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Qolsys Inc.
TEST REPORT

SCOPE OF WORK
EMC TESTING – Z-WAVE 700 CARD

REPORT NUMBER
103979153LEX-001

ISSUE DATE

12/17/2019

PAGES
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DOCUMENT CONTROL NUMBER
Non-Specific EMC Report Shell Rev. December 2017

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 103979153LEX-001
Project Number: G103979153

Report Issue Date: 12/17/2019

Model(s) Tested: Z-Wave 700 Card

Standards: FCC Part 15.249
RSS-210 Issue 9
RSS-Gen Issue 5
FCC Part 15B
ICES-003 Issue 6

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Dr.
Lexington, KY 40510
USA

Client:
Qolsys Inc.
1900 The Alameda Ste 420
San Jose, CA 95126-1437
USA

Report prepared by

Bryan Taylor, Team Leader

Report reviewed by

Brian Lackey, Staff Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
6	Radiated Emissions (Transmitters Idle) (ANSI C63.4:2014)	Pass
7	Radiated Spurious Emissions (Z-Wave Transmitting) (ANSI C63.10:2013)	Pass
8	Conducted Emissions (ANSI C63.4:2014, ANSI C63.10: 2010)	Pass
9	Occupied Bandwidth (ANSI C63.10:2013)	Pass
10	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5)	Pass

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Qolsys Inc.
Address:	1900 The Alameda Ste 420 San Jose, CA 95126-1437 USA
Contact:	Mark Skeen
Telephone:	408-857-8415
Email:	markjskeen@gmail.com
Manufacturer Information	
Manufacturer Name:	Qolsys Inc.
Manufacturer Address:	1900 The Alameda Ste 420 San Jose, CA 95126-1437 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Z-Wave 700 Card
Model Number	Z-Wave 700 Card
Serial Number	Test Sample 1
Transmitter Frequency Range	908.42MHz
Receive Date	11/19/2019
Test Start Date	11/19/2019
Test End Date	12/10/2019
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	3.3VDC
Description of Equipment Under Test (provided by client)	
The device under test was a Z-Wave module manufactured by Qolsys Inc.	

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 System Setup and Method

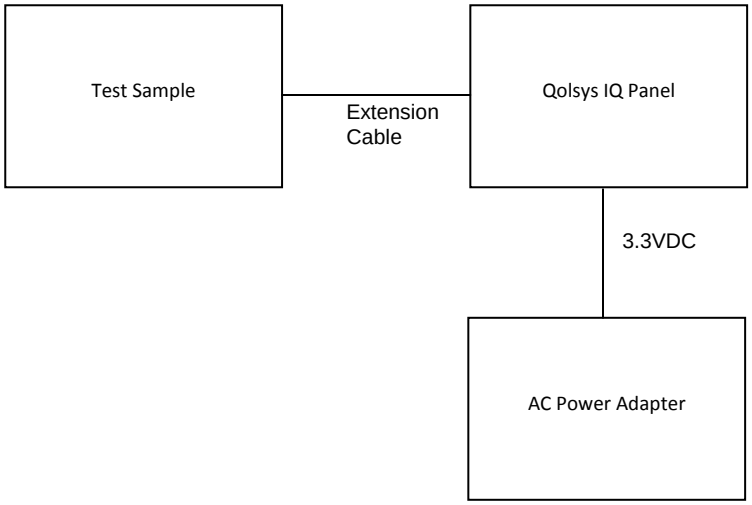
5.1 Method:

Configuration as required by ANSI C63.4:2014 and ANSI C63.10:2013.

No.	Descriptions of EUT Exercising
1	Idle Mode: During idle mode the Z-Wave transmitter module was powered but not actively transmitting. Power was provided via a 3.3VDC to 120VAC / 60Hz power adapter connected to a Qolsys Inc. IQ Panel.
2	Transmit Mode: During transmit mode the Z-Wave transmitter module was transmitting with a raw power setting of 22 on the test utility. Power was provided via a 3.3VDC to 120VAC / 60Hz power adapter connected to a Qolsys Inc. IQ Panel.

Cables					
Qty	Description	Length (m)	Shielding	Ferrites	Termination
1	DC Power Cable	1.5m	None	None	AC Power Adapter
1	Extension Cable	15cm	None	None	Qolsys IQ Panel

5.2 EUT Block Diagram:



6 Radiated Emissions (Transmitter Idle)

6.1 Method

Configuration as required by ANSI C63.4:2014.

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

6.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

6.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2019	9/18/2020
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	8/8/2019	8/8/2020
Horn Antenna (1GHz – 18GHz)	3780	ETS Lindgren	3117	6/7/2019	6/7/2020
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Antenna→Preamp	3074			11/26/2018	11/26/2019
3m Cable Preamplifier	3918	Rohde & Schwarz	TS-PR18	11/26/2018	11/26/2019
3m Cable Preamp→Chamber	2588			11/26/2018	11/26/2019
3m Cable Chamber→Control Room	2593			11/26/2018	11/26/2019
3m Cable Control Room→Receiver	3339			11/26/2018	11/26/2019

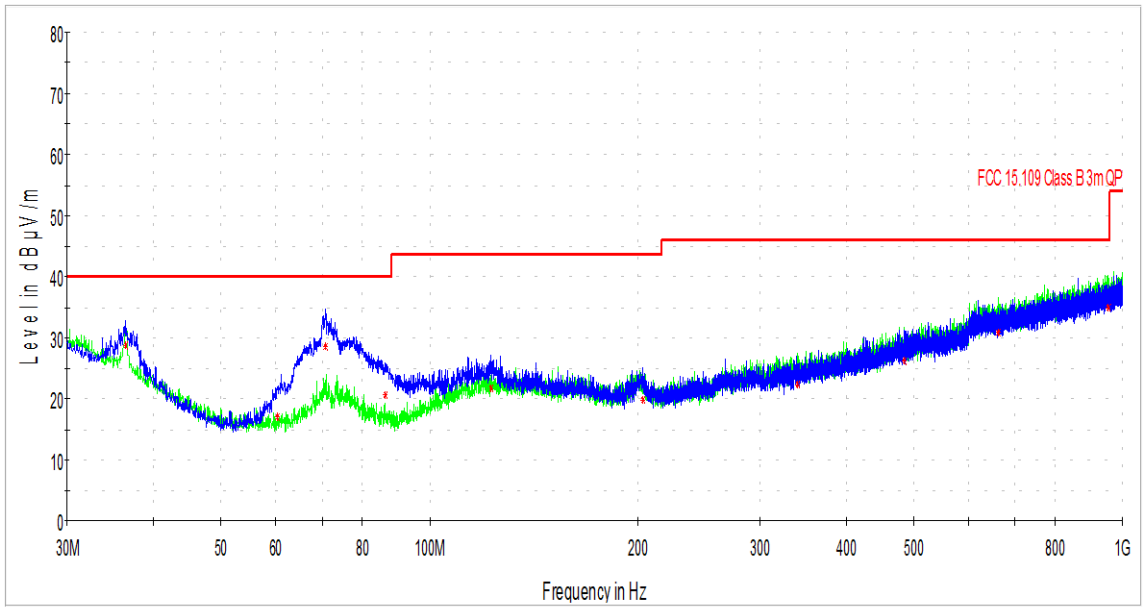
6.4 Software Utilized:

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

6.5 Results:

The sample tested was found to Comply.

6.6 Plots/Data: Radiated Emissions, 30MHz – 1GHz (Transmitters Idle)

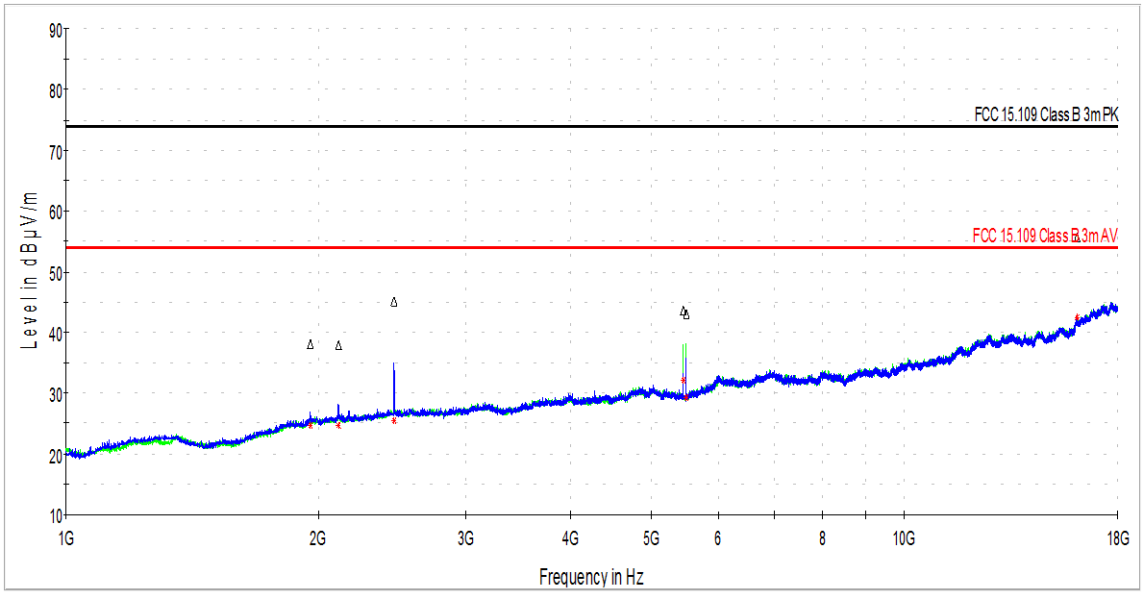


Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.466667	28.72	40.00	11.28	120.000	117.6	V	346.0	23.0
60.285556	16.98	40.00	23.02	120.000	105.6	V	0.0	14.2
70.847778	28.57	40.00	11.43	120.000	100.0	V	330.0	14.8
86.260000	20.74	40.00	19.26	120.000	105.0	V	348.0	16.1
122.742778	21.68	43.52	21.84	120.000	100.1	V	144.0	21.9
203.198889	19.84	43.52	23.68	120.000	104.7	V	319.0	21.4
339.753333	22.33	46.02	23.69	120.000	383.4	H	27.0	24.2
484.175556	26.23	46.02	19.79	120.000	249.6	H	80.0	27.8
661.470000	30.82	46.02	15.20	120.000	225.1	H	145.0	30.9
954.517778	34.79	46.02	11.23	120.000	320.1	H	118.0	34.8

Test Personnel:	Bryan Taylor	Test Date:	11/19/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	22.5 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	29.8 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	997 mbar

Deviations, Additions, or Exclusions: None

6.7 Plots/Data: Radiated Emissions, 1GHz – 18GHz (Transmitters Idle)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1956.500000	38.07	73.98	35.91	1000.000	100.0	V	284.0	1.8
2115.500000	37.81	73.98	36.17	1000.000	222.0	V	12.0	1.9
2462.500000	45.07	73.98	28.91	1000.000	366.0	V	152.0	3.0
5453.000000	43.59	73.98	30.39	1000.000	160.0	H	315.0	8.1
5498.500000	43.03	73.98	30.95	1000.000	213.0	V	0.0	8.0
16088.000000	55.70	73.98	18.28	1000.000	100.0	H	216.0	24.6

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1956.500000	24.74	53.98	29.24	1000.000	100.0	V	284.0	1.8
2115.500000	24.67	53.98	29.31	1000.000	222.0	V	12.0	1.9
2462.500000	25.51	53.98	28.47	1000.000	366.0	V	152.0	3.0
5453.000000	32.09	53.98	21.89	1000.000	160.0	H	315.0	8.1
5498.500000	29.19	53.98	24.79	1000.000	213.0	V	0.0	8.0
16088.000000	42.51	53.98	11.47	1000.000	100.0	H	216.0	24.6

Test Personnel:	Bryan Taylor	Test Date:	11/19/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	22.5 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	29.8 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	997 mbar

Deviations, Additions, or Exclusions: None

7 Radiated Emissions (Z-Wave Transmitter Active)

7.1 Method

Configuration as required by ANSI C63.10:2013.

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

7.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

7.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2019	9/18/2020
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	8/8/2019	8/8/2020
Horn Antenna (1GHz – 18GHz)	3780	ETS Lindgren	3117	6/7/2019	6/7/2020
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Antenna→Preamp	3074			12/4/2019	12/4/2020
3m Cable Preamplifier	3918	Rohde & Schwarz	TS-PR18	12/4/2019	12/4/2020
3m Cable Preamp→Chamber	2588			12/4/2019	12/4/2020
3m Cable Chamber→Control Room	2593			12/4/2019	12/4/2020
3m Cable Control Room→Receiver	3339			12/4/2019	12/4/2020

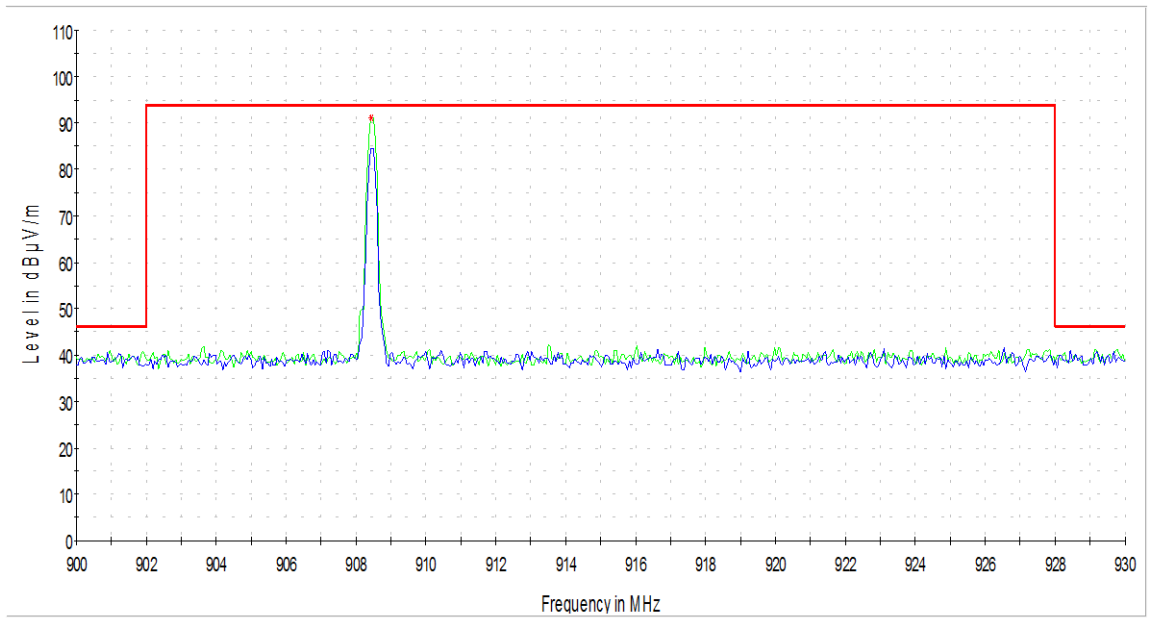
7.4 Software Utilized:

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

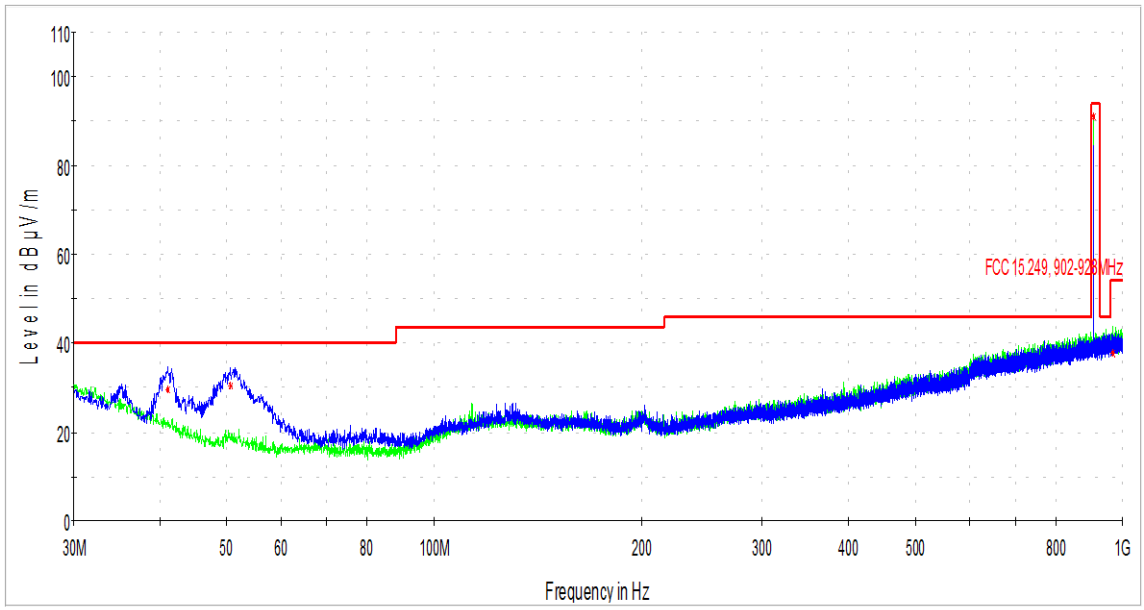
7.5 Results:

The sample tested was found to Comply.

7.6 Plots/Data: Radiated Emissions, 902 – 928MHz (Z-Wave Transmitter Active, Fundamental Plot)



7.7 Plots/Data: Radiated Emissions, 30MHz – 1GHz (Z-Wave Transmitter Active)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
41.047222	29.47	40.00	10.53	120.000	105.1	V	310.0	19.8
50.639445	30.43	40.00	9.57	120.000	99.9	V	295.0	15.1
908.442778*	91.04	94.00	2.96	120.000	99.9	H	293.0	37.0
968.205556	37.75	54.00	16.25	120.000	145.5	H	286.0	37.6

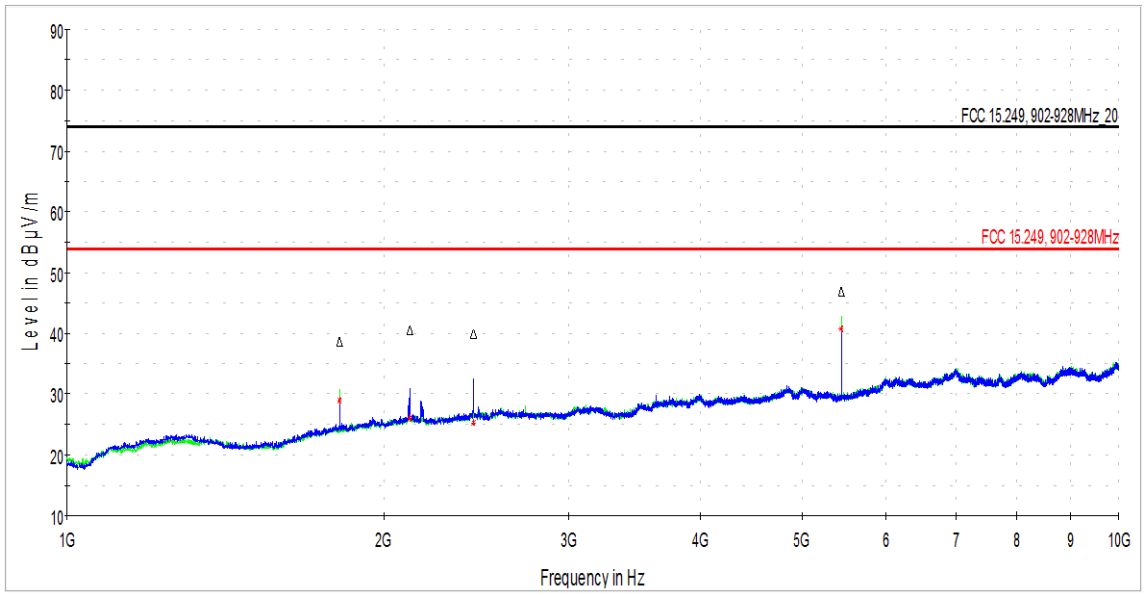
*Fundamental Signal

Test Personnel:	Brian Lackey	Test Date:	12/4/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC part 15.249, RSS-210 Annex B.10
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	23.6 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	23.6 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.7 mbar

Deviations, Additions, or Exclusions:

1) Raw power setting of 22 on test utility.
2) Reported measurements are worst case with the device positioned in 3 orthogonal axis.

7.8 Plots/Data: Radiated Emissions, 1GHz – 18GHz (Z-Wave Transmitter Active)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1816.500000	38.67	74.00	35.33	1000.000	186.0	H	234.0	0.6
2116.500000	40.47	74.00	33.53	1000.000	100.0	V	106.0	1.9
2434.500000	39.91	74.00	34.09	1000.000	168.0	V	181.0	3.2
5450.500000	46.78	74.00	27.22	1000.000	410.0	H	257.0	8.0

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1816.500000	28.84	54.00	25.16	1000.000	186.0	H	234.0	0.6
2116.500000	25.99	54.00	28.01	1000.000	100.0	V	106.0	1.9
2434.500000	25.26	54.00	28.74	1000.000	168.0	V	181.0	3.2
5450.500000	40.72	54.00	13.28	1000.000	410.0	H	257.0	8.0

Test Personnel:	Brian Lackey	Test Date:	12/4/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	FCC part 15.249, RSS-210 Annex B.10
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	23.6 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	23.6 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.7 mbar

Deviations, Additions, or Exclusions:

1) Raw power setting of 22 on test utility.
2) Reported measurements are worst case with the device positioned in 3 orthogonal axis.

8 Conducted Emissions

8.1 Method

Tests are performed in accordance with ANSI C63.4:2014 and ANSI C63.10: 2013.

TEST SITE: Ground Plane

Site Designation: Ground Plane

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Power Line Conducted Emissions	150 kHz - 30 MHz	3.1dB	3.4dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.

8.2 Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

8.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	9/18/2019	9/18/2020
LISN	2508	Fischer Custom Communication	FCC-LISN-50-50-2M	4/10/2019	4/10/2020
Coaxial Cable (COND 2)	5025			12/4/2019	12/4/2020

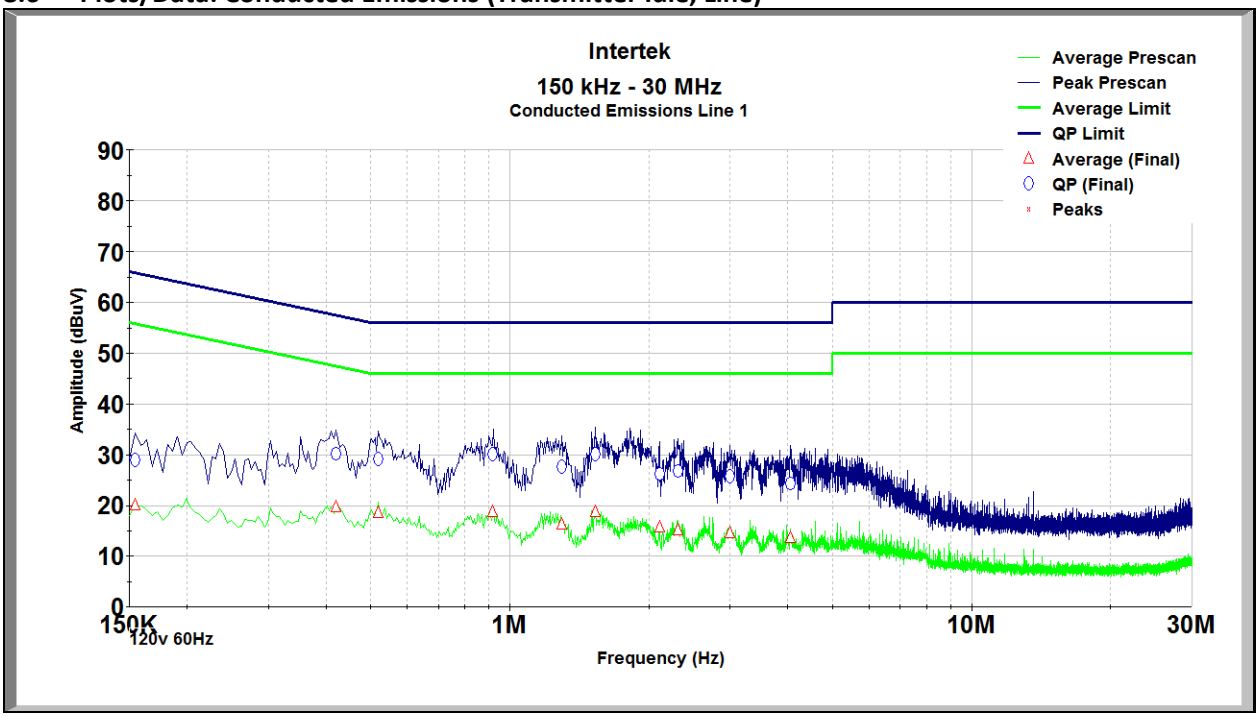
8.4 Software Utilized:

Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

8.5 Results:

The sample tested was found to Comply.

8.6 Plots/Data: Conducted Emissions (Transmitter Idle, Line)

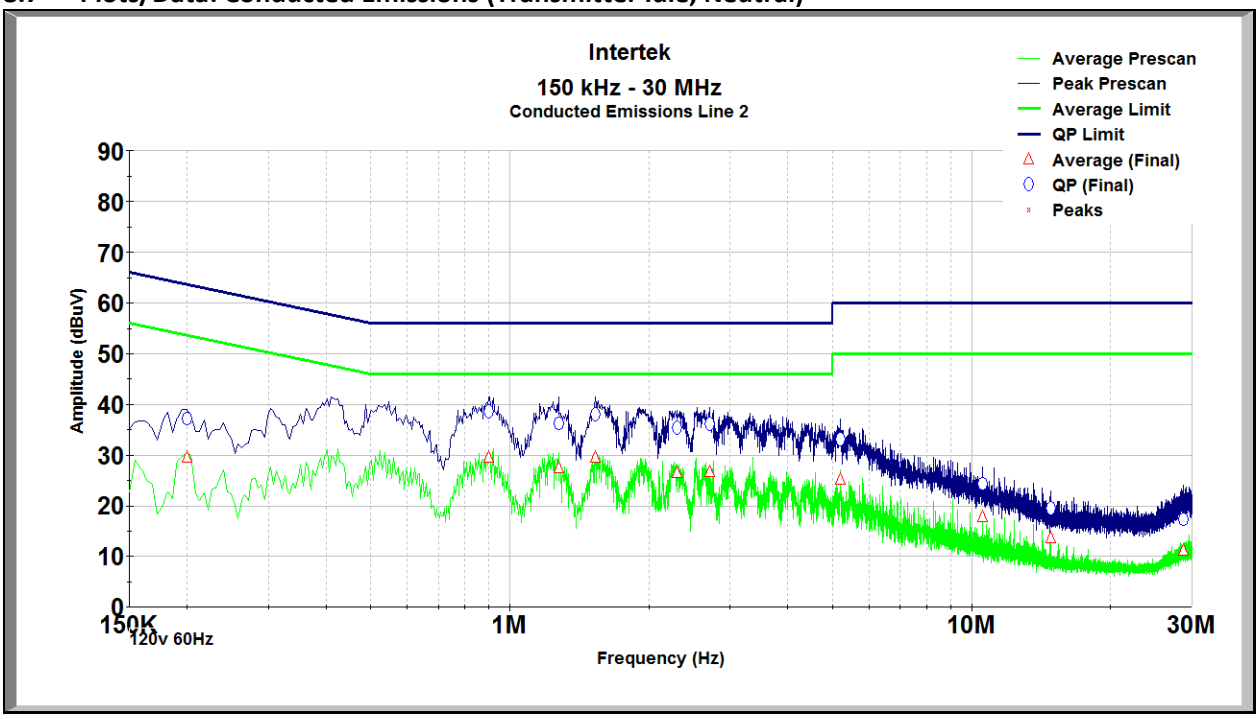


Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.155	29.028	65.871	36.843	20.046	55.871	35.825
0.420	30.281	58.286	28.005	19.722	48.286	28.563
0.519	29.085	56.000	26.932	18.476	46.000	27.541
0.919	30.081	56.000	26.292	18.683	46.000	27.689
1.298	27.642	56.000	29.067	16.289	46.000	30.419
1.532	30.171	56.000	26.746	18.747	46.000	28.170
2.107	26.234	56.000	31.195	15.712	46.000	31.717
2.310	26.872	56.000	30.737	15.139	46.000	32.470
2.998	25.770	56.000	32.451	14.534	46.000	33.687
4.056	24.444	56.000	34.716	13.685	46.000	35.476

Test Personnel:	Bryan Taylor	Test Date:	12/10/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	23.1 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	38.6 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	993 mbar

Deviations, Additions, or Exclusions: None

8.7 Plots/Data: Conducted Emissions (Transmitter Idle, Neutral)

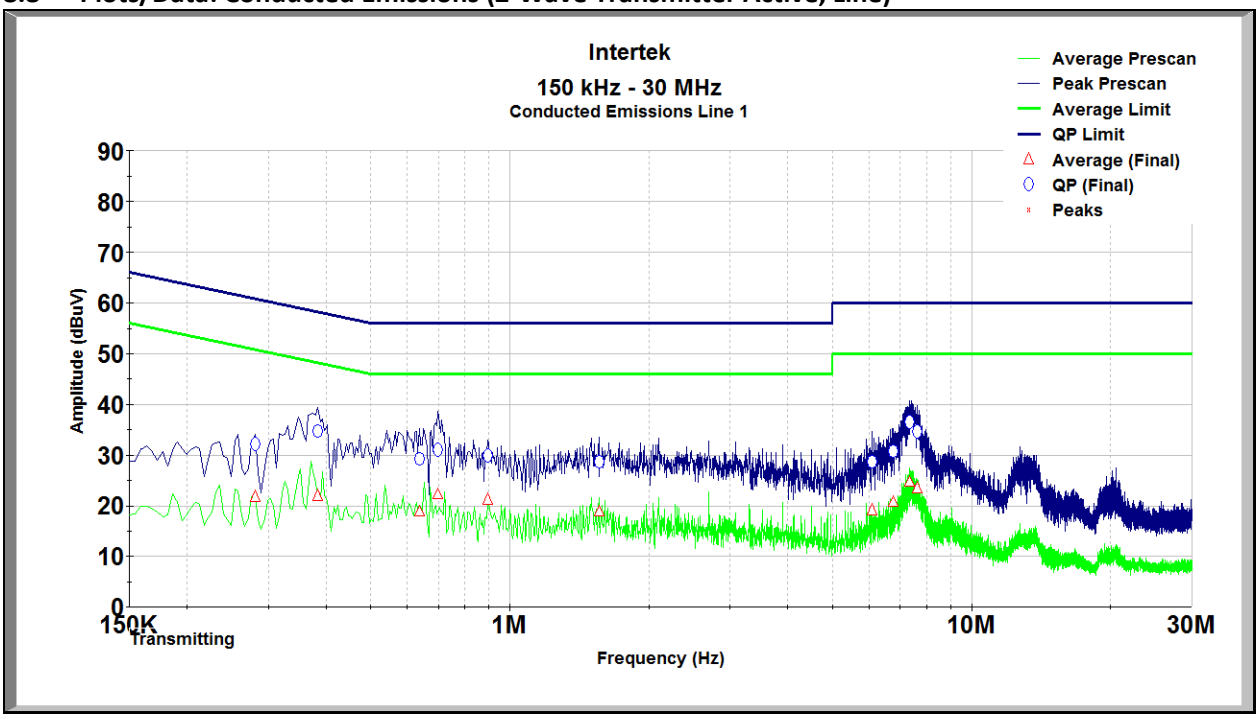


Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.200	37.250	64.586	27.336	29.568	54.586	25.018
0.901	38.551	56.000	17.806	29.588	46.000	16.769
1.275	36.293	56.000	20.396	27.487	46.000	19.202
1.532	38.083	56.000	18.834	29.454	46.000	17.463
2.301	35.467	56.000	22.134	26.441	46.000	21.160
2.706	36.105	56.000	21.856	26.682	46.000	21.279
5.199	33.198	60.000	22.834	25.103	50.000	20.928
10.556	24.427	60.000	32.462	17.890	50.000	28.999
14.839	19.584	60.000	37.990	13.668	50.000	33.907
28.797	17.523	60.000	42.284	11.107	50.000	38.700

Test Personnel:	Bryan Taylor	Test Date:	12/10/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 6	Ambient Temperature:	23.1°C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	38.6 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	993 mbar

Deviations, Additions, or Exclusions: None

8.8 Plots/Data: Conducted Emissions (Z-Wave Transmitter Active, Line)

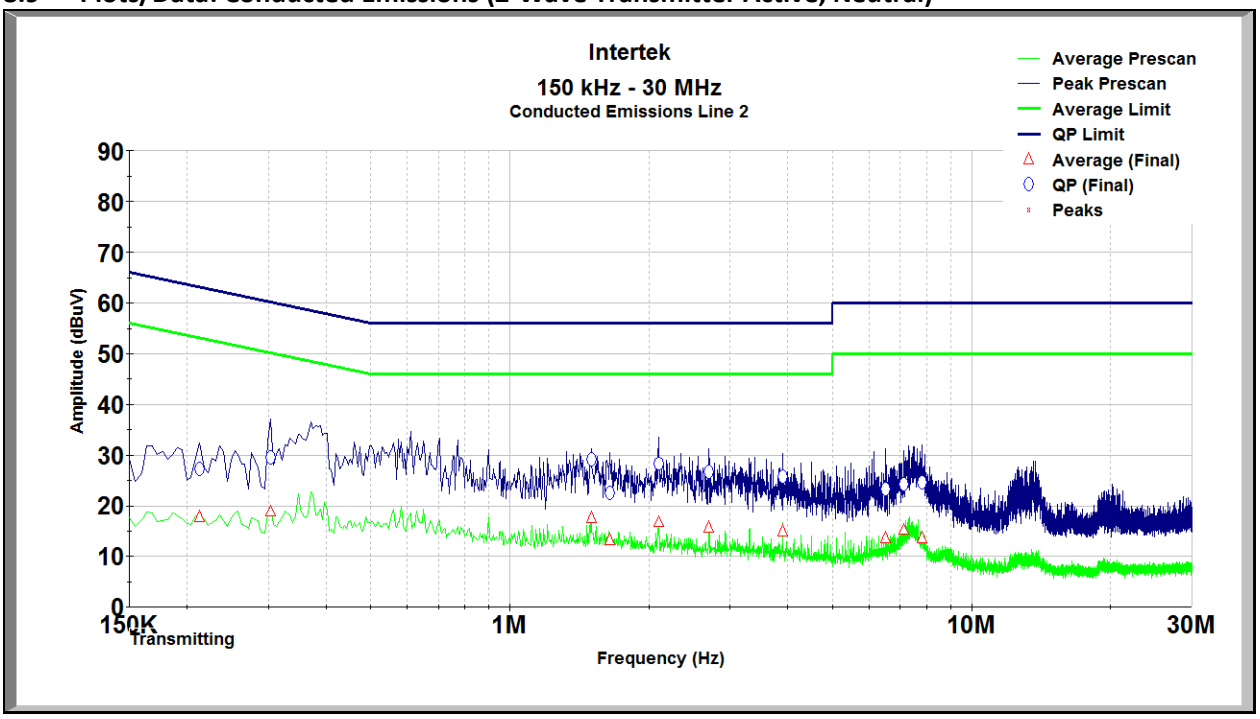


Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.281	32.201	62.271	30.070	21.795	52.271	30.476
0.384	34.879	59.314	24.435	21.978	49.314	27.336
0.636	29.248	56.000	26.752	18.916	46.000	27.084
0.699	31.119	56.000	24.881	22.363	46.000	23.637
0.897	29.927	56.000	26.073	21.159	46.000	24.841
1.559	28.735	56.000	27.265	18.873	46.000	27.127
6.077	28.776	60.000	31.224	19.128	50.000	30.872
6.747	30.876	60.000	29.124	20.821	50.000	29.179
7.354	36.580	60.000	23.420	24.795	50.000	25.205
7.617	34.611	60.000	25.389	23.403	50.000	26.597

Test Personnel:	Bryan Taylor	Test Date:	12/10/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	15.207 / RSS-Gen
Product Standard:	FCC Part 15C RSS-Gen Issue 5	Ambient Temperature:	23.1 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	38.6 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	993 mbar

Deviations, Additions, or Exclusions: None

8.9 Plots/Data: Conducted Emissions (Z-Wave Transmitter Active, Neutral)



Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.213	27.244	64.200	36.956	17.712	54.200	36.488
0.303	29.573	61.629	32.055	18.956	51.629	32.673
1.500	29.213	56.000	26.787	17.696	46.000	28.304
1.644	22.495	56.000	33.505	13.318	46.000	32.682
2.099	28.334	56.000	27.666	16.879	46.000	29.121
2.697	26.732	56.000	29.268	15.788	46.000	30.212
3.898	25.657	56.000	30.343	14.951	46.000	31.049
6.522	23.332	60.000	36.668	13.648	50.000	36.352
7.120	24.244	60.000	35.756	15.256	50.000	34.744
7.806	24.628	60.000	35.372	13.668	50.000	36.332

Test Personnel:	Bryan Taylor	Test Date:	12/10/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	15.207 / RSS-Gen
Product Standard:	FCC Part 15C RSS-Gen Issue 5	Ambient Temperature:	23.1 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	38.6 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	993 mbar

Deviations, Additions, or Exclusions: None

9 Occupied Bandwidth

9.1 Test Method

Tests are performed in accordance with ANSI C63.10:2013.

9.2 Test Equipment Used

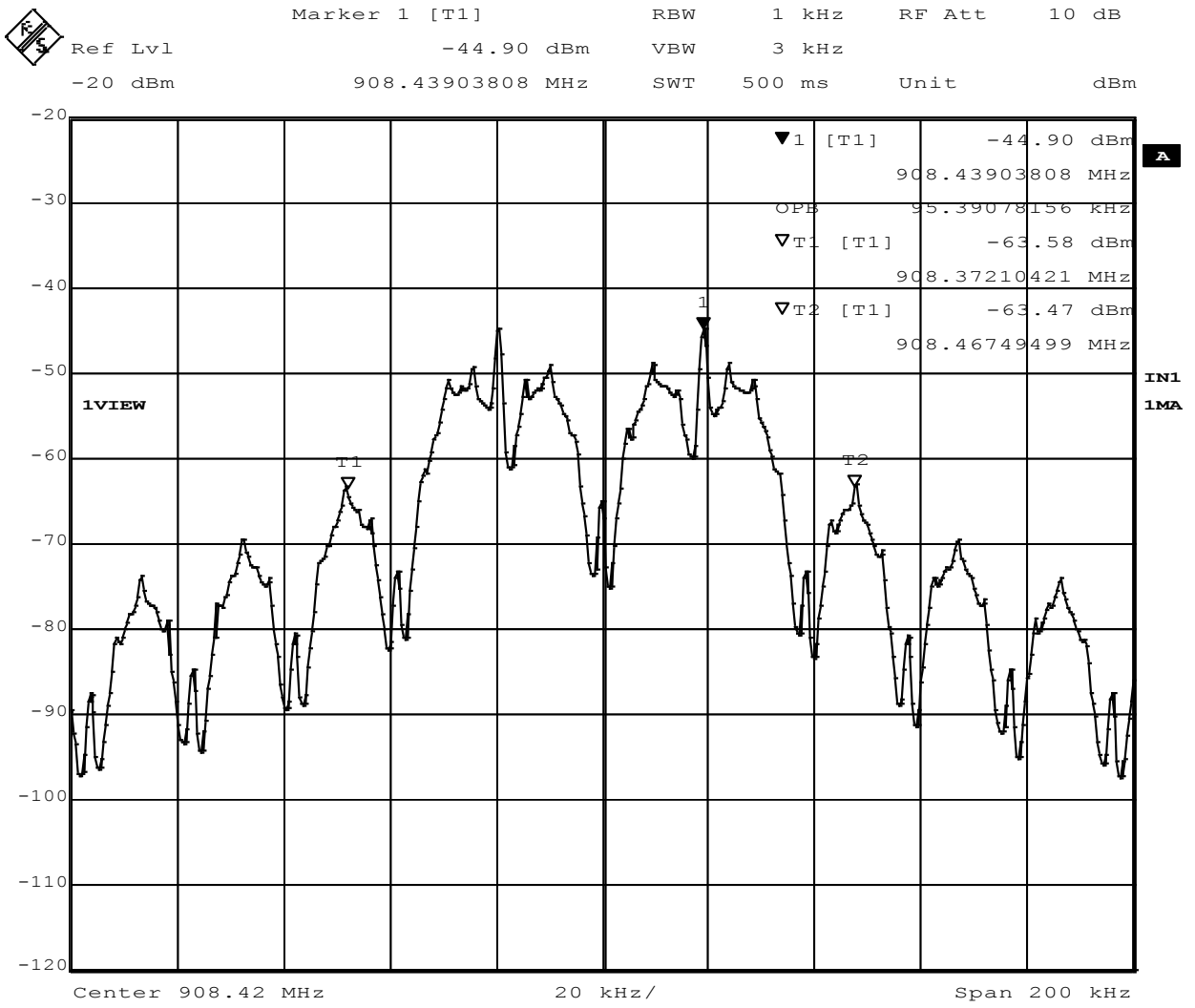
Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	9/30/2019	9/30/2020

9.3 Test Results

The sample tested was found to be **compliant**. The 99% power bandwidth was measured as was the 20dB down bandwidth and 6dB down bandwidth. No limits apply for these measurements.

9.4 Test Data (99% bandwidth):

RBW	VBW	99% BW
1kHz	3kHz	95.39kHz



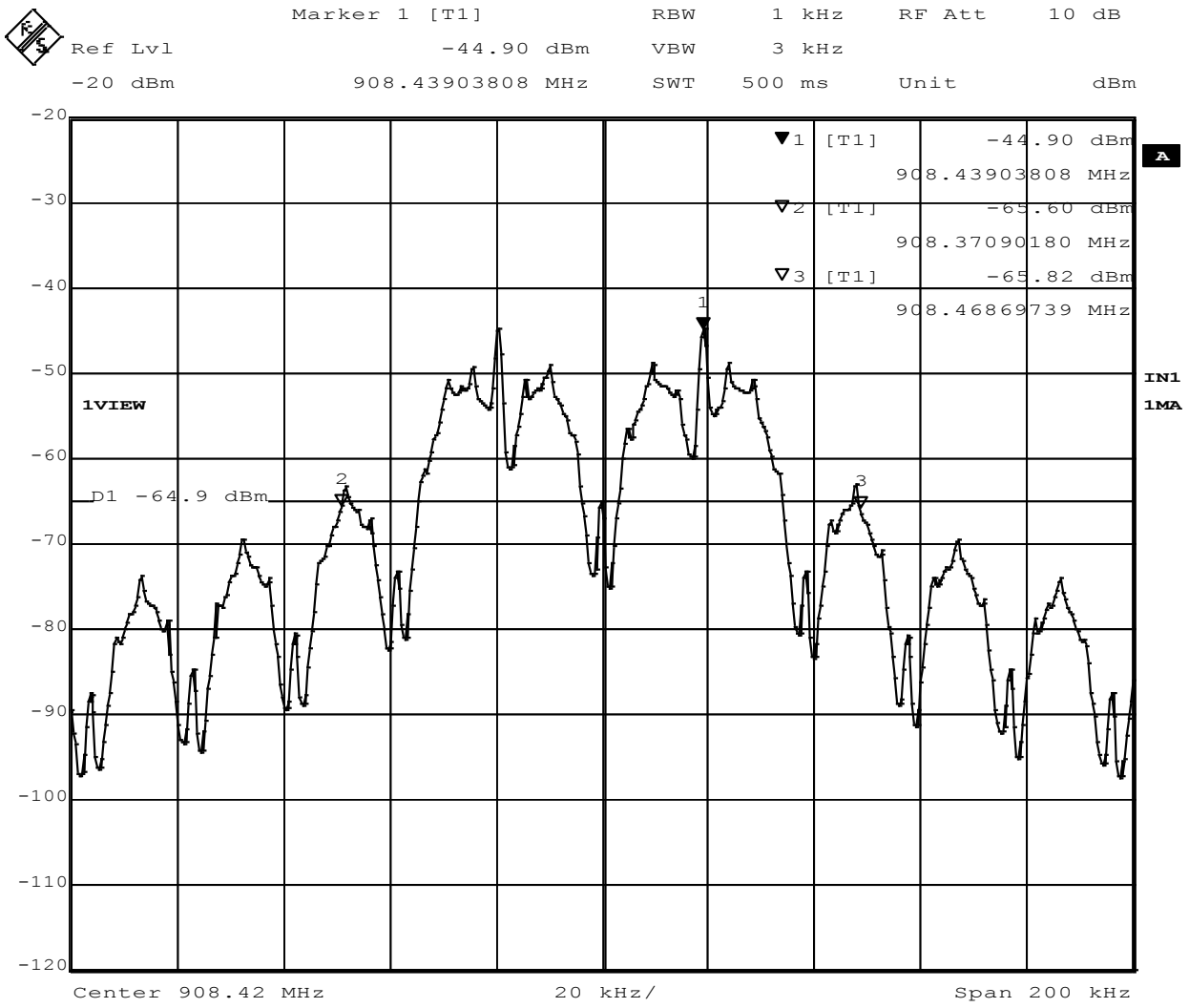
99% OBW = 95.39kHz

Test Personnel:	Brandon Norris	Test Date:	12/3/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	None
Product Standard:	RSS-210 Issue 9	Ambient Temperature:	24.7 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	45.9 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.6 mbar

Deviations, Additions, or Exclusions: None

9.5 Test Data (20dB Bandwidth):

RBW	VBW	20dB BW
1kHz	3kHz	97.8kHz



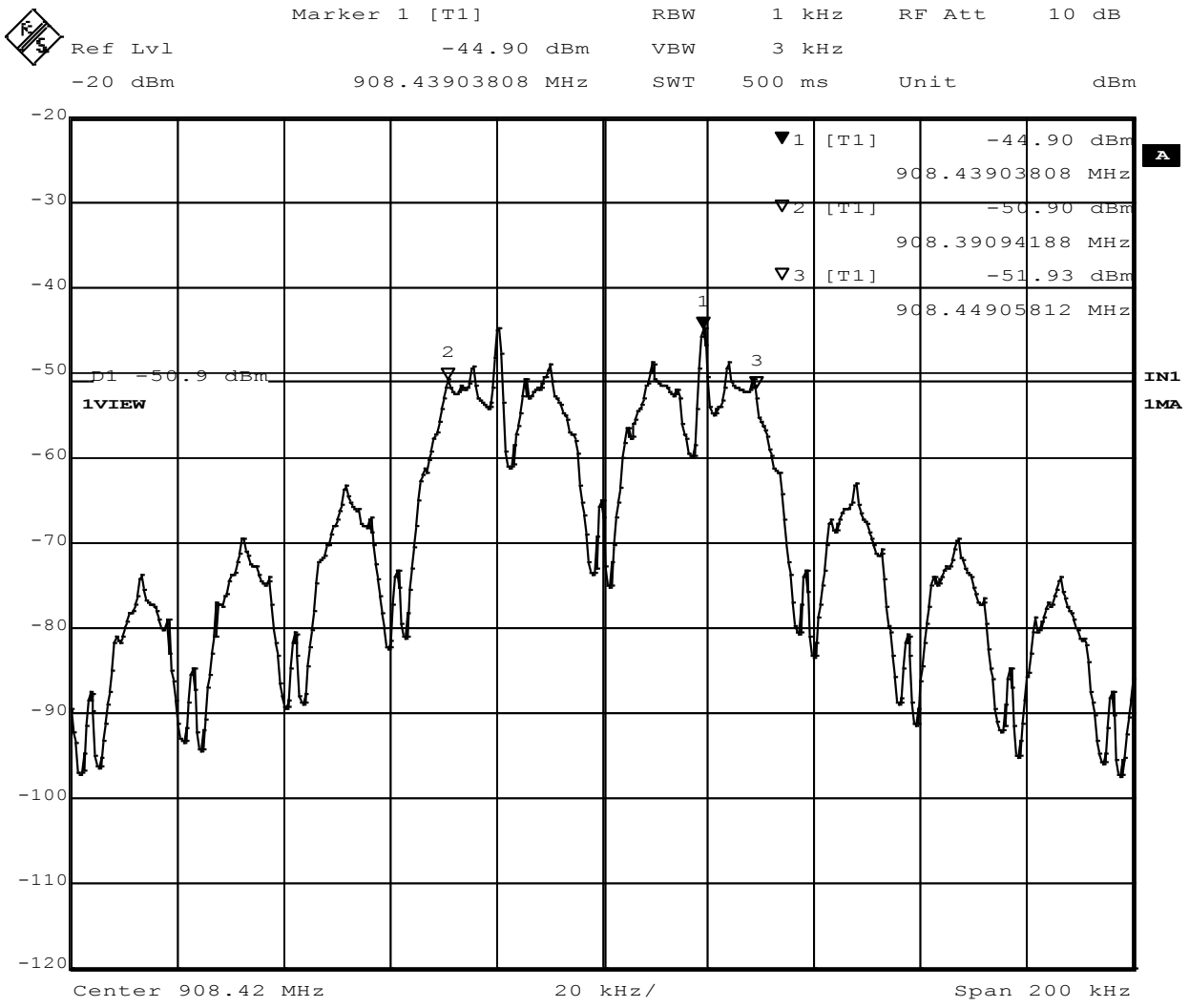
OBW = 908.46869739 MHz – 908.37090180 MHz = 97.80kHz
RBW = 1.02% OBW
Span = 2.04 * OBW

Test Personnel:	Brandon Norris	Test Date:	12/3/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	None
Product Standard:	RSS-210 Issue 9	Ambient Temperature:	24.7 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	45.9 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.6 mbar

Deviations, Additions, or Exclusions: None

9.6 Test Data (6dB Bandwidth):

RBW	VBW	20dB BW
1kHz	3kHz	58.12kHz



Date: 3.DEC.2019 10:06:30

OBW = 908.44905812 MHz – 908.39094188 MHz = 58.12kHz
RBW = 1.7% OBW
Span = 3.44 * OBW

Test Personnel:	Brandon Norris	Test Date:	12/3/2019
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	None
Product Standard:	RSS-210 Issue 9	Ambient Temperature:	24.7 °C
Input Voltage:	120VAC / 60Hz	Relative Humidity:	45.9 %
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	978.6 mbar

Deviations, Additions, or Exclusions: None

10 Antenna Requirement

10.1 Test Limits

FCC Part 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

10.2 Test Results

The device was found to be **compliant**. The device has permanent antenna designed into the PCB.

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	12/17/2019	103979153LEX-001	BCT	BL	Original Issue