51.24	61.24	0.14	0.03
0.28	-5.96	-10.04	44.80	50.72	57.23	50.76	60.76	0.12	0.03
0.30	-3.48	-8.61	46.71	51.58	55.25	50.19	60.19	0.09	0.03
0.33	-4.37	-9.29	45.18	50.26	53.67	49.55	59.55	0.06	0.02
0.35	-4.12	-8.97	44.75	49.89	53.74	48.87	58.87	0.03	0.02
0.37	-3.07	-8.15	45.35	50.26	53.69	48.41	58.41	0.03	0.02
0.39	-5.11	-9.85	42.95	48.22	51.53	48.06	58.06	0.03	0.02
0.42	-3.93	-9.14	43.56	48.34	51.87	47.49	57.49	0.03	0.02
0.45	-5.43	-9.85	41.52	47.10	50.85	46.95	56.95	0.03	0.01
0.48	-5.26	-9.54	41.11	46.83	50.11	46.37	56.37	0.03	0.01
0.51	-6.25	-10.68	39.75	45.32	48.64	46.00	56.00	0.03	0.01
0.53	-8.18	-12.03	37.82	43.97	48.05	46.00	56.00	0.03	0.01
0.57	-9.07	-12.50	36.93	43.50	47.27	46.00	56.00	0.02	0.02
0.83	-10.25	-13.36	35.75	42.64	46.10	46.00	56.00	0.00	0.03

This is worst case channel.



***FUNDAMENTAL & HARMONICS
DATA SHEETS***



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Lake Forest Division
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Lake Forest, CA 92630
(949) 587-0400

FUNDAMENTAL FIELD STRENGTH

FCC 15.249

Company: Nortek
 500 Series Z-Wave Wall
 EUT: Switch
 Model: WS15Z5-1

Date: 11/10/2016
 Lab: R
 Tested by: Matt Harrison

Compatible Electronics, Inc. FAC-3

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table	Tower	Comments
908.40	94.54	H	--	--	Peak	289.00	101.00	
908.40	93.51	H	93.97	-0.46	QP	289.00	101.00	
908.40	92.94	V	--	--	Peak	214.00	1.25	
908.40	91.37	V	93.97	-2.60	QP	214.00	1.25	
916.00	91.61	H	--	--	Peak	286.00	1.96	
916.00	90.29	H	93.97	-3.68	QP	286.00	1.96	
916.00	93.75	V	--	--	Peak	212.00	1.05	
916.00	92.73	V	93.97	-1.24	QP	212.00	1.05	

Test distance
 3 meter



HARMONICS LOW CHANNEL HORIZONTAL

FCC 15.249

 Company: Nortek
 EUT: 500 Series Z-Wave Wall Switch
 Model: WS15Z5-1

 Date: 11/10/2016
 Lab: R
 Tested by: Matt Harrison

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1816.8		H	73.98		Peak			No Emissions Found
1816.8		H	53.98		Avg			No Emissions Found
2725.2	44.68	H	73.98	-29.30	Peak	1.05	267	
2725.2	29.81	H	53.98	-24.17	Avg	1.05	267	
3633.6	41.52	H	73.98	-32.46	Peak	1.33	356	
3633.6	27.95	H	53.98	-26.03	Avg	1.33	356	
4542.0	50.86	H	73.98	-23.12	Peak	1.11	318	
4542.0	35.97	H	53.98	-18.01	Avg	1.11	318	
5450.4		H	73.98		Peak			No Emissions Found
5450.4		H	53.98		Avg			No Emissions Found
6358.8		H	73.98		Peak			No Emissions Found
6358.8		H	53.98		Avg			No Emissions Found
7267.2	52.71	H	73.98	-21.27	Peak	2.56	360	
7267.2	38.10	H	53.98	-15.88	Avg	2.56	360	
8175.6	52.39	H	73.98	-21.59	Peak	2.90	31	
8175.6	39.90	H	53.98	-14.08	Avg	2.90	31	
9084.0		H	73.98		Peak			No Emissions Found
9084.0		H	53.98		Avg			No Emissions Found

 Test distance
 3 meter


HARMONICS LOW CHANNEL VERTICAL

FCC 15.249

 Company: Nortek
 EUT: 500 Series Z-Wave Wall Switch
 Model: WS15Z5-1

 Date: 11/10/2016
 Lab: R
 Tested by: Matt Harrison

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1816.8		V	73.98	-30.51	Peak			
1816.8		V	53.98	-25.96	Avg			
2725.2	42.61	V	73.98	-31.37	Peak	3.33	335	
2725.2	27.73	V	53.98	-26.25	Avg	3.33	335	
3633.6	46.80	V	73.98	-27.18	Peak	1.60	0	
3633.6	31.24	V	53.98	-22.74	Avg	1.60	0	
4542.0	46.82	V	73.98	-27.16	Peak	1.89	322	
4542.0	32.46	V	53.98	-21.52	Avg	1.89	322	
5450.4		V	73.98		Peak			No Emissions Found
5450.4		V	53.98		Avg			No Emissions Found
6358.8		V	73.98		Peak			No Emissions Found
6358.8		V	53.98		Avg			No Emissions Found
7267.2	53.48	V	73.98	-20.50	Peak	1.24	14	
7267.2	38.66	V	53.98	-15.32	Avg	1.24	14	
8175.6	52.72	V	73.98	-21.26	Peak	1.28	351	
8175.6	40.00	V	53.98	-13.98	Avg	1.28	351	
9084.0		V	73.98		Peak			No Emissions Found
9084.0		V	53.98		Avg			No Emissions Found

 Test distance
 3 meter


HARMONICS HIGH CHANNEL HORIZONTAL

FCC 15.249

 Company: Nortek
 500 SERIES Z-WAVE WALL
 EUT: SWITCH
 Model: WS15Z5-1

Date: 11/10/2016

 Lab: R
 Tested by: Matt Harrison

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1832.00		H	73.98		Peak			No Emissions Found
1832.00		H	53.98		Peak			No Emissions Found
2748.00	47.47	H	73.98	-26.51	Peak	1.01	133	
2748.00	28.74	H	53.98	-25.24	Peak	1.01	133	
3664.00		H	73.98		Peak			No Emissions Found
3664.00		H	53.98		Avg			No Emissions Found
4580.00	57.18	H	73.98	-16.80	Peak	1.08	321	
4580.00	36.83	H	53.98	-17.15	Avg	1.08	321	
5496.00		H	73.98		Peak			No Emissions Found
5496.00		H	53.98		Avg			No Emissions Found
6412.00		H	73.98		Peak			No Emissions Found
6412.00		H	53.98		Avg			No Emissions Found
7328.00	54.74	H	73.98	-19.24	Peak	2.20	307	
7328.00	37.81	H	53.98	-16.17	Avg	2.20	307	
8244.00	54.74	H	73.98	-19.24	Peak	2.20	307	
8244.00	37.81	H	53.98	-16.17	Avg	2.20	307	
9160.00		H	73.98		Peak			No Emissions Found
9160.00		H	53.98		Avg			No Emissions Found

 Test distance
 3 meter


HARMONICS HIGH CHANNEL VERTICAL

FCC 15.249

 Company: Nortek
 500 SERIES Z-WAVE WALL
 EUT: SWITCH
 Model: WS15Z5-1

 Date: 11/10/2016
 Lab: R
 Tested by: Matt Harrison

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1832.00		V	73.98	-36.42	Peak			
1832.00		V	53.98	-29.45	Avg			
2748.00	53.73	V	73.98	-20.25	Peak	1.53	52	
2748.00	32.86	V	53.98	-21.12	Avg	1.53	52	
3664.00		V	73.98		Peak			No Emissions Found
3664.00		V	53.98		Avg			No Emissions Found
4580.00	49.06	V	73.98	-24.92	Peak	1.82	311	
4580.00	32.65	V	53.98	-21.33	Avg	1.82	311	
5496.00		V	73.98		Peak			No Emissions Found
5496.00		V	53.98		Avg			No Emissions Found
6412.00		V	73.98		Peak			No Emissions Found
6412.00		V	53.98		Avg			No Emissions Found
7328.00	59.27	V	73.98	-14.71	Peak	1.13	49	
7328.00	40.83	V	53.98	-13.15	Avg	1.13	49	
8244.00	58.46	V	73.98	-15.52	Peak	2.63	41	
8244.00	41.62	V	53.98	-12.36	Avg	2.63	41	
9160.00		V	73.98		Peak			No Emissions Found
9160.00		V	53.98		Avg			No Emissions Found

 Test distance
 3 meter


***EMISSIONS RADIATED OUTSIDE OF THE FUNDAMENTAL
FREQUENCY BAND***

DATA SHEETS



Brea Division
114 Olinda Drive
Brea, CA 92823
(714) 579-0500

Agoura Division
2337 Troutdale Drive
Agoura, CA 91301
(818) 597-0600

Silverado Division
19121 El Toro Road
Silverado, CA 92676
(949) 589-0700

Lake Forest Division
20621 Pascal Way
Lake Forest, CA 92630
(949) 587-0400

BAND EDGES LOW CHANNEL

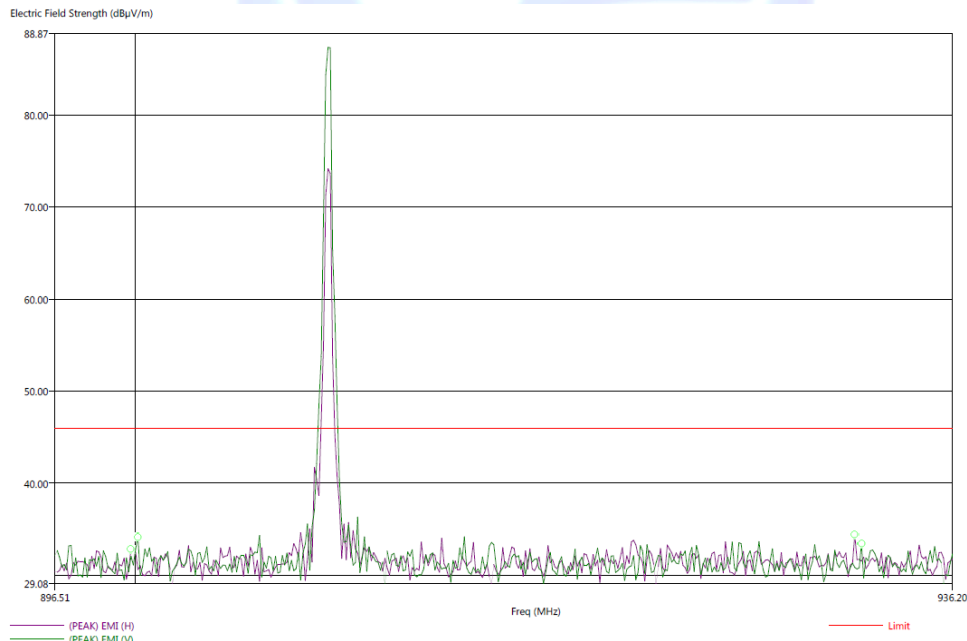
FCC 15.249
 Nortek
 500 SERIES Z-WAVE WALL SWITCH
 Model: WS15Z5-1

Date: 11/14/2016
 Lab: P
 Tested by: Matt Harrison

Band Edge

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV)	Margin (dB)	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
899.80	34.71	H	46.00	-11.29	Peak	73.00	3.23	No Marker Delta Method Used
931.80	34.37	H	46.00	-11.63	Peak	300.00	1.00	No Marker Delta Method Used
900.1	34.50	V	46.00	-11.50	Peak	360.00	2.83	No Marker Delta Method Used
932.1	34.64	V	46.00	-11.36	Peak	0.00	2.78	No Marker Delta Method Used

Test Distance
 3 meters



Plot is from pre-scan; final readings are maximized.



BAND EDGES HIGH CHANNEL

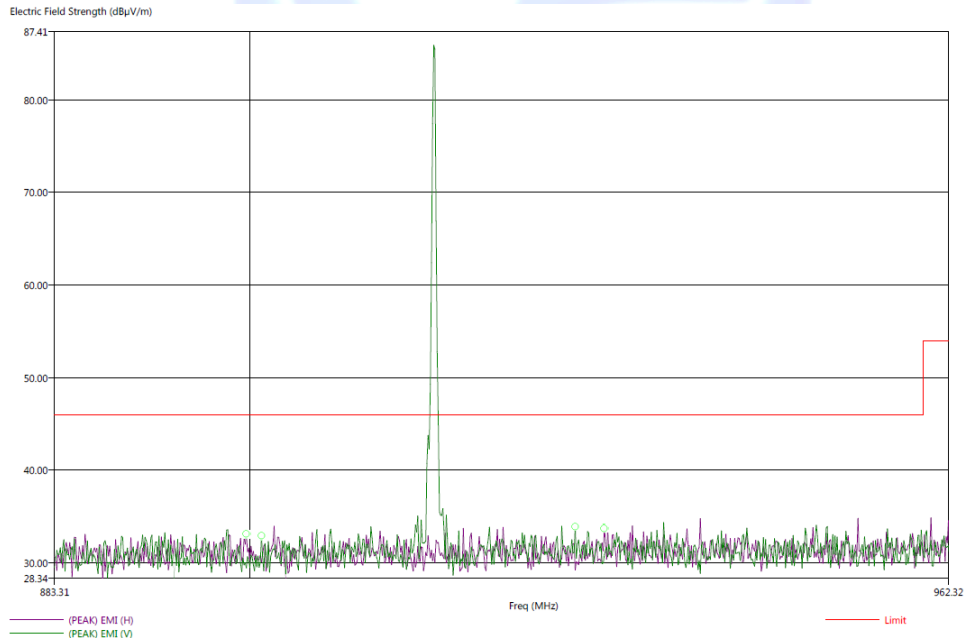
FCC 15.249
 Nortek
 500 SERIES Z-WAVE WALL SWITCH
 Model: WS15Z5-1

Date: 11/14/2016
 Lab: P
 Tested by: Matt Harrison

Band Edge

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit (dBuV)	Margin (dB)	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
899.70	35.26	H	46.00	-10.74	Peak	2.47	0.00	No Marker Delta Method Used
931.10	34.57	H	46.00	-11.43	Peak	3.58	80.00	No Marker Delta Method Used
901.00	34.56	V	46.00	-11.44	Peak	1.66	68.00	No Marker Delta Method Used
931.10	34.88	V	46.00	-11.12	Peak	3.25	267.00	No Marker Delta Method Used

Test Distance
 3 meters



Plot is from pre-scan; final readings are maximized.

