



Engineering Solutions & Electromagnetic Compatibility Services

**FCC Part 15.231 Test Data**

**EUT: 433.92 MHz Panel 56-0053-00 Rev G01**

**for**

**Resolution Engineering, Inc.  
1402 Heggen Street  
Hudson, WI 54016  
Contact: Jake Peterson**

**Testing Conducted By  
Rhein Tech Laboratories, Inc.  
360 Herndon Parkway, Suite 1400  
Herndon, VA 20170**

**RTL Test Engineer: Jon Wilson**

**RTL Project/Report Number: 2014154DXT**

**August 20, 2014**

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These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

## Testing Represented in Report

### 15.231

The data and limits presented in this report are for radiated emissions per 15.231(b)(2) which references 15.35(b), and peak limiting for restricted bands per 15.209(e), which again references 15.35(b)(2), as procured by Resolution Engineering. No average data is presented in this report. Data is also presented for spurious, non-harmonic radiated emissions per 15.209.

### 15.207

Unintentional digital emissions, mains conducted.

The Equipment Under Test (EUT) was the **433.92 MHz Panel 56-0053-00 Rev G01 (RTL Bar Code 21477) with AC Adapter (RTL Bar Code 21476)**.

### 15.231 Radiated Emissions Test Data – FCC Limits/ 3m Distance

#### Top Antenna

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
433.92	Peak	V	79.3	18.0	97.3	100.8	-3.5	Pass
867.84	Peak	H	55.0	-2.9	52.1	80.8	-28.7	Pass
1301.76	Peak	H	39.9	2.9	42.8	74.0	-31.2	Pass
1735.69	Peak	H	45.2	5.3	50.5	80.8	-30.3	Pass
2169.59	Peak	H	49.0	-10.7	38.3	80.8	-42.5	Pass
2603.51	Peak	V	53.0	-8.7	44.3	80.8	-36.5	Pass
3037.43	Peak	V	60.3	-8.7	51.6	80.8	-29.2	Pass
3471.35	Peak	H	48.2	-7.4	40.8	80.8	-40.0	Pass
3905.27	Peak	H	53.8	-6.0	47.8	74.0	-26.2	Pass
4339.19	Peak	V	42.9	-0.4	42.5	74.0	-31.5	Pass

#### Side Antenna

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
433.92	Peak	H	80.2	18.0	98.2	100.8	-2.6	Pass
867.84	Peak	V	50.6	-2.9	47.7	80.8	-33.1	Pass
1301.76	Peak	H	38.8	2.9	41.7	74.0	-32.3	Pass
1735.69	Peak	H	42.8	5.3	48.1	80.8	-32.7	Pass
2169.59	Peak	V	50.3	-10.7	39.6	80.8	-41.2	Pass
2603.51	Peak	H	54.3	-8.7	45.6	80.8	-35.2	Pass
3037.43	Peak	H	60.1	-8.7	51.4	80.8	-29.4	Pass
3471.35	Peak	V	48.0	-7.4	40.6	80.8	-40.2	Pass
3905.27	Peak	H	53.3	-6.0	47.3	74.0	-26.7	Pass
4339.19	Peak	H	44.9	-0.4	44.5	74.0	-29.5	Pass

### Non-Harmonic Spurious Emissions

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
78.55	QP	V	54.7	-20.1	34.6	40.0	-5.4	Pass
88.80	QP	H	43.4	-18.9	24.5	43.5	-19.0	Pass
108.00	QP	V	42.6	-16.6	26.0	43.5	-17.5	Pass
153.52	QP	V	50.7	-18.2	32.5	43.5	-11.0	Pass
216.97	QP	H	56.4	-14.5	41.9	60.8	-18.9	Pass
277.11	QP	H	36.2	-13.0	23.2	46.0	-22.8	Pass
325.44	QP	H	47.0	-11.9	35.1	46.0	-10.9	Pass

### Test Procedure

Radiated fundamental and spurious emissions were tested at three meters. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities. The emissions were maximized per ANSI C63.4:2003 8.3.1.2; that is, the measurement antenna height was varied between 1 and 4 m, and the EUT was rotated through 360° on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 100 kHz was used for frequencies less than 1000 MHz, and a resolution bandwidth of 1 MHz was used for frequencies greater than or equal to 1000 MHz. The video bandwidth was set to a value at least three times greater than the resolution bandwidth.

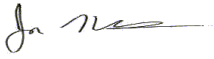
### EUT Disposition

The EUT was adapted to continuously transmit for testing purposes.

### Radiated Emissions Test Equipment

Part	Manufacturer	Model	Serial Number	RTL Bar Code	Calibration Due Date
Amplifier (20 MHz-2 GHz)	Rhein Tech Laboratories, Inc.	PR-1040	900905	900905	9/4/14
Spectrum Analyzer (10 Hz-26.5 GHz)	Agilent	EXA N9010	MY51250846	901583	4/16/15
Bilog Periodic Antenna (25 MHz-2000 MHz)	ARA	LPB-2520	1037	900724	4/19/15
Amplifier (1 GHz-26.5 GHz)	Hewlett Packard	8449B OPT H02	3008A00505	900932	8/27/2014
Horn Antenna (2.0-4.0 GHz)	EMCO	3161-02	9804-1044	900772	4/20/15
Horn Antenna (4.0-8.0 GHz)	EMCO	3161-03	9508-1020	900321	4/20/17
Emissions Testing Software	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Rev. 14.0.2	N/A	N/A

### Test Personnel:

Jon Wilson		August 18, 2014
Test Engineer	Signature	Date of Test

Rhein Tech Laboratories, Inc.  
360 Herndon Parkway, Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

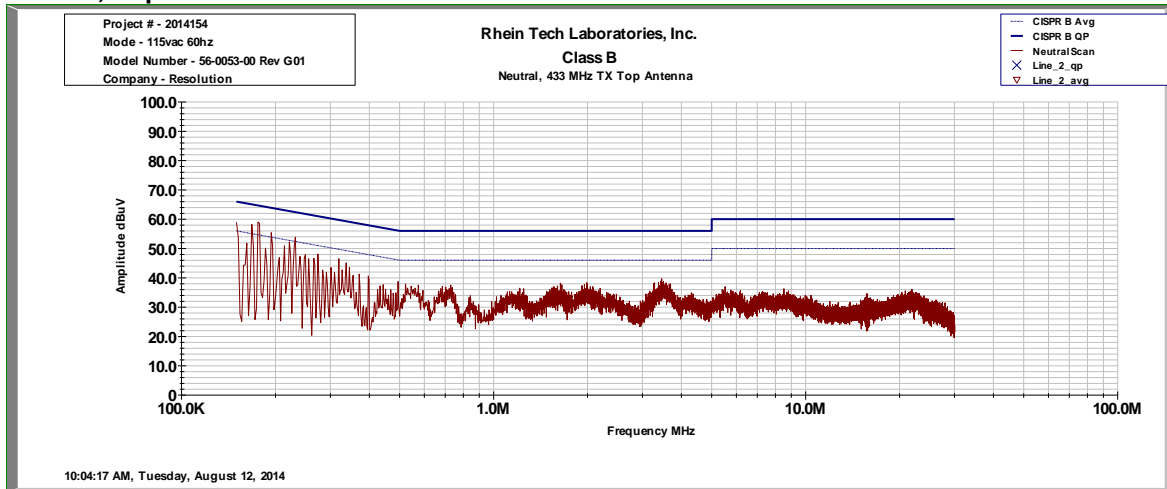
Client: Resolution Engineering  
EUT: 433.92 MHz Panel 56-0053-00 Rev G01  
Standards: FCC Parts 2, 15  
Report #: 2014154DXT

**FCC/IC Cross Reference**

FCC 15.231(b)(2)	RSS-210 Issue 8 A1.1
FCC 15.35(b)	RSS-Gen Issue 3 7.2.3
FCC 15.205	RSS-Gen Issue 3 7.2.2
FCC 15.209	RSS-Gen Issue 3 7.2.5

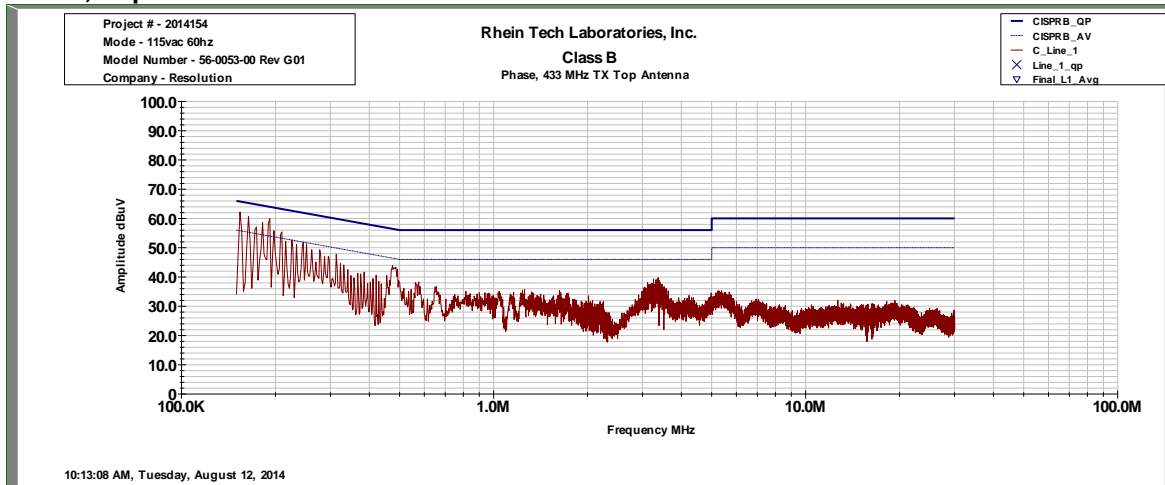
### 15.207 Conducted Line Emissions Test Data – FCC Limits

#### Neutral, Top Antenna Active



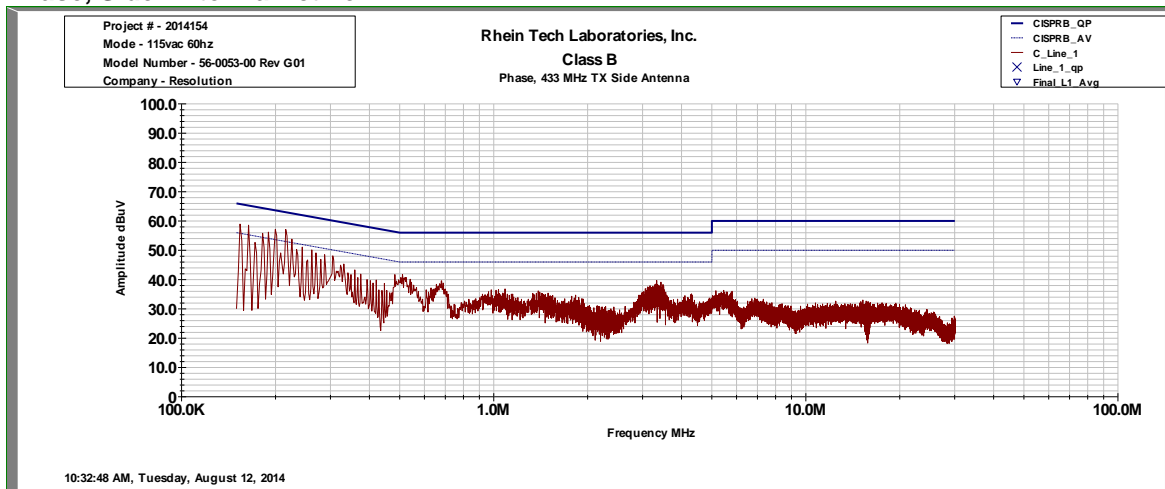
Frequency (MHz)	Detector	Level (dB $\mu$ V)	Site Correction Factor (dB)	Corrected Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Pass/Fail
0.151	QP	49.0	0.4	49.4	65.9	-16.5	Pass
0.151	Av	32.5	0.4	32.9	55.9	-23.0	Pass
0.176	QP	49.8	0.4	50.2	64.7	-14.5	Pass
0.176	Av	35.9	0.4	36.3	54.7	-18.4	Pass
0.232	QP	49.2	0.4	49.6	62.4	-12.8	Pass
0.232	Av	34.5	0.4	34.9	52.4	-17.5	Pass

### Phase, Top Antenna Active



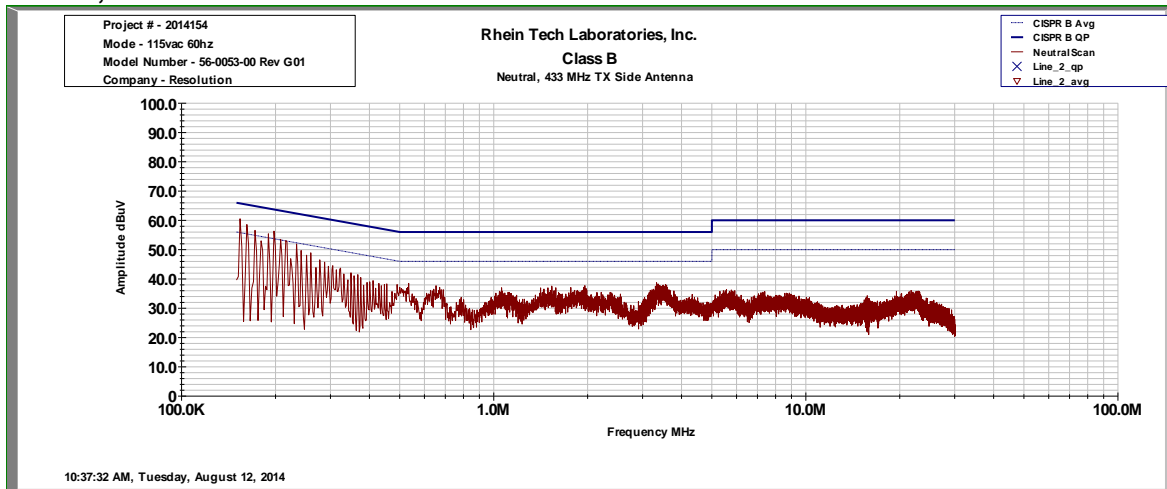
Frequency (MHz)	Detector	Level (dB $\mu$ V)	Site Correction Factor (dB)	Corrected Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Pass/Fail
0.223	QP	52.5	0.4	52.9	62.7	-9.8	Pass
0.223	Av	42.6	0.4	43.0	52.7	-9.7	Pass
0.154	QP	50.7	0.4	51.1	65.8	-14.7	Pass
0.154	Av	34.6	0.4	35.0	55.8	-20.8	Pass
0.243	QP	44.5	0.4	44.9	62.0	-17.1	Pass
0.243	Av	32.6	0.4	33.0	52.0	-19.0	Pass

### Phase, Side Antenna Active



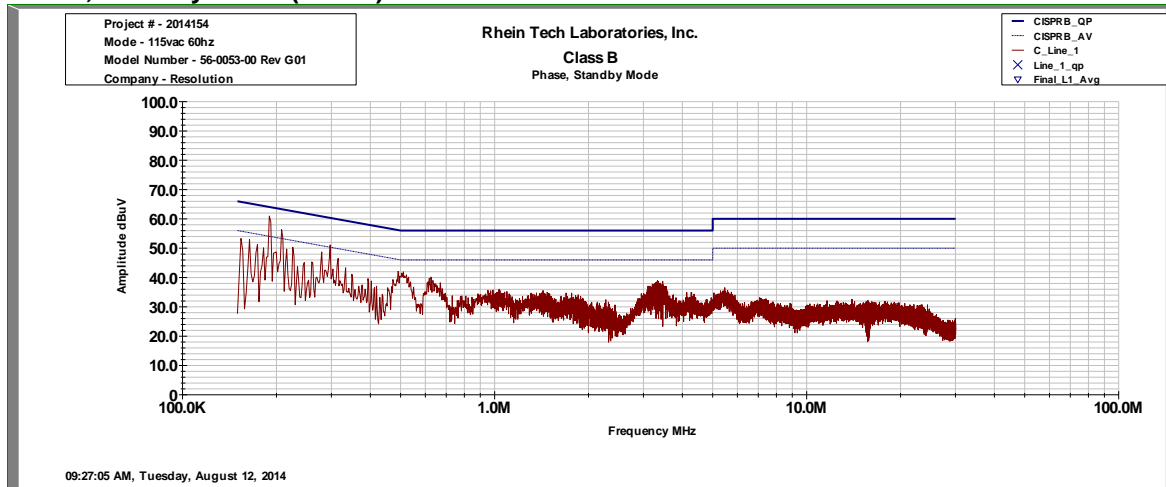
Frequency (MHz)	Detector	Level (dB $\mu$ V)	Site Correction Factor (dB)	Corrected Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Pass/Fail
0.154	QP	51.2	0.4	51.6	65.8	-14.2	Pass
0.154	Av	34.8	0.4	35.2	55.8	-20.6	Pass
0.227	QP	49.9	0.4	50.3	62.6	-12.3	Pass
0.227	Av	42.4	0.4	42.8	52.6	-9.8	Pass

**Neutral, Side Antenna Active**



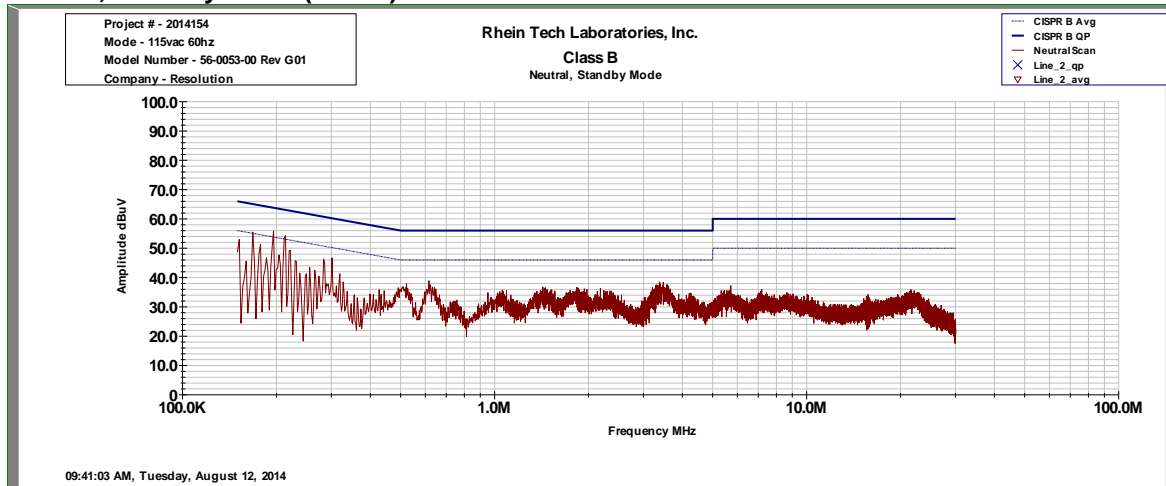
Frequency (MHz)	Detector	Level (dBµV)	Site Correction Factor (dB)	Corrected Level (dBµV)	Limit (dBµV)	Margin (dB)	Pass/Fail
0.154	QP	49.0	0.4	49.4	65.8	-16.4	Pass
0.154	Av	33.2	0.4	33.6	55.8	-22.2	Pass
0.227	QP	44.1	0.4	44.5	62.6	-18.1	Pass
0.227	Av	37.4	0.4	37.8	52.6	-14.8	Pass

### Phase, Standby Mode (No TX)



Frequency (MHz)	Detector	Level (dBµV)	Site Correction Factor (dB)	Corrected Level (dBµV)	Limit (dBµV)	Margin (dB)	Pass/Fail
0.202	QP	52.6	0.4	53.0	63.5	-10.5	Pass
0.202	Av	44.2	0.4	44.6	53.5	-8.9	Pass
0.311	QP	43.4	0.4	43.8	59.9	-16.1	Pass
0.311	Av	37.5	0.4	37.9	49.9	-12.0	Pass

### Neutral, Standby Mode (No TX)



Frequency (MHz)	Detector	Level (dBµV)	Site Correction Factor (dB)	Corrected Level (dBµV)	Limit (dBµV)	Margin (dB)	Pass/Fail
0.204	QP	52.0	0.4	52.4	63.4	-11.0	Pass
0.204	Av	38.3	0.4	38.7	53.4	-14.7	Pass
0.168	QP	45.6	0.4	46.0	65.1	-19.1	Pass
0.168	Av	30.0	0.4	30.4	55.1	-24.7	Pass

**Result: Pass**



**Test Procedure**

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was placed on a wooden table. Power was fed to the EUT through a 50-ohm/50 microhenry LISN. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB resolution bandwidth was set to 9 kHz. The video bandwidth was set to a value at least three times greater than the resolution bandwidth. Average measurements are performed in linear mode using a 9 kHz resolution bandwidth and a 1 Hz video bandwidth. The frequency spectrum was scanned from 150 kHz to 30 MHz.


**EUT Disposition**

The EUT was adapted to continuously transmit for testing purposes.

**Conducted Line Emissions Test Equipment**

Part Type	Manufacturer	Model	Serial Number	Barcode	Cal Due Date
<b>Conducted Emissions</b>					
Spectrum Analyzer (100 Hz – 22 GHz)	Hewlett Packard	8566B	3138A07771	900930	4/21/2016
Spectrum Analyzer Display Section	Hewlett Packard	85662A	3144A20839	900931	4/21/2016
Quasi-Peak Adapter	Hewlett Packard	85650A	2412A00414	900969	4/21/2016
Filter	Solar	8130	947306	900729	3/26/2015
16A LISN	AFJ International	LS16/110VAC	16010020080	901083	8/27/2014
Test software	Quantum Change	Tile!	4.0.A.8	N/A	N/A

**Test Personnel:**

Jon Wilson		August 12, 2014
Test Engineer	Signature	Date Of Test

## Test Configuration Photographs

### Radiated Emissions



### Conducted Emissions



### EUT Photograph

