



element

Ademco, Inc.

Z Wave

**FCC 15.249:2021
902-928 MHz Transceiver**

Report: ADEM0017.1 Rev. 2, Issue Date: February 8, 2022



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CERTIFICATE OF TEST

Last Date of Test: October 14, 2021

Ademco, Inc.

EUT: Z Wave

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2021	ANSI C63.10:2013
FCC 15.249:2021	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.5	Field Strength of Harmonics and Spurious Radiated Emissions	Yes	Pass	
6.5	Field Strength of Fundamental	Yes	Pass	
11.6	Duty Cycle	Yes	Pass	

Deviations From Test Standards

None

Approved By:

James Morris, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
01	Moved 902-928 datasheets to spurious emissions	2021-12-30	31
	Burst gating was not used, removed wording from test description	2021-12-30	34 and 38
	Denoted uncertainty range (+/-3.2 dB from measured value)	2021-12-30	12
	Replaced Block Diagrams page with copy that includes emissions sample calculations	2021-12-30	12-21
02	Moved 902-928 datasheets to spurious emissions	2022-02-08	30
	Burst gating was not used, removed wording from test description	2022-02-08	33, 37
	Denotes uncertainty range (+/-3.2 dB from measured value)	2022-02-08	12
	Replaced Block Diagrams page with copy that includes emissions sample calculations	2022-02-08	12-21
	New Test Setup Block Diagrams page added	2022-02-08	8,15-21, 24-29, 30-32

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:

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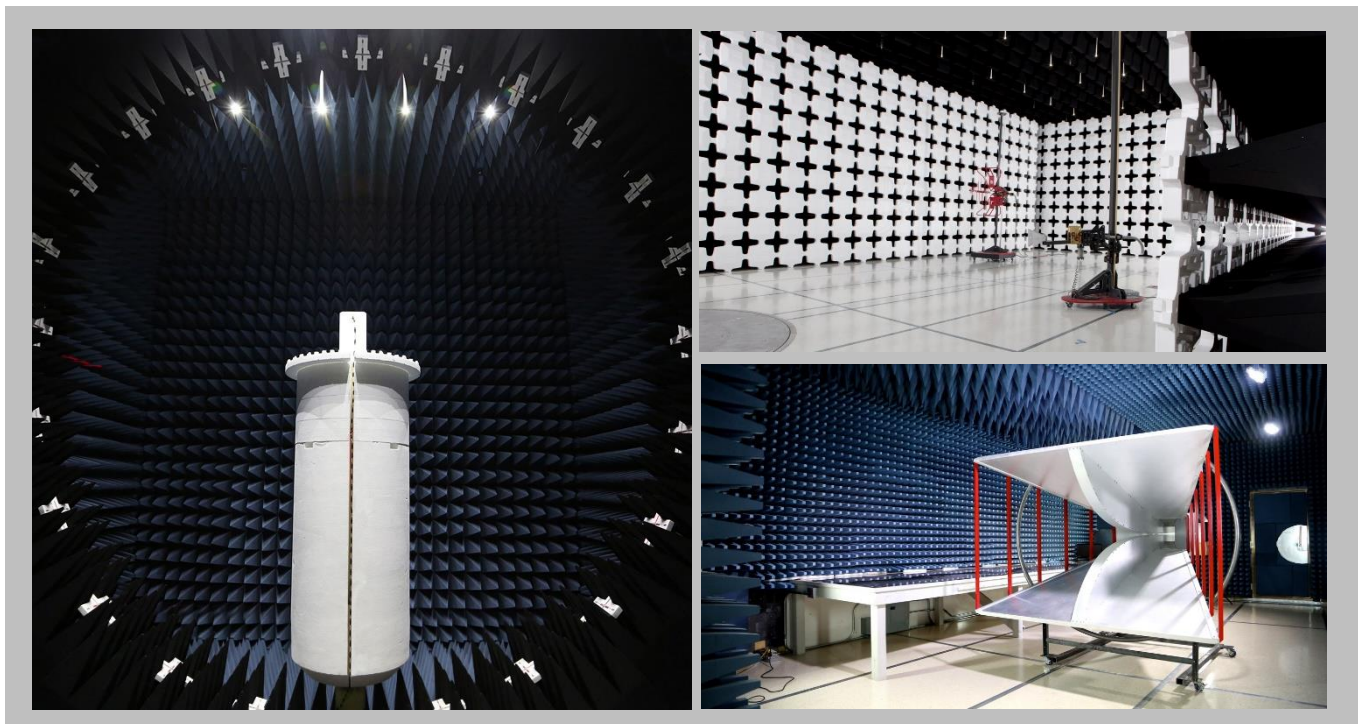
[Texas](#)

[Washington](#)

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY



Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	3.2 dB	-3.2 dB

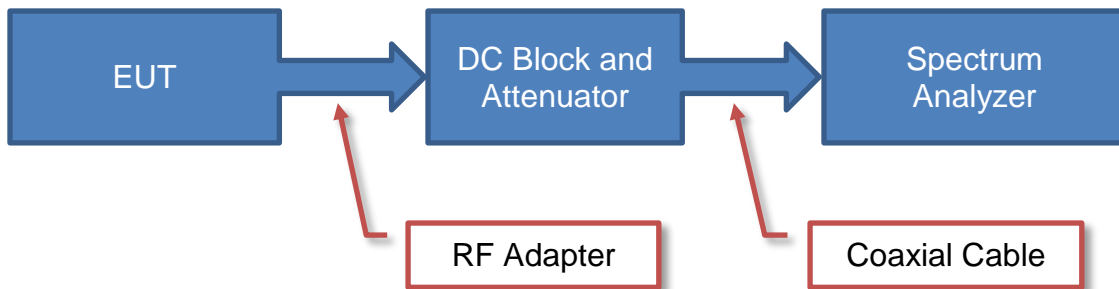
TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

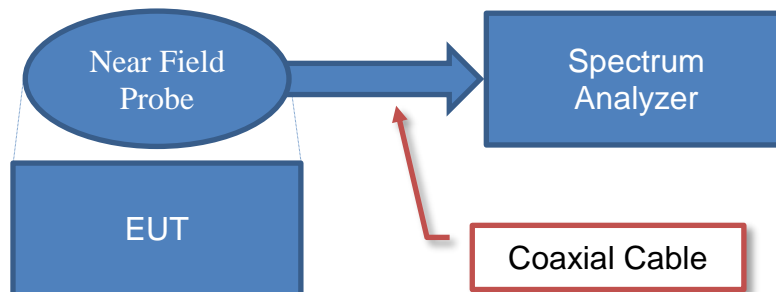
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

$$\begin{array}{r}
 \text{Measured Value} \\
 71.2
 \end{array}
 =
 \begin{array}{r}
 \text{Measured Level} \\
 42.6
 \end{array}
 +
 \begin{array}{r}
 \text{Reference Level Offset} \\
 28.6
 \end{array}$$

Near Field Test Fixture Measurements

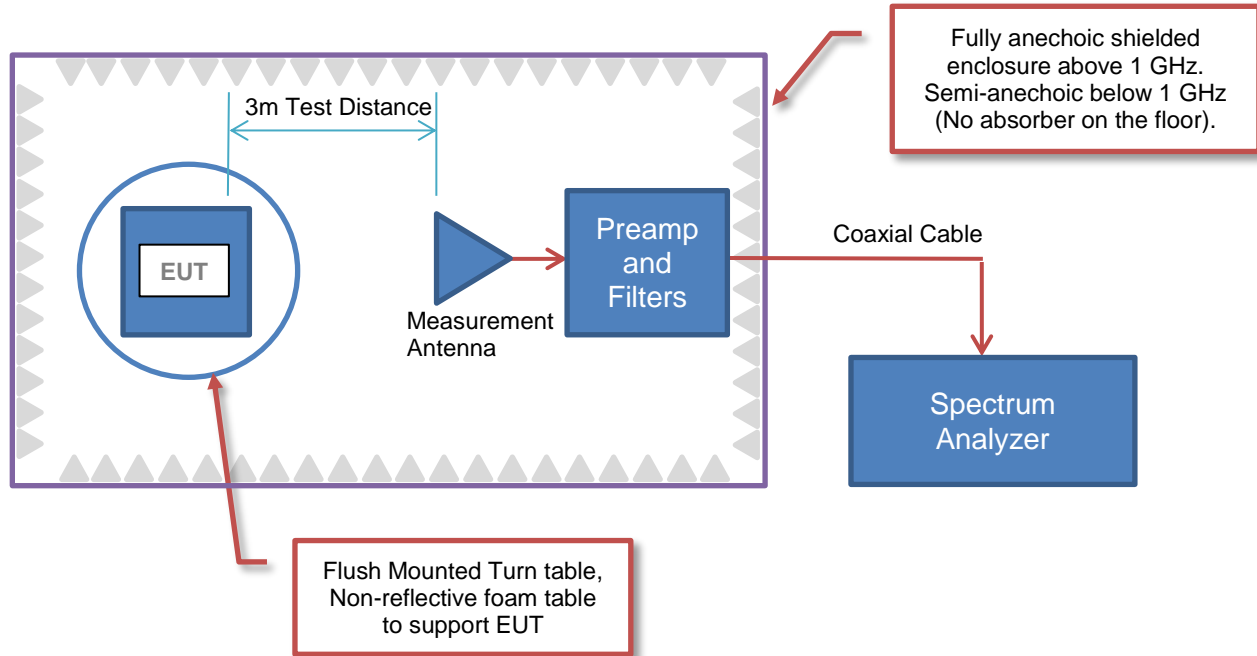


Sample Calculation (logarithmic units)

$$\begin{array}{r}
 \text{Measured Value} \\
 71.2
 \end{array}
 =
 \begin{array}{r}
 \text{Measured Level} \\
 42.6
 \end{array}
 +
 \begin{array}{r}
 \text{Reference Level Offset} \\
 28.6
 \end{array}$$

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)	Factor			Distance Adjustment Factor	External Attenuation	Field Strength
	Antenna Factor	Cable Factor	Amplifier Gain			
42.6	28.6	3.1	40.8	0.0	0.0	33.5

42.6 + 28.6 + 3.1 - 40.8 + 0.0 + 0.0 = 33.5

Conducted Emissions:

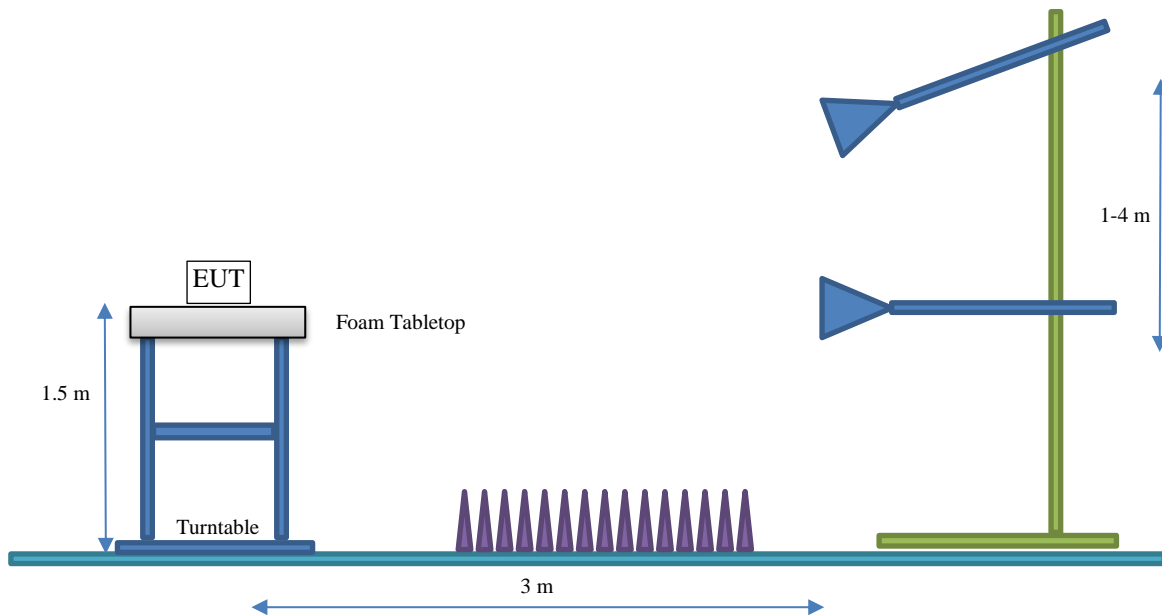
Measured Level (Amplitude)	Factor		External Attenuation	Adjusted Level
	Transducer Factor	Cable Factor		
26.7	0.3	0.1	20.0	47.1

26.7 + 0.3 + 0.1 + 20.0 = 47.1

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Ademco, Inc.
Address:	1985 Douglas Drive N
City, State, Zip:	Golden Valley, MN 55422
Test Requested By:	Divya Venkat
EUT:	Z Wave
First Date of Test:	September 22, 2021
Last Date of Test:	October 14, 2021
Receipt Date of Samples:	September 22, 2021
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Thermostat containing Z-Wave
Testing Objective:
Seeking to demonstrate compliance under FCC 15.249:2021 for operation in the 902-928 MHz band.

CONFIGURATIONS



Configuration ADEM0017- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Z Wave	Ademco, Inc.	Z Wave	1 TRP

Configuration ADEM0017- 2

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Z Wave	Ademco, Inc.	Z Wave	1 TRP
AC Adapter			

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Cable	No	2 m	No	Z Wave	AC Adapter

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-09-22	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2021-10-08	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2021-10-11	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2021-10-14	Field Strength of Harmonics and Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS



TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Gauss Instruments	TDEMI 30M	ARK	2020-10-27	2021-10-27
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2021-03-15	2022-03-15
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2021-03-10	2022-03-10

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.2 dB	-3.2 dB

CONFIGURATIONS INVESTIGATED

ADEM0017-2

MODES INVESTIGATED

Transmitting High Channel 916 MHz
Transmitting Low Channel 908.4 MHz

POWERLINE CONDUCTED EMISSIONS



EUT:	Z Wave	Work Order:	ADEM0017
Serial Number:	1 TRP	Date:	2021-10-11
Customer:	Ademco, Inc.	Temperature:	21.5°C
Attendees:	None	Relative Humidity:	48%
Customer Project:	None	Bar. Pressure:	1007 mb
Tested By:	Chris Patterson	Job Site:	MN03
Power:	24VAC	Configuration:	ADEM0017-2

TEST SPECIFICATIONS

Specification: Equipment Class B FCC 15.207:2021	Method: ANSI C63.4:2014
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TEST PARAMETERS

Run #:	1	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

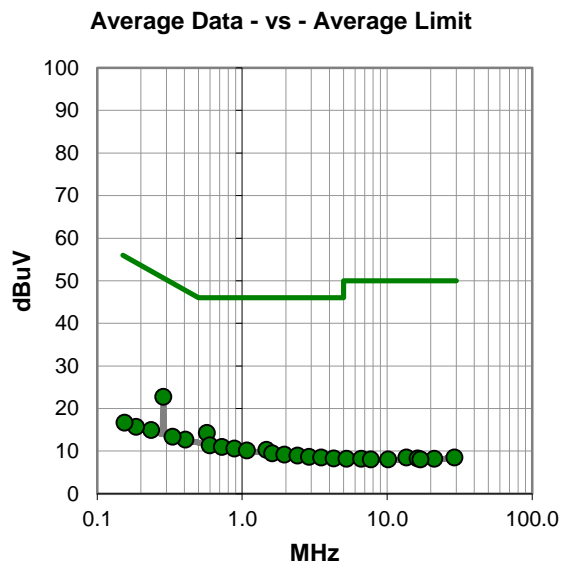
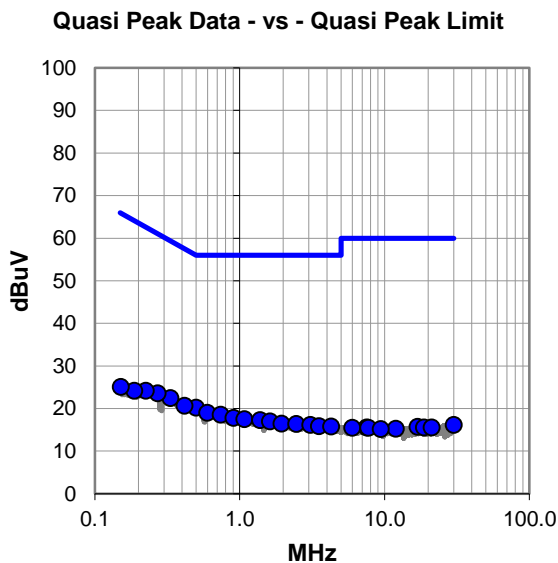
None

EUT OPERATING MODES

Transmitting High Channel 916 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.500	-0.3	20.5	20.2	56.0	-35.8
0.417	0.2	20.5	20.7	57.5	-36.8
0.334	2.0	20.5	22.5	59.4	-36.9
0.598	-1.4	20.4	19.0	56.0	-37.0
0.741	-1.9	20.5	18.6	56.0	-37.4
0.271	3.1	20.5	23.6	61.1	-37.5
0.908	-2.7	20.5	17.8	56.0	-38.2
0.225	3.6	20.6	24.2	62.6	-38.4
1.079	-3.0	20.5	17.5	56.0	-38.5
1.382	-3.2	20.5	17.3	56.0	-38.7
1.621	-3.5	20.5	17.0	56.0	-39.0
1.949	-4.0	20.5	16.5	56.0	-39.5
2.456	-4.2	20.6	16.4	56.0	-39.6
3.076	-4.4	20.6	16.2	56.0	-39.8
0.188	3.4	20.8	24.2	64.1	-39.9
3.536	-4.7	20.6	15.9	56.0	-40.1
4.275	-4.8	20.6	15.8	56.0	-40.2
0.151	4.2	20.9	25.1	65.9	-40.8
29.996	-5.4	21.6	16.2	60.0	-43.8
16.872	-5.4	21.1	15.7	60.0	-44.3
7.543	-5.2	20.8	15.6	60.0	-44.4
18.729	-5.5	21.1	15.6	60.0	-44.4
21.176	-5.7	21.3	15.6	60.0	-44.4
5.984	-5.1	20.6	15.5	60.0	-44.5
7.715	-5.3	20.8	15.5	60.0	-44.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.285	2.3	20.5	22.8	50.7	-27.9
0.571	-6.1	20.4	14.3	46.0	-31.7
0.596	-9.0	20.4	11.4	46.0	-34.6
0.726	-9.5	20.5	11.0	46.0	-35.0
0.404	-7.8	20.5	12.7	47.8	-35.1
0.884	-9.9	20.5	10.6	46.0	-35.4
1.470	-10.2	20.5	10.3	46.0	-35.7
1.076	-10.3	20.5	10.2	46.0	-35.8
0.331	-7.1	20.5	13.4	49.4	-36.0
1.606	-11.0	20.5	9.5	46.0	-36.5
1.955	-11.3	20.5	9.2	46.0	-36.8
2.404	-11.6	20.6	9.0	46.0	-37.0
0.235	-5.6	20.6	15.0	52.3	-37.3
2.885	-11.9	20.6	8.7	46.0	-37.3
3.511	-12.1	20.6	8.5	46.0	-37.5
4.272	-12.3	20.6	8.3	46.0	-37.7
0.185	-5.1	20.8	15.7	54.3	-38.6
0.154	-4.2	20.9	16.7	55.8	-39.1
13.560	-12.4	20.9	8.5	50.0	-41.5
29.050	-13.0	21.5	8.5	50.0	-41.5
16.228	-12.8	21.1	8.3	50.0	-41.7
5.234	-12.4	20.6	8.2	50.0	-41.8
6.630	-12.6	20.8	8.2	50.0	-41.8
21.103	-13.1	21.3	8.2	50.0	-41.8
7.725	-12.7	20.8	8.1	50.0	-41.9

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	Z Wave	Work Order:	ADEM0017
Serial Number:	1 TRP	Date:	2021-10-11
Customer:	Ademco, Inc.	Temperature:	21.5°C
Attendees:	None	Relative Humidity:	48%
Customer Project:	None	Bar. Pressure:	1007 mb
Tested By:	Chris Patterson	Job Site:	MN03
Power:	24VAC	Configuration:	ADEM0017-2

TEST SPECIFICATIONS

Specification: Equipment Class B FCC 15.207:2021	Method: ANSI C63.4:2014
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TEST PARAMETERS

Run #:	2	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

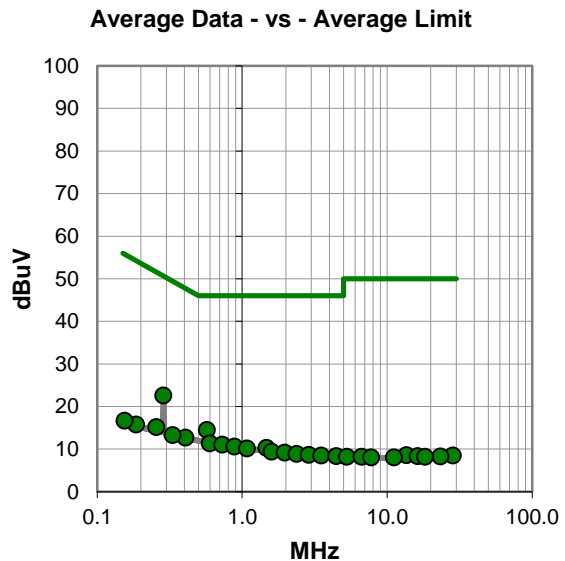
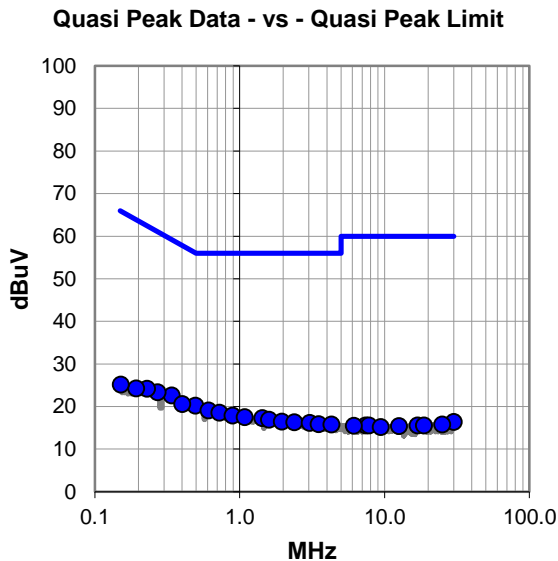
None

EUT OPERATING MODES

Transmitting High Channel 916 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.495	-0.3	20.5	20.2	56.1	-35.9
0.339	2.1	20.5	22.6	59.2	-36.6
0.610	-1.3	20.4	19.1	56.0	-36.9
0.402	0.1	20.5	20.6	57.8	-37.2
0.726	-1.9	20.5	18.6	56.0	-37.4
0.271	2.9	20.5	23.4	61.1	-37.7
0.891	-2.6	20.5	17.9	56.0	-38.1
0.229	3.6	20.6	24.2	62.5	-38.3
1.086	-3.0	20.5	17.5	56.0	-38.5
1.435	-3.2	20.5	17.3	56.0	-38.7
1.596	-3.6	20.5	16.9	56.0	-39.1
1.952	-4.0	20.5	16.5	56.0	-39.5
0.193	3.5	20.8	24.3	63.9	-39.6
2.388	-4.3	20.6	16.3	56.0	-39.7
3.041	-4.4	20.6	16.2	56.0	-39.8
3.508	-4.7	20.6	15.9	56.0	-40.1
4.312	-4.8	20.6	15.8	56.0	-40.2
0.151	4.3	20.9	25.2	65.9	-40.7
30.000	-5.2	21.6	16.4	60.0	-43.6
25.005	-5.5	21.3	15.8	60.0	-44.2
7.413	-5.2	20.8	15.6	60.0	-44.4
7.789	-5.2	20.8	15.6	60.0	-44.4
16.890	-5.5	21.1	15.6	60.0	-44.4
18.719	-5.5	21.1	15.6	60.0	-44.4
6.153	-5.2	20.7	15.5	60.0	-44.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.285	2.1	20.5	22.6	50.7	-28.1
0.571	-5.9	20.4	14.5	46.0	-31.5
0.596	-9.0	20.4	11.4	46.0	-34.6
0.727	-9.4	20.5	11.1	46.0	-34.9
0.404	-7.8	20.5	12.7	47.8	-35.1
0.884	-9.9	20.5	10.6	46.0	-35.4
1.470	-10.2	20.5	10.3	46.0	-35.7
1.078	-10.3	20.5	10.2	46.0	-35.8
0.331	-7.2	20.5	13.3	49.4	-36.1
0.256	-5.4	20.6	15.2	51.6	-36.4
1.596	-11.1	20.5	9.4	46.0	-36.6
1.958	-11.3	20.5	9.2	46.0	-36.8
2.367	-11.7	20.6	8.9	46.0	-37.1
2.881	-11.9	20.6	8.7	46.0	-37.3
3.508	-12.1	20.6	8.5	46.0	-37.5
4.453	-12.2	20.6	8.4	46.0	-37.6
0.185	-5.0	20.8	15.8	54.3	-38.5
0.154	-4.2	20.9	16.7	55.8	-39.1
13.560	-12.3	20.9	8.6	50.0	-41.4
28.306	-13.0	21.5	8.5	50.0	-41.5
16.227	-12.7	21.1	8.4	50.0	-41.6
23.293	-13.0	21.3	8.3	50.0	-41.7
5.256	-12.4	20.6	8.2	50.0	-41.8
6.661	-12.6	20.8	8.2	50.0	-41.8
18.243	-12.9	21.1	8.2	50.0	-41.8

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	Z Wave	Work Order:	ADEM0017
Serial Number:	1 TRP	Date:	2021-10-11
Customer:	Ademco, Inc.	Temperature:	21.5°C
Attendees:	None	Relative Humidity:	48%
Customer Project:	None	Bar. Pressure:	1007 mb
Tested By:	Chris Patterson	Job Site:	MN03
Power:	24VAC	Configuration:	ADEM0017-2

TEST SPECIFICATIONS

Specification: Equipment Class B FCC 15.207:2021	Method: ANSI C63.4:2014
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TEST PARAMETERS

Run #:	3	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

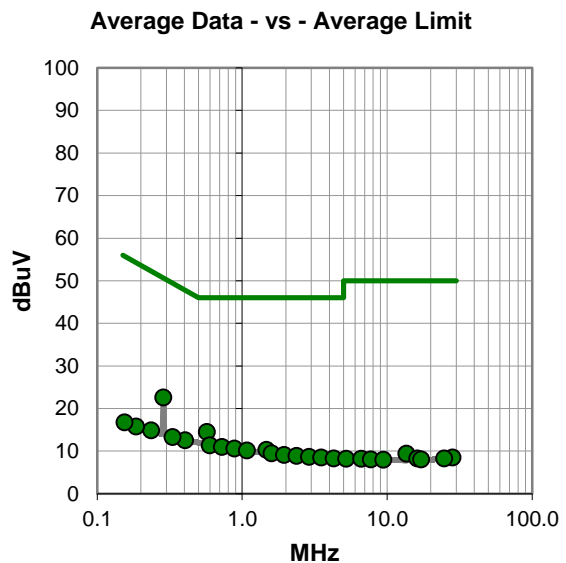
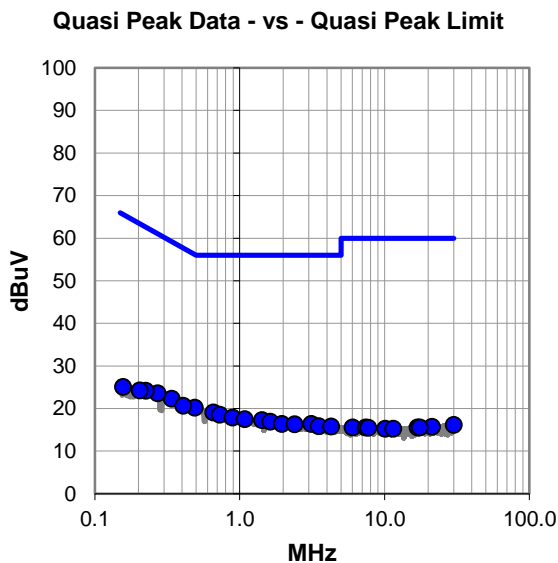
None

EUT OPERATING MODES

Transmitting Low Channel 908.4 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



RESULTS - Run #3

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.489	-0.3	20.5	20.2	56.2	-36.0
0.658	-1.3	20.4	19.1	56.0	-36.9
0.339	1.8	20.5	22.3	59.2	-36.9
0.407	0.2	20.5	20.7	57.7	-37.0
0.730	-1.9	20.5	18.6	56.0	-37.4
0.271	3.1	20.5	23.6	61.1	-37.5
0.893	-2.6	20.5	17.9	56.0	-38.1
0.225	3.6	20.6	24.2	62.6	-38.4
1.085	-3.0	20.5	17.5	56.0	-38.5
1.424	-3.2	20.5	17.3	56.0	-38.7
0.204	3.6	20.7	24.3	63.4	-39.1
1.627	-3.6	20.5	16.9	56.0	-39.1
1.951	-4.1	20.5	16.4	56.0	-39.6
3.115	-4.2	20.6	16.4	56.0	-39.6
2.399	-4.3	20.6	16.3	56.0	-39.7
3.514	-4.7	20.6	15.9	56.0	-40.1
4.284	-4.8	20.6	15.8	56.0	-40.2
0.157	4.2	20.9	25.1	65.6	-40.5
30.000	-5.4	21.6	16.2	60.0	-43.8
21.230	-5.6	21.3	15.7	60.0	-44.3
6.005	-5.1	20.7	15.6	60.0	-44.4
7.413	-5.2	20.8	15.6	60.0	-44.4
16.868	-5.5	21.1	15.6	60.0	-44.4
17.494	-5.5	21.1	15.6	60.0	-44.4
7.737	-5.3	20.8	15.5	60.0	-44.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.285	2.1	20.5	22.6	50.7	-28.1
0.571	-5.9	20.4	14.5	46.0	-31.5
0.596	-9.0	20.4	11.4	46.0	-34.6
0.726	-9.5	20.5	11.0	46.0	-35.0
0.403	-7.9	20.5	12.6	47.8	-35.2
0.884	-9.9	20.5	10.6	46.0	-35.4
1.470	-10.2	20.5	10.3	46.0	-35.7
1.078	-10.3	20.5	10.2	46.0	-35.8
0.331	-7.2	20.5	13.3	49.4	-36.1
1.596	-11.0	20.5	9.5	46.0	-36.5
1.943	-11.4	20.5	9.1	46.0	-36.9
2.367	-11.7	20.6	8.9	46.0	-37.1
2.884	-11.9	20.6	8.7	46.0	-37.3
0.235	-5.7	20.6	14.9	52.3	-37.4
3.508	-12.1	20.6	8.5	46.0	-37.5
4.272	-12.3	20.6	8.3	46.0	-37.7
0.185	-5.0	20.8	15.8	54.3	-38.5
0.154	-4.1	20.9	16.8	55.8	-39.0
13.560	-11.5	20.9	9.4	50.0	-40.6
28.246	-13.0	21.5	8.5	50.0	-41.5
16.166	-12.8	21.1	8.3	50.0	-41.7
24.745	-13.0	21.3	8.3	50.0	-41.7
5.219	-12.4	20.6	8.2	50.0	-41.8
6.615	-12.6	20.8	8.2	50.0	-41.8
7.729	-12.7	20.8	8.1	50.0	-41.9

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	Z Wave	Work Order:	ADEM0017
Serial Number:	1 TRP	Date:	2021-10-11
Customer:	Ademco, Inc.	Temperature:	21.5°C
Attendees:	None	Relative Humidity:	48%
Customer Project:	None	Bar. Pressure:	1007 mb
Tested By:	Chris Patterson	Job Site:	MN03
Power:	24VAC	Configuration:	ADEM0017-2

TEST SPECIFICATIONS

Specification: Equipment Class B FCC 15.207:2021	Method: ANSI C63.4:2014
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TEST PARAMETERS

Run #:	4	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

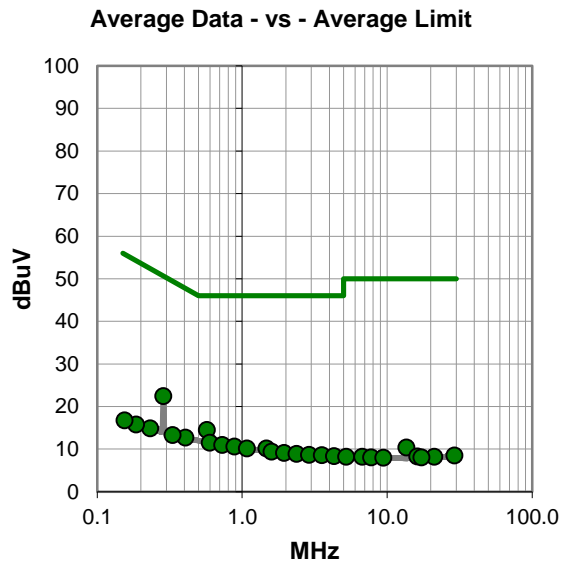
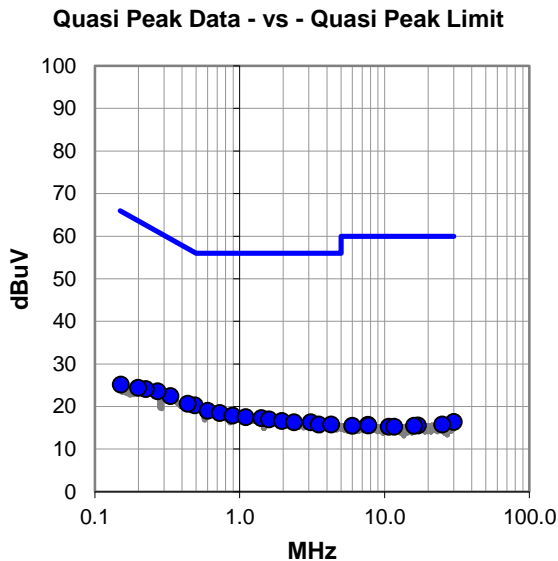
None

EUT OPERATING MODES

Transmitting Low Channel 908.4 MHz

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS



RESULTS - Run #4

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.491	-0.2	20.5	20.3	56.2	-35.9
0.438	0.2	20.5	20.7	57.1	-36.4
0.334	2.0	20.5	22.5	59.4	-36.9
0.601	-1.4	20.4	19.0	56.0	-37.0
0.271	3.1	20.5	23.6	61.1	-37.5
0.730	-2.0	20.5	18.5	56.0	-37.5
0.891	-2.6	20.5	17.9	56.0	-38.1
0.225	3.5	20.6	24.1	62.6	-38.5
1.101	-3.0	20.5	17.5	56.0	-38.5
1.409	-3.2	20.5	17.3	56.0	-38.7
1.596	-3.5	20.5	17.0	56.0	-39.0
0.199	3.7	20.7	24.4	63.7	-39.3
1.951	-3.9	20.5	16.6	56.0	-39.4
2.374	-4.3	20.6	16.3	56.0	-39.7
3.090	-4.3	20.6	16.3	56.0	-39.7
3.510	-4.8	20.6	15.8	56.0	-40.2
4.275	-4.8	20.6	15.8	56.0	-40.2
0.151	4.3	20.9	25.2	65.9	-40.7
29.998	-5.2	21.6	16.4	60.0	-43.6
24.975	-5.5	21.3	15.8	60.0	-44.2
7.690	-5.1	20.8	15.7	60.0	-44.3
7.730	-5.2	20.8	15.6	60.0	-44.4
16.971	-5.5	21.1	15.6	60.0	-44.4
5.992	-5.1	20.6	15.5	60.0	-44.5
15.967	-5.6	21.1	15.5	60.0	-44.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.285	2.0	20.5	22.5	50.7	-28.2
0.571	-5.9	20.4	14.5	46.0	-31.5
0.598	-8.9	20.4	11.5	46.0	-34.5
0.727	-9.5	20.5	11.0	46.0	-35.0
0.404	-7.8	20.5	12.7	47.8	-35.1
0.884	-9.9	20.5	10.6	46.0	-35.4
1.076	-10.3	20.5	10.2	46.0	-35.8
1.468	-10.3	20.5	10.2	46.0	-35.8
0.331	-7.2	20.5	13.3	49.4	-36.1
1.596	-11.1	20.5	9.4	46.0	-36.6
1.943	-11.4	20.5	9.1	46.0	-36.9
2.367	-11.7	20.6	8.9	46.0	-37.1
2.892	-11.9	20.6	8.7	46.0	-37.3
3.545	-12.0	20.6	8.6	46.0	-37.4
0.232	-5.7	20.6	14.9	52.4	-37.5
4.305	-12.2	20.6	8.4	46.0	-37.6
0.185	-5.0	20.8	15.8	54.3	-38.5
0.154	-4.1	20.9	16.8	55.8	-39.0
13.560	-10.5	20.9	10.4	50.0	-39.6
29.062	-13.0	21.5	8.5	50.0	-41.5
16.166	-12.8	21.1	8.3	50.0	-41.7
5.215	-12.4	20.6	8.2	50.0	-41.8
6.707	-12.6	20.8	8.2	50.0	-41.8
21.116	-13.1	21.3	8.2	50.0	-41.8
7.739	-12.7	20.8	8.1	50.0	-41.9

CONCLUSION

Pass

Tested By

FIELD STRENGTH OF HARMONICS AND SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2021.03.17.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal

POWER SETTINGS INVESTIGATED

Battery
110VAC/60Hz

CONFIGURATIONS INVESTIGATED

ADEM0017 - 1
ADEM0017 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	12400 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	Fairview Microwave	SA18E-10	TYA	2021-09-09	2022-09-09
Attenuator	Fairview Microwave	SA18E-20	TWZ	2021-09-09	2022-09-09
Filter - Low Pass	Micro-Tronics	LPM50003	HGL	2021-09-10	2022-09-10
Filter - High Pass	Micro-Tronics	HPM50108	HFV	2021-09-10	2022-09-10
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2021-01-15	2022-01-15
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2021-03-07	2022-03-07
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2021-01-15	2022-01-15
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2021-01-15	2022-01-15
Antenna - Double Ridge	ETS Lindgren	3115	AJQ	2021-01-25	2023-01-25
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2020-12-27	2021-12-27
Cable	ESM Cable Corp.	Bilog Cables	MNH	2021-10-13	2022-10-13
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2021-10-13	2022-10-13
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2021-09-14	2023-09-14

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

FIELD STRENGTH OF HARMONICS AND SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2021.03.17.0

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

FIELD STRENGTH OF HARMONICS AND SPURIOUS RADIATED EMISSIONS

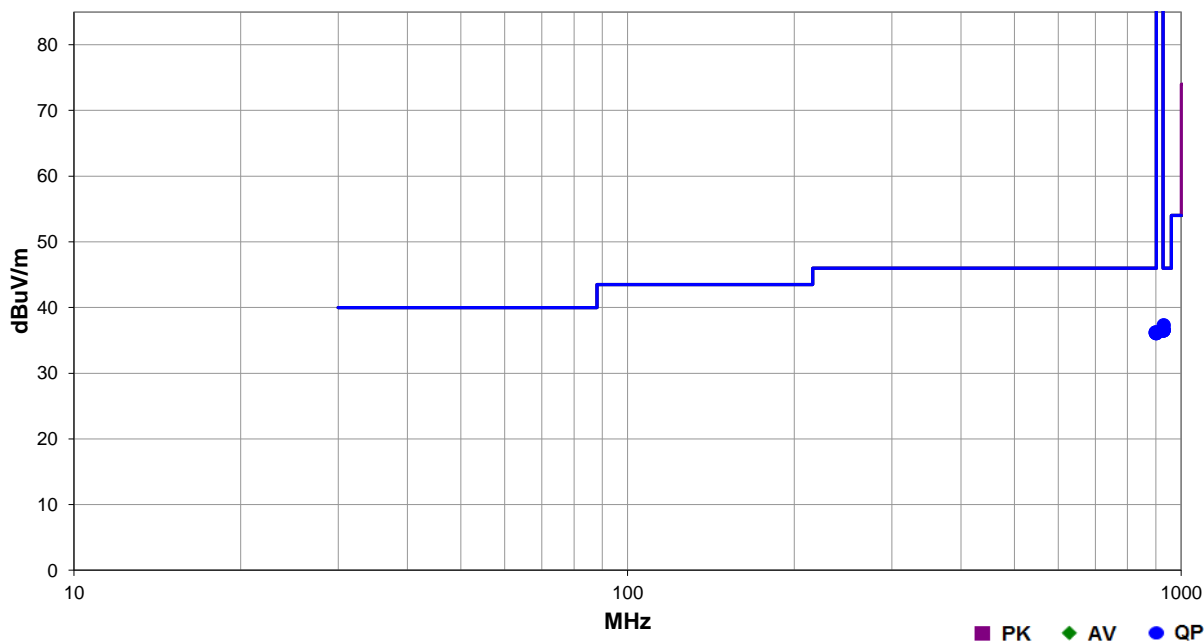


EmiR5 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ADEM0017	Date:	2021-09-22	
Project:	None	Temperature:	21.8 °C	
Job Site:	MN09	Humidity:	42.6% RH	
Serial Number:	1 TRP	Barometric Pres.:	1026 mbar	
EUT:	Z Wave			
Configuration:	1			
Customer:	Ademco, Inc.			
Attendees:	None			
EUT Power:	Battery			
Operating Mode:	Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal			
Deviations:	None			
Comments:	Power 12			

Test Specifications	Test Method
FCC 15.249:2021	ANSI C63.10:2013

Run #	3	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
929.630	16.1	11.2	2.94	324.0	3.0	10.0	Vert	QP	0.0	37.3	46.0	-8.7	EUT On Side, High Ch
929.917	15.4	11.2	1.0	193.0	3.0	10.0	Vert	QP	0.0	36.6	46.0	-9.4	EUT Horz, High Ch
929.632	15.4	11.2	2.99	280.0	3.0	10.0	Vert	QP	0.0	36.6	46.0	-9.4	EUT Vert, High Ch
929.180	15.4	11.1	1.0	22.0	3.0	10.0	Horz	QP	0.0	36.5	46.0	-9.5	EUT Horz, High Ch
928.162	15.4	11.1	1.0	354.0	3.0	10.0	Horz	QP	0.0	36.5	46.0	-9.5	EUT Vert, High Ch
928.460	15.4	11.1	1.0	48.0	3.0	10.0	Horz	QP	0.0	36.5	46.0	-9.5	EUT On Side, High Ch
899.213	15.6	10.6	1.0	301.0	3.0	10.0	Horz	QP	0.0	36.2	46.0	-9.8	EUT On Side, Low Ch
899.475	15.6	10.6	1.0	9.0	3.0	10.0	Vert	QP	0.0	36.2	46.0	-9.8	EUT Vert, Low Ch
901.525	15.6	10.5	1.38	323.0	3.0	10.0	Vert	QP	0.0	36.1	46.0	-9.9	EUT On Side, Low Ch
901.652	15.6	10.5	1.0	160.0	3.0	10.0	Horz	QP	0.0	36.1	46.0	-9.9	EUT Vert, Low Ch
900.223	15.6	10.5	1.03	349.0	3.0	10.0	Horz	QP	0.0	36.1	46.0	-9.9	EUT Horz, Low Ch
901.698	15.6	10.5	1.0	109.0	3.0	10.0	Vert	QP	0.0	36.1	46.0	-9.9	EUT Horz, Low Ch

FIELD STRENGTH OF HARMONICS AND SPURIOUS RADIATED EMISSIONS

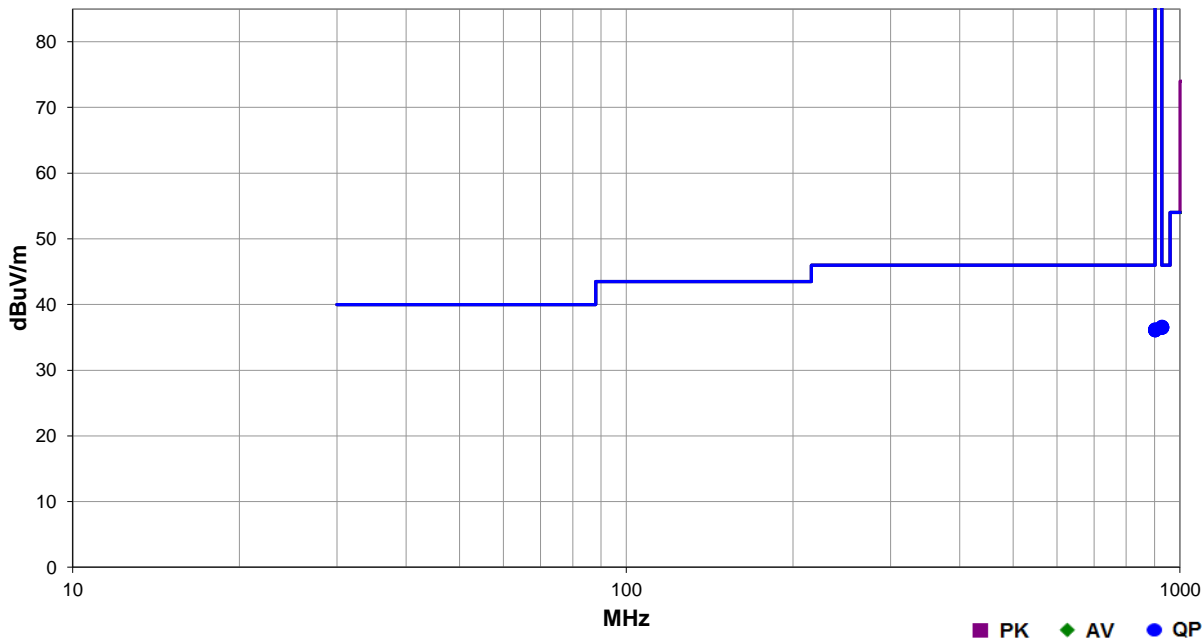


EmiR5 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ADEM0017	Date:	2021-10-08	<i>Andrew Rogstad</i>
Project:	None	Temperature:	21.9 °C	
Job Site:	MN09	Humidity:	57.4% RH	
Serial Number:	1 TRP	Barometric Pres.:	1017 mbar	
EUT:	Z Wave			
Configuration:	2			
Customer:	Ademco, Inc.			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.249:2021	ANSI C63.10:2013

Run #	8	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
928.000	15.5	11.1	1.0	275.0	3.0	10.0	Horz	QP	0.0	36.6	46.0	-9.4	EUT on side, High ch.
928.000	15.5	11.1	1.0	334.0	3.0	10.0	Vert	QP	0.0	36.6	46.0	-9.4	EUT horz, High ch.
928.000	15.4	11.1	1.0	253.0	3.0	10.0	Vert	QP	0.0	36.5	46.0	-9.5	EUT on side, High ch.
928.000	15.4	11.1	1.03	232.0	3.0	10.0	Vert	QP	0.0	36.5	46.0	-9.5	EUT vert, High ch.
928.000	15.4	11.1	2.9	18.0	3.0	10.0	Horz	QP	0.0	36.5	46.0	-9.5	EUT vert, High ch.
928.000	15.4	11.1	1.0	113.0	3.0	10.0	Horz	QP	0.0	36.5	46.0	-9.5	EUT horz, High ch.
902.000	15.7	10.5	1.0	209.0	3.0	10.0	Horz	QP	0.0	36.2	46.0	-9.8	EUT on side, Low ch.
902.000	15.6	10.5	1.0	94.0	3.0	10.0	Horz	QP	0.0	36.1	46.0	-9.9	EUT horz, Low ch.
902.000	15.6	10.5	3.76	293.0	3.0	10.0	Vert	QP	0.0	36.1	46.0	-9.9	EUT horz, Low ch.
902.000	15.6	10.5	1.0	39.0	3.0	10.0	Horz	QP	0.0	36.1	46.0	-9.9	EUT vert, Low ch.
902.000	15.6	10.5	1.53	167.0	3.0	10.0	Vert	QP	0.0	36.1	46.0	-9.9	EUT vert, Low ch.
902.000	15.6	10.5	1.0	233.0	3.0	10.0	Vert	QP	0.0	36.1	46.0	-9.9	EUT on side, Low ch.

FIELD STRENGTH OF HARMONICS AND SPURIOUS RADIATED EMISSIONS

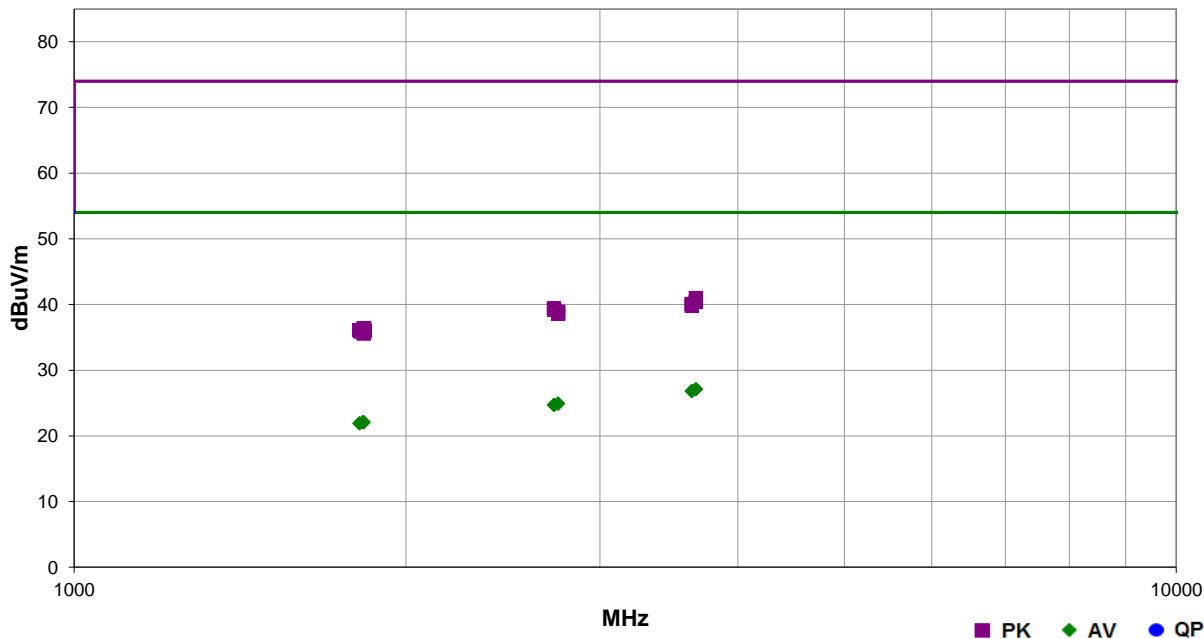


EmiR5 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ADEM0017	Date:	2021-09-30	<i>Andrew Rogstad</i>
Project:	None	Temperature:	21.5 °C	
Job Site:	MN05	Humidity:	54.5% RH	
Serial Number:	1 TRP	Barometric Pres.:	1021 mbar	
EUT:	Z Wave			
Configuration:	1			
Customer:	Ademco, Inc.			
Attendees:	None			
EUT Power:	Battery			
Operating Mode:	Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal			
Deviations:	None			
Comments:	Power 12			

Test Specifications	Test Method
FCC 15.249:2021	ANSI C63.10:2013

Run #	8	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
3666.242	28.5	-1.4	1.5	16.9	3.0	0.0	Horz	AV	0.0	27.1	54.0	-26.9	EUT horz, High ch.
3666.367	28.5	-1.4	2.2	156.9	3.0	0.0	Vert	AV	0.0	27.1	54.0	-26.9	EUT horz, High ch.
3634.725	28.4	-1.6	1.5	308.9	3.0	0.0	Horz	AV	0.0	26.8	54.0	-27.2	EUT horz, Low ch.
3634.200	28.4	-1.6	1.5	6.9	3.0	0.0	Vert	AV	0.0	26.8	54.0	-27.2	EUT horz, Low ch.
2748.642	29.5	-4.6	2.17	275.9	3.0	0.0	Horz	AV	0.0	24.9	54.0	-29.1	EUT horz, High ch.
2748.175	29.5	-4.6	1.5	98.0	3.0	0.0	Vert	AV	0.0	24.9	54.0	-29.1	EUT horz, High ch.
2724.500	29.4	-4.7	1.52	153.9	3.0	0.0	Horz	AV	0.0	24.7	54.0	-29.3	EUT horz, Low ch.
2725.225	29.4	-4.7	2.97	207.0	3.0	0.0	Vert	AV	0.0	24.7	54.0	-29.3	EUT horz, Low ch.
1829.542	28.2	-6.1	1.5	69.0	3.0	0.0	Horz	AV	0.0	22.1	54.0	-31.9	EUT horz, High ch.
1829.808	28.2	-6.1	1.43	228.0	3.0	0.0	Vert	AV	0.0	22.1	54.0	-31.9	EUT horz, High ch.
1829.608	28.2	-6.1	1.5	274.0	3.0	0.0	Horz	AV	0.0	22.1	54.0	-31.9	EUT vert, High ch.
1829.525	28.2	-6.1	1.5	329.9	3.0	0.0	Vert	AV	0.0	22.1	54.0	-31.9	EUT vert, High ch.
1829.525	28.2	-6.1	3.95	238.0	3.0	0.0	Horz	AV	0.0	22.1	54.0	-31.9	EUT on side, High ch.
1829.533	28.2	-6.1	1.5	221.0	3.0	0.0	Vert	AV	0.0	22.1	54.0	-31.9	EUT on side, High ch.
1815.383	28.1	-6.2	1.5	33.0	3.0	0.0	Horz	AV	0.0	21.9	54.0	-32.1	EUT horz, Low ch.
1814.767	28.1	-6.2	1.72	141.0	3.0	0.0	Vert	AV	0.0	21.9	54.0	-32.1	EUT horz, Low ch.
3664.933	42.4	-1.4	2.2	156.9	3.0	0.0	Vert	PK	0.0	41.0	74.0	-33.0	EUT horz, High ch.

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
3664.617	41.8	-1.4	1.5	16.9	3.0	0.0	Horz	PK	0.0	40.4	74.0	-33.6	EUT horz, High ch.
3631.633	41.7	-1.6	1.5	308.9	3.0	0.0	Horz	PK	0.0	40.1	74.0	-33.9	EUT horz, Low ch.
3634.217	41.4	-1.6	1.5	6.9	3.0	0.0	Vert	PK	0.0	39.8	74.0	-34.2	EUT horz, Low ch.
2723.900	44.1	-4.7	1.52	153.9	3.0	0.0	Horz	PK	0.0	39.4	74.0	-34.6	EUT horz, Low ch.
2725.058	43.9	-4.7	2.97	207.0	3.0	0.0	Vert	PK	0.0	39.2	74.0	-34.8	EUT horz, Low ch.
2748.725	43.5	-4.6	1.5	98.0	3.0	0.0	Vert	PK	0.0	38.9	74.0	-35.1	EUT horz, High ch.
2748.525	43.2	-4.6	2.17	275.9	3.0	0.0	Horz	PK	0.0	38.6	74.0	-35.4	EUT horz, High ch.
1832.833	42.4	-6.0	3.95	238.0	3.0	0.0	Horz	PK	0.0	36.4	74.0	-37.6	EUT on side, High ch.
1830.275	42.5	-6.1	1.5	69.0	3.0	0.0	Horz	PK	0.0	36.4	74.0	-37.6	EUT horz, High ch.
1832.783	42.2	-6.0	1.5	221.0	3.0	0.0	Vert	PK	0.0	36.2	74.0	-37.8	EUT on side, High ch.
1815.150	42.3	-6.2	1.72	141.0	3.0	0.0	Vert	PK	0.0	36.1	74.0	-37.9	EUT horz, Low ch.
1834.108	42.0	-6.0	1.5	329.9	3.0	0.0	Vert	PK	0.0	36.0	74.0	-38.0	EUT vert, High ch.
1817.750	42.1	-6.2	1.5	33.0	3.0	0.0	Horz	PK	0.0	35.9	74.0	-38.1	EUT horz, Low ch.
1832.225	41.7	-6.1	1.43	228.0	3.0	0.0	Vert	PK	0.0	35.6	74.0	-38.4	EUT horz, High ch.
1830.242	41.7	-6.1	1.5	274.0	3.0	0.0	Horz	PK	0.0	35.6	74.0	-38.4	EUT vert, High ch.

FIELD STRENGTH OF HARMONICS AND SPURIOUS RADIATED EMISSIONS

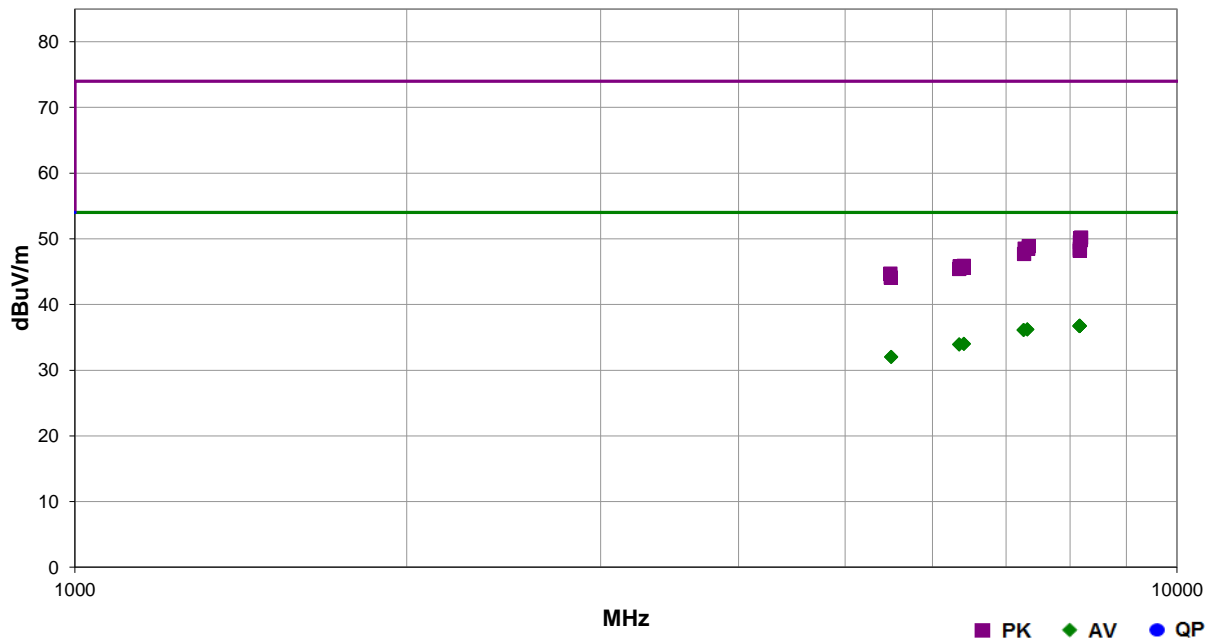


EmR5 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ADEM0017	Date:	2021-10-14	
Project:	None	Temperature:	22 °C	
Job Site:	MN05	Humidity:	46.8% RH	
Serial Number:	1 TRP	Barometric Pres.:	952.5 mbar	
EUT:	Z Wave			
Configuration:	2			
Customer:	Ademco, Inc.			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.249:2021	ANSI C63.10:2013

Run #	24	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
8163.100	26.5	10.3	1.5	0.0	3.0	0.0	Horz	AV	0.0	36.8	54.0	-17.2	EUT Horz, Low Ch
8163.350	26.4	10.3	1.5	333.9	3.0	0.0	Vert	AV	0.0	36.7	54.0	-17.3	EUT Horz, Low Ch
8163.392	26.4	10.3	1.45	153.0	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3	EUT Vert, Low Ch
8163.183	26.4	10.3	1.5	162.0	3.0	0.0	Vert	AV	0.0	36.7	54.0	-17.3	EUT Vert, Low Ch
8163.392	26.4	10.3	1.5	290.9	3.0	0.0	Horz	AV	0.0	36.7	54.0	-17.3	EUT On Side, Low Ch
8163.100	26.4	10.3	1.5	116.0	3.0	0.0	Vert	AV	0.0	36.7	54.0	-17.3	EUT On Side, Low Ch
7315.625	27.0	9.2	1.5	221.0	3.0	0.0	Horz	AV	0.0	36.2	54.0	-17.8	EUT Horz, High Ch
7315.542	27.0	9.2	1.5	152.0	3.0	0.0	Vert	AV	0.0	36.2	54.0	-17.8	EUT Horz, High Ch
7260.658	26.9	9.2	1.5	148.0	3.0	0.0	Horz	AV	0.0	36.1	54.0	-17.9	EUT Horz, Low Ch
7260.450	26.9	9.2	1.1	307.0	3.0	0.0	Vert	AV	0.0	36.1	54.0	-17.9	EUT Horz, Low Ch
6407.833	26.3	7.7	1.5	153.9	3.0	0.0	Horz	AV	0.0	34.0	54.0	-20.0	EUT Horz, High Ch
6407.250	26.3	7.7	1.5	203.0	3.0	0.0	Vert	AV	0.0	34.0	54.0	-20.0	EUT Horz, High Ch
6346.300	26.5	7.4	1.5	150.9	3.0	0.0	Horz	AV	0.0	33.9	54.0	-20.1	EUT Horz, Low Ch
6346.425	26.5	7.4	3.54	200.9	3.0	0.0	Vert	AV	0.0	33.9	54.0	-20.1	EUT Horz, Low Ch
5505.083	27.4	4.6	1.5	55.9	3.0	0.0	Horz	AV	0.0	32.0	54.0	-22.0	EUT Horz, High Ch
5504.958	27.4	4.6	1.5	246.0	3.0	0.0	Vert	AV	0.0	32.0	54.0	-22.0	EUT Horz, High Ch
8184.350	39.5	10.7	1.5	116.0	3.0	0.0	Vert	PK	0.0	50.2	74.0	-23.8	EUT On Side, Low Ch

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
8168.933	39.7	10.4	1.5	0.0	3.0	0.0	Horz	PK	0.0	50.1	74.0	-23.9	EUT Horz, Low Ch
8182.975	39.1	10.7	1.45	153.0	3.0	0.0	Horz	PK	0.0	49.8	74.0	-24.2	EUT Vert, Low Ch
8166.475	39.2	10.3	1.5	162.0	3.0	0.0	Vert	PK	0.0	49.5	74.0	-24.5	EUT Vert, Low Ch
7339.125	39.7	9.2	1.5	221.0	3.0	0.0	Horz	PK	0.0	48.9	74.0	-25.1	EUT Horz, High Ch
8163.892	38.2	10.3	1.5	333.9	3.0	0.0	Vert	PK	0.0	48.5	74.0	-25.5	EUT Horz, Low Ch
7276.325	39.3	9.2	1.1	307.0	3.0	0.0	Vert	PK	0.0	48.5	74.0	-25.5	EUT Horz, Low Ch
7327.792	39.3	9.2	1.5	152.0	3.0	0.0	Vert	PK	0.0	48.5	74.0	-25.5	EUT Horz, High Ch
8163.225	37.9	10.3	1.5	290.9	3.0	0.0	Horz	PK	0.0	48.2	74.0	-25.8	EUT On Side, Low Ch
7264.950	38.5	9.2	1.5	148.0	3.0	0.0	Horz	PK	0.0	47.7	74.0	-26.3	EUT Horz, Low Ch
6406.500	38.2	7.7	1.5	203.0	3.0	0.0	Vert	PK	0.0	45.9	74.0	-28.1	EUT Horz, High Ch
6352.008	38.4	7.4	3.54	200.9	3.0	0.0	Vert	PK	0.0	45.8	74.0	-28.2	EUT Horz, Low Ch
6404.458	37.9	7.7	1.5	153.9	3.0	0.0	Horz	PK	0.0	45.6	74.0	-28.4	EUT Horz, High Ch
6346.342	38.0	7.4	1.5	150.9	3.0	0.0	Horz	PK	0.0	45.4	74.0	-28.6	EUT Horz, Low Ch
5495.042	40.1	4.6	1.5	246.0	3.0	0.0	Vert	PK	0.0	44.7	74.0	-29.3	EUT Horz, High Ch
5499.000	39.5	4.6	1.5	55.9	3.0	0.0	Horz	PK	0.0	44.1	74.0	-29.9	EUT Horz, High Ch

FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2021.03.17.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal

POWER SETTINGS INVESTIGATED

Battery

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

ADEM0017 - 1

ADEM0017 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency | 30 MHz

Stop Frequency | 1000 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Filter - Low Pass	Micro-Tronics	LPM50003	HGL	2021-09-10	2022-09-10
Attenuator	Fairview Microwave	SA18E-10	TYA	2021-09-09	2022-09-09
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2021-10-13	2022-10-13
Cable	ESM Cable Corp.	Bilog Cables	MNH	2021-10-13	2022-10-13
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2021-09-14	2023-09-14
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2020-12-27	2021-12-27

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0


TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting and while set at the lowest channel, a middle channel, and the highest channel available. While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT and EUT antenna in 3 orthogonal planes.

FIELD STRENGTH OF FUNDAMENTAL

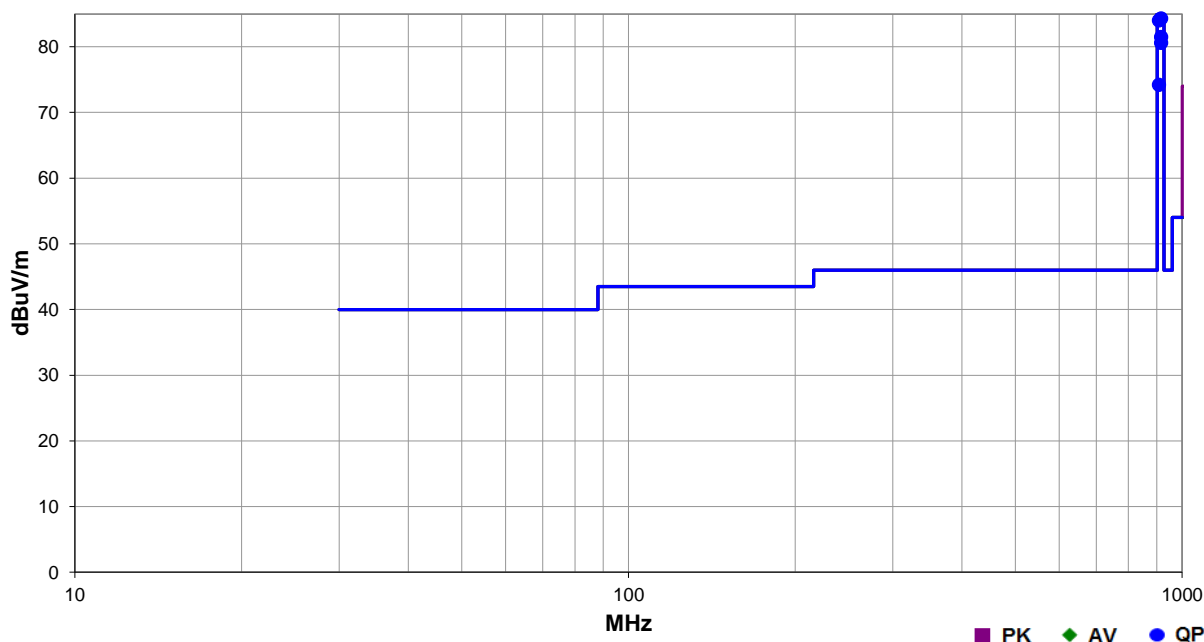


EmR5 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ADEM0017	Date:	2021-09-22	
Project:	None	Temperature:	21.8 °C	
Job Site:	MN09	Humidity:	42.6% RH	
Serial Number:	1 TRP	Barometric Pres.:	1026 mbar	
EUT:	Z Wave			
Configuration:	1			
Customer:	Ademco, Inc.			
Attendees:	None			
EUT Power:	Battery			
Operating Mode:	Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal			
Deviations:	None			
Comments:	Power 12			

Test Specifications	Test Method
FCC 15.249:2021	ANSI C63.10:2013

Run #	1	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
916.017	51.6	30.9	1.0	271.0	3.0	10.0	Horz	QP	0.0	92.5	94.0	-1.5	EUT Horz, High Ch
908.433	51.1	30.7	1.0	96.0	3.0	10.0	Horz	QP	0.0	91.8	94.0	-2.2	EUT Horz, Low Ch
908.422	51.1	30.7	1.0	164.0	3.0	10.0	Horz	QP	0.0	91.8	94.0	-2.2	EUT On Side, Low Ch
916.018	50.2	30.9	1.46	30.0	3.0	10.0	Horz	QP	0.0	91.1	94.0	-2.9	EUT On Side, High Ch
916.020	50.0	30.9	1.21	201.0	3.0	10.0	Vert	QP	0.0	90.9	94.0	-3.1	EUT Vert, High Ch
908.413	48.7	30.7	1.0	122.0	3.0	10.0	Vert	QP	0.0	89.4	94.0	-4.6	EUT Vert, Low Ch
908.420	45.8	30.7	1.0	114.0	3.0	10.0	Vert	QP	0.0	86.5	94.0	-7.5	EUT On Side, Low Ch
916.020	43.4	30.9	2.26	192.0	3.0	10.0	Horz	QP	0.0	84.3	94.0	-9.7	EUT Vert, High Ch
908.432	43.3	30.7	2.32	181.0	3.0	10.0	Vert	QP	0.0	84.0	94.0	-10.0	EUT Horz, Low Ch
916.035	40.6	30.9	1.0	61.0	3.0	10.0	Vert	QP	0.0	81.5	94.0	-12.5	EUT On Side, High Ch
916.030	39.7	30.9	1.0	17.0	3.0	10.0	Vert	QP	0.0	80.6	94.0	-13.4	EUT Horz, High Ch
908.420	33.5	30.7	1.0	236.0	3.0	10.0	Horz	QP	0.0	74.2	94.0	-19.8	EUT Vert, Low Ch

FIELD STRENGTH OF FUNDAMENTAL

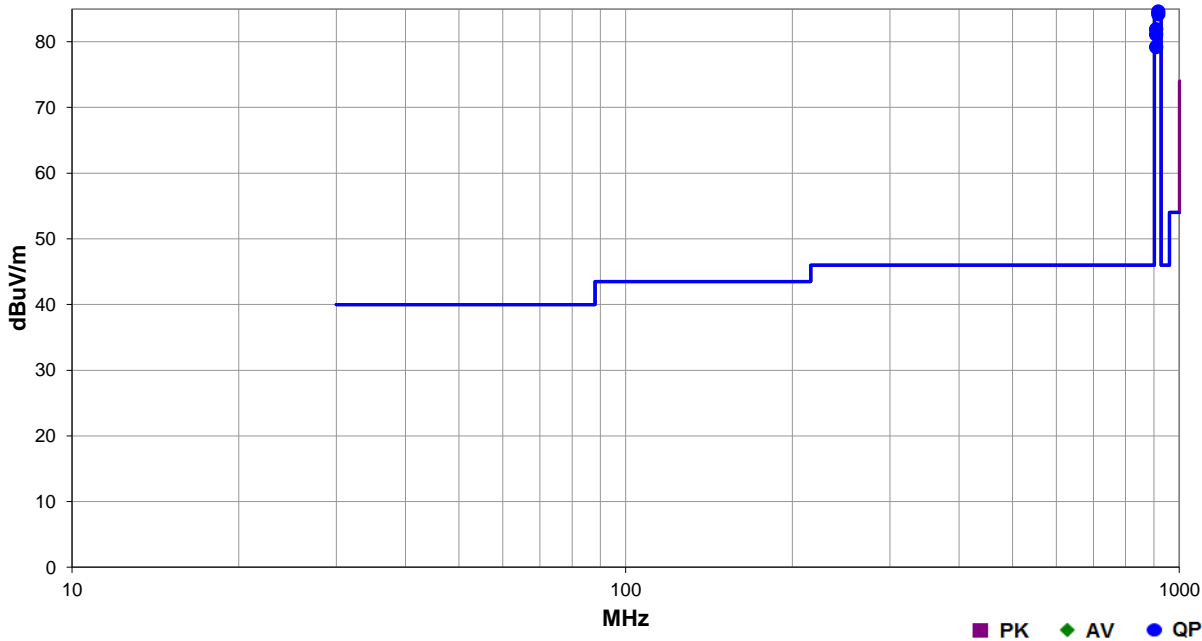


EmiRS 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ADEM0017	Date:	2021-10-08	<i>Andrew Rogstad</i>
Project:	None	Temperature:	21.9 °C	
Job Site:	MN09	Humidity:	57.4% RH	
Serial Number:	1 TRP	Barometric Pres.:	1017 mbar	
EUT:	Z Wave			
Configuration:	2			
Customer:	Ademco, Inc.			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Transmitting Low Channel at 908.4 MHz or High Channel at 916 MHz, Modulated signal			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
FCC 15.249:2021	ANSI C63.10:2013

Run #	7	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
908.425	73.2	10.5	1.0	56.0	3.0	10.0	Horz	QP	0.0	93.7	94.0	-0.3	EUT horz, Low ch.
916.012	71.6	10.7	1.0	348.0	3.0	10.0	Horz	QP	0.0	92.3	94.0	-1.7	EUT on side, High ch.
916.015	69.7	10.7	1.0	264.0	3.0	10.0	Horz	QP	0.0	90.4	94.0	-3.6	EUT horz, High ch.
916.033	69.2	10.7	1.07	103.0	3.0	10.0	Vert	QP	0.0	89.9	94.0	-4.1	EUT vert, High ch.
908.423	68.6	10.5	1.24	53.0	3.0	10.0	Vert	QP	0.0	89.1	94.0	-4.9	EUT vert, Low ch.
908.410	68.5	10.5	1.0	140.0	3.0	10.0	Horz	QP	0.0	89.0	94.0	-5.0	EUT on side, Low ch.
916.032	64.7	10.7	1.0	254.0	3.0	10.0	Vert	QP	0.0	85.4	94.0	-8.6	EUT on side, High ch.
916.010	63.9	10.7	2.6	340.0	3.0	10.0	Vert	QP	0.0	84.6	94.0	-9.4	EUT horz, High ch.
916.015	63.5	10.7	1.0	39.0	3.0	10.0	Horz	QP	0.0	84.2	94.0	-9.8	EUT vert, High ch.
908.423	61.4	10.5	1.85	19.0	3.0	10.0	Horz	QP	0.0	81.9	94.0	-12.1	EUT vert, Low ch.
908.432	60.6	10.5	1.0	178.0	3.0	10.0	Vert	QP	0.0	81.1	94.0	-12.9	EUT on side, Low ch.
908.423	58.7	10.5	1.0	30.0	3.0	10.0	Vert	QP	0.0	79.2	94.0	-14.8	EUT horz, Low ch.

DUTY CYCLE



XMit 2020.12.30.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2021-05-21	2022-05-21
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	2021-02-01	2022-02-01
Cable	Element	Biconilog Cable	MNX	2021-02-01	2022-02-01
Antenna - Biconilog	Teseq	CBL 6141B	AYD	2020-02-05	2022-02-05

TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

DUTY CYCLE



TstTx 2021.03.19.1 XMI 2020.12.30.0

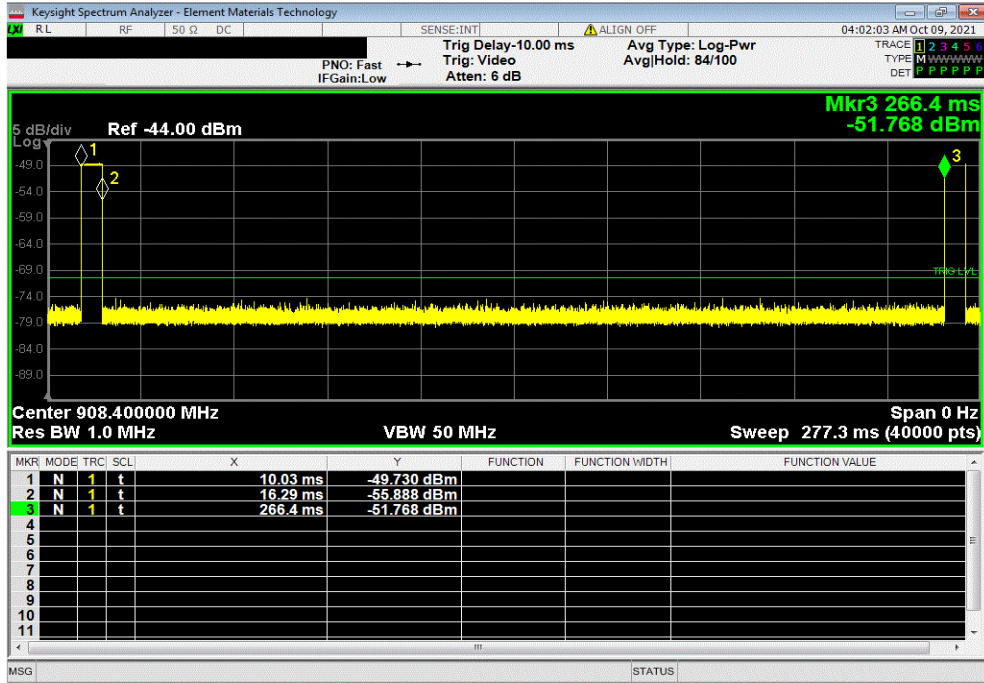
EUT: Z Wave		Work Order: ADEM0017					
Serial Number: 1 TRP		Date: 8-Oct-21					
Customer: Ademco, Inc.		Temperature: 23.1 °C					
Attendees: None		Humidity: 39.4% RH					
Project: None		Barometric Pres.: 1015 mbar					
Tested by: Andrew Rogstad		Power: Battery					
		Job Site: MN09					
TEST SPECIFICATIONS							
FCC 15.247:2021		Test Method					
		ANSI C63.10:2013					
COMMENTS							
None							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	1	Signature <i>Andrew Rogstad</i>					
		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Low Channel, 908.4 MHz		6.262 ms	256.41 ms	1	2.4	N/A	N/A
Low Channel, 908.4 MHz		N/A	N/A	8	N/A	N/A	N/A
High Channel, 916 MHz		4.922 ms	255.068 ms	1	1.9	N/A	N/A
High Channel, 916 MHz		N/A	N/A	8	N/A	N/A	N/A

DUTY CYCLE

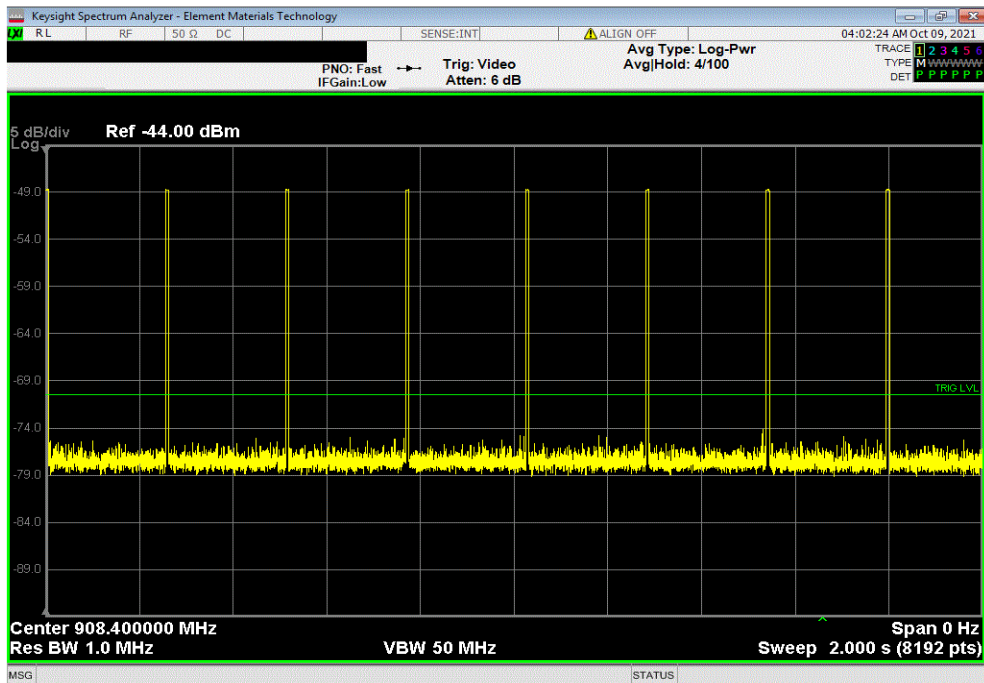


TbTx 2021.03.19.1 XMI 2020.12.30.0

Low Channel, 908.4 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
6.262 ms	256.41 ms	1	2.4	N/A	N/A	



Low Channel, 908.4 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	8	N/A	N/A	N/A	

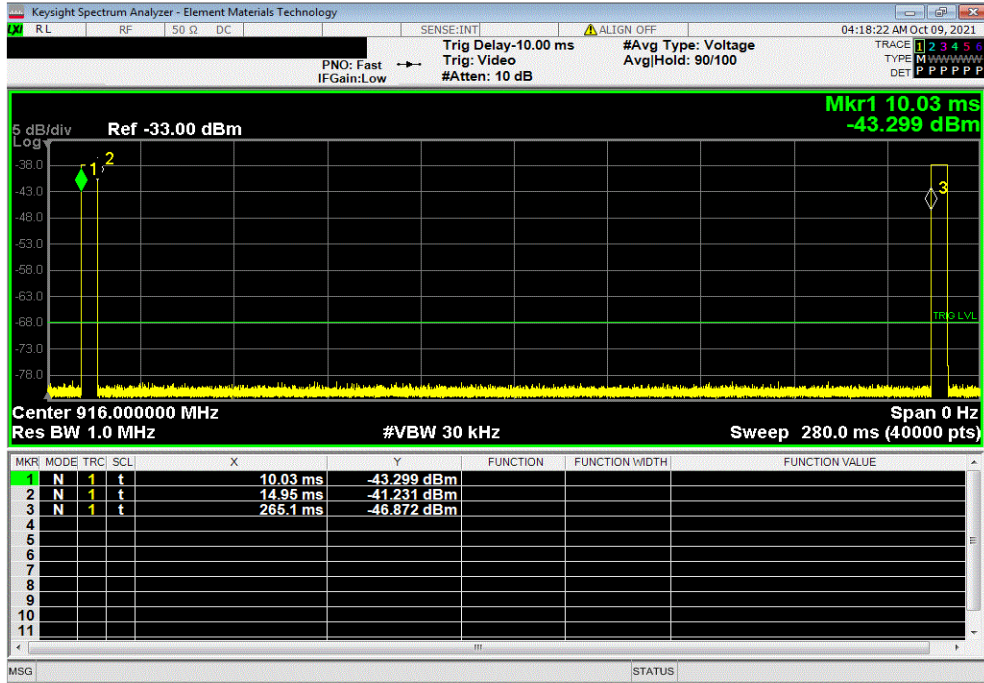


DUTY CYCLE

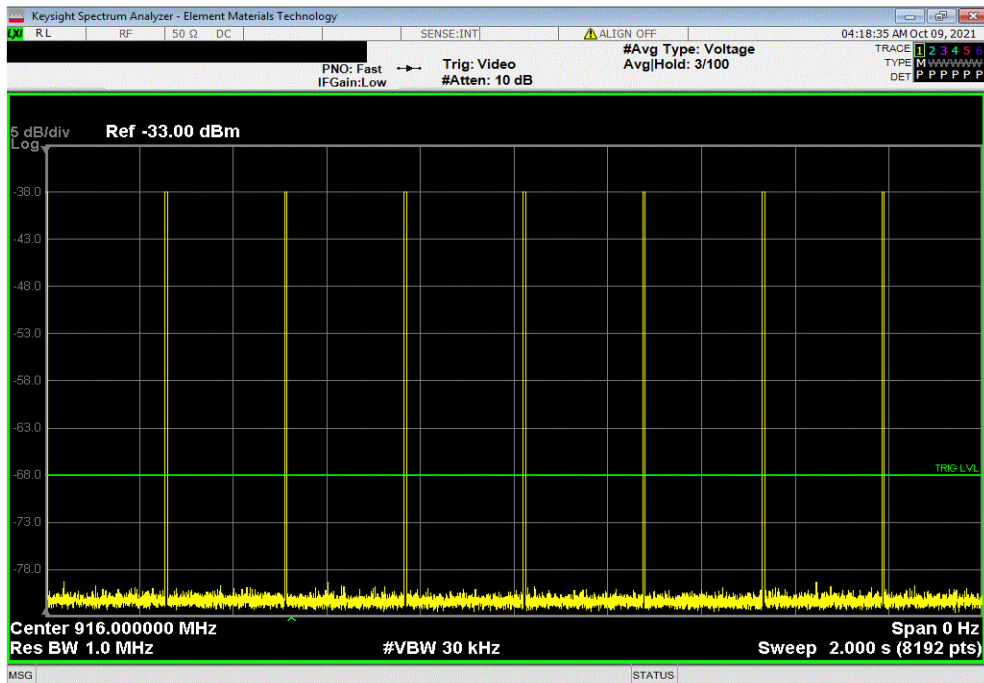


TbTx 2021.03.19.1 XMI 2020.12.30.0

High Channel, 916 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
4.922 ms	255.068 ms	1	1.9	N/A	N/A	



High Channel, 916 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	8	N/A	N/A	N/A	



DUTY CYCLE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAQ	2021-05-21	2022-05-21
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	2021-02-01	2022-02-01
Cable	Element	Biconilog Cable	MNX	2021-02-01	2022-02-01
Antenna - Biconilog	Teseq	CBL 6141B	AYD	2020-02-05	2022-02-05

TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

DUTY CYCLE



TelTx 2021.03.19.1 XMI 2020.12.30.0

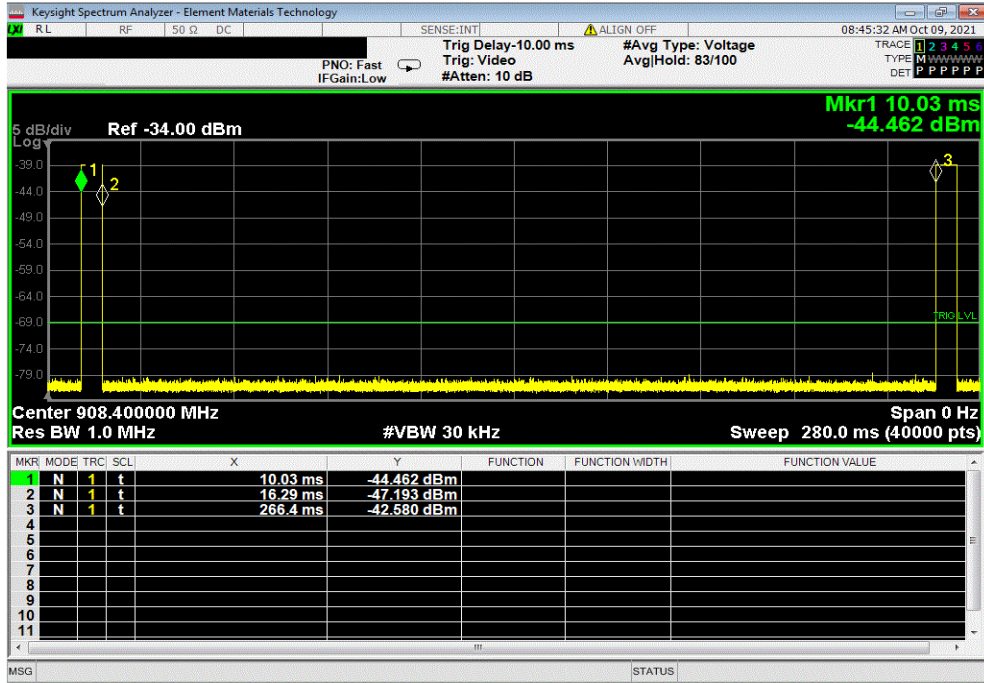
EUT: Z Wave		Work Order: ADEM0017					
Serial Number: 1 TRP		Date: 8-Oct-21					
Customer: Ademco, Inc.		Temperature: 23 °C					
Attendees: None		Humidity: 39.3% RH					
Project: None		Barometric Pres.: 1015 mbar					
Tested by: Andrew Rogstad		Power: 110VAC/60Hz					
		Job Site: MN09					
TEST SPECIFICATIONS							
FCC 15.249:2021		ANSI C63.10:2013					
TEST METHOD							
COMMENTS							
None							
DEVIATIONS FROM TEST STANDARD							
None							
Configuration #	2	Signature <i>Andrew Rogstad</i>					
		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
Low Channel, 908.4 MHz		6.263 ms	256.416 ms	1	2.4	N/A	N/A
Low Channel, 908.4 MHz		N/A	N/A	8	N/A	N/A	N/A
High Channel, 916 MHz		4.922 ms	255.063 ms	1	1.9	N/A	N/A
High Channel, 916 MHz		N/A	N/A	8	N/A	N/A	N/A

DUTY CYCLE

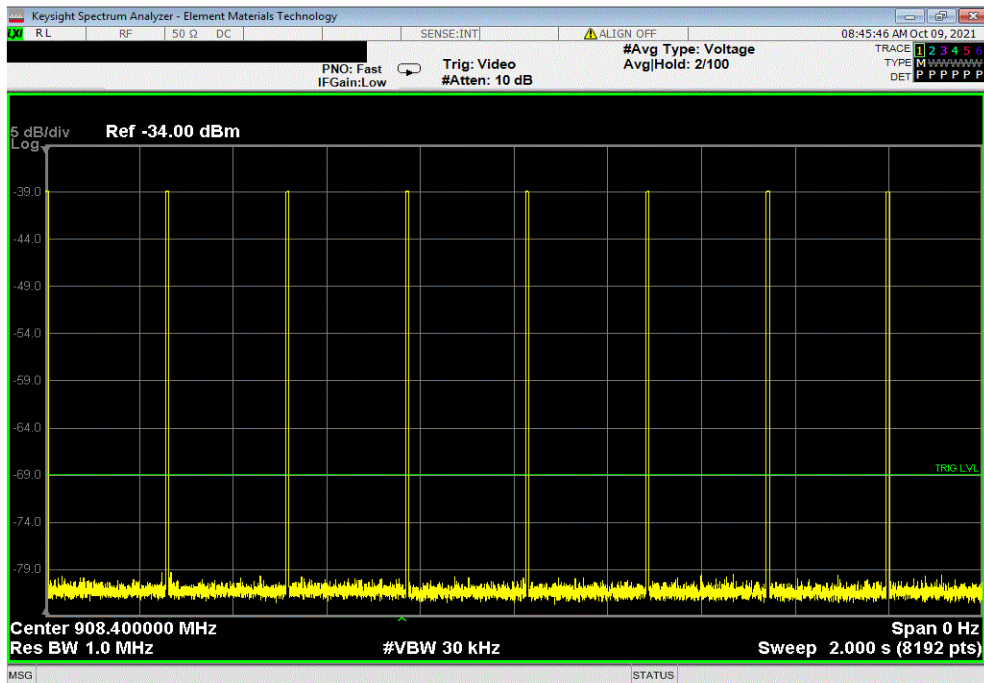


TbTx 2021.03.19.1 XMI 2020.12.30.0

Low Channel, 908.4 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
6.263 ms	256.416 ms	1	2.4	N/A	N/A	



Low Channel, 908.4 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	8	N/A	N/A	N/A	

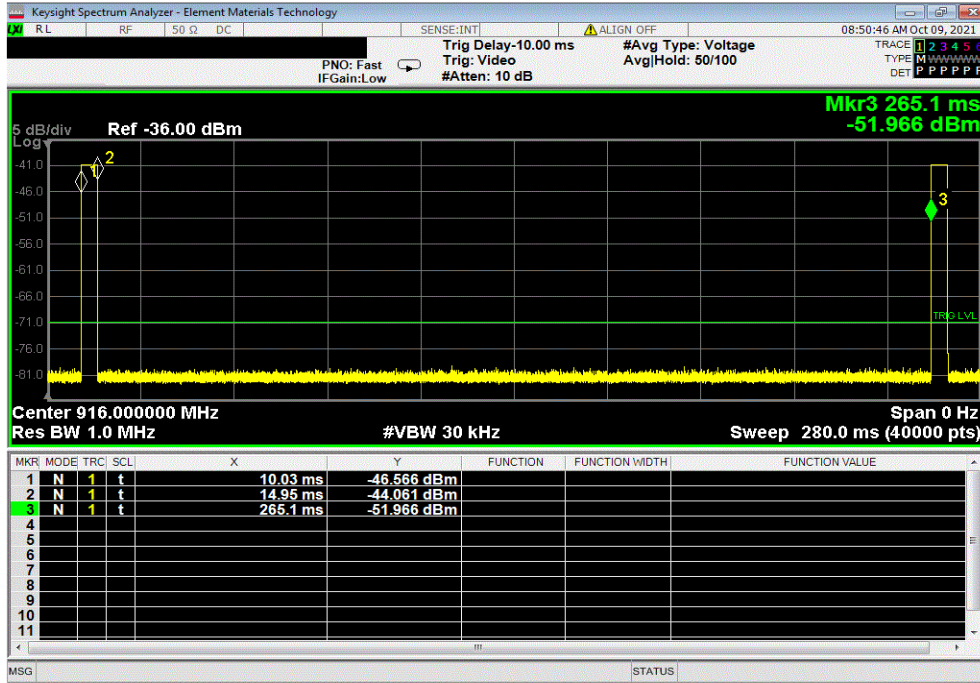


DUTY CYCLE

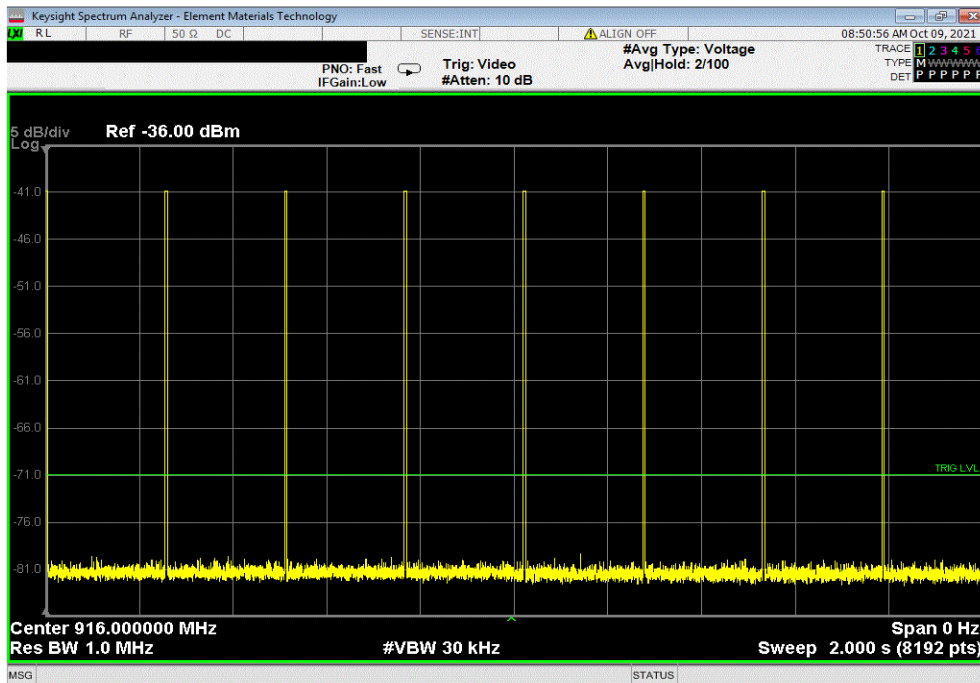


TbTx 2021.03.19.1 XMI 2020.12.30.0

High Channel, 916 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
4.922 ms	255.063 ms	1	1.9	N/A	N/A	



High Channel, 916 MHz						
Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results	
N/A	N/A	8	N/A	N/A	N/A	



End of Test Report