

TEST REPORT ADDENDUM – Part 15B & ICES-003

FROM



Test of: Radwin Ltd. Outdoor Subscriber Radio Unit

To: FCC CFR 47 Part 15B; ICES-003 Issue 6: 2016

Test Report Serial No.: RDWN41-U5 Rev A

Issue Date: 13th July 2016

Master Document Number	Addendum Reports
RDWN41 – U5 _Master	RDWN41 – U5 _Conducted
	RDWN41 – U5 _Radiated
	RDWN41-U5 (FCC Part15B & ICES-003)



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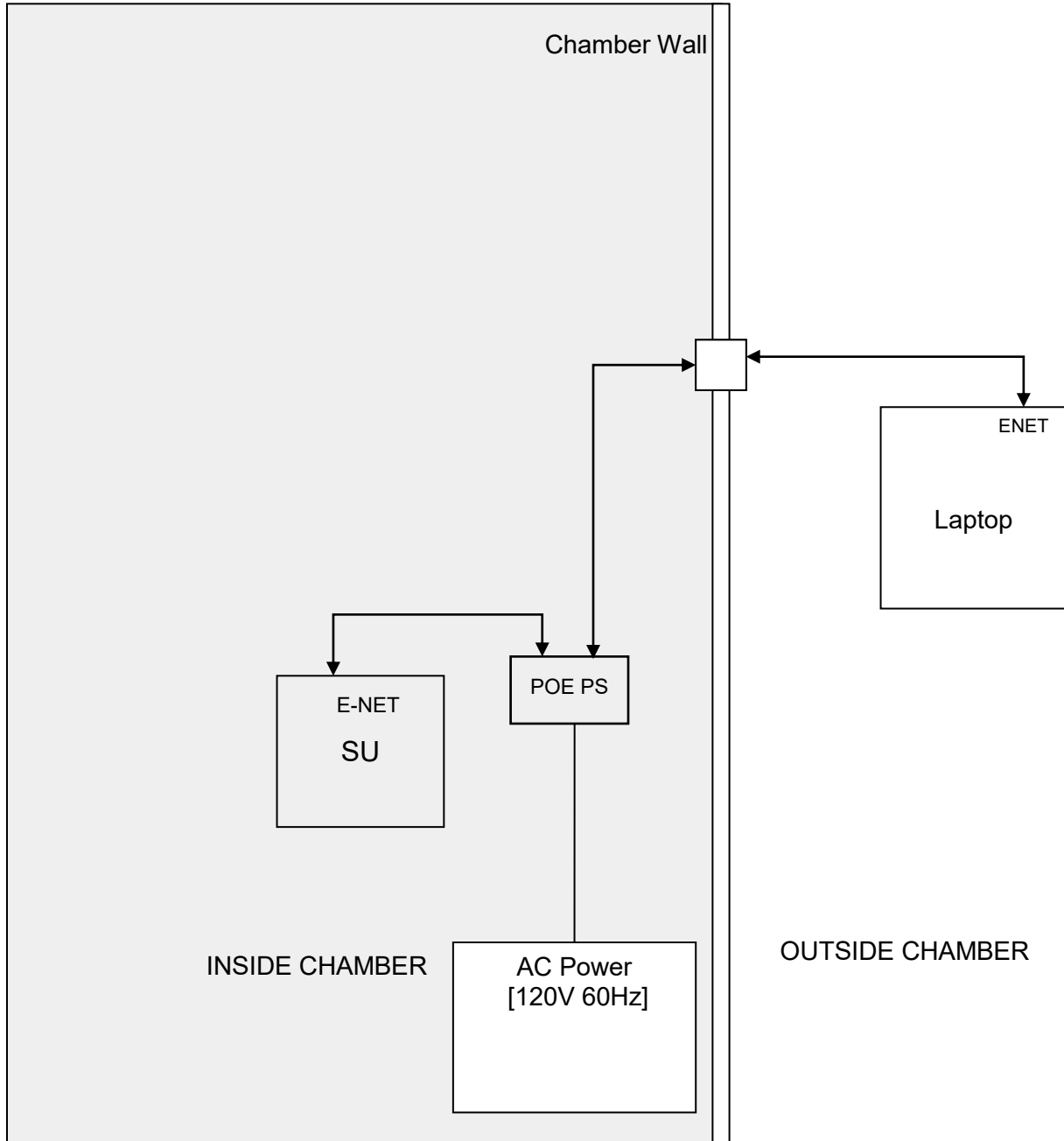
1. EUT Configurations

1.1. EUT Configuration - Radiated Emissions:

The EUT setup consist of one configuration: POE. Data was streamed between laptop outside the chamber

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Diagram of EUT Configuration for Emissions Measurements



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1.2. Equipment Modifications

No modifications were required to bring the equipment into compliance:

1.3. Deviations from the Test Standard

No deviations from the test standard were required in order to complete the test program:

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2. TEST RESULTS

2.1. EMC EMISSIONS TEST RESULTS

2.1.1. Radiated Emissions

Test Procedure

Testing 30 – 6,000 MHz was performed in an anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Only the highest emissions relative to the limit are listed.

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Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
FO = Distance Falloff Factor

$$CORR = \text{Correction Factor} = CL - AG + NFL$$

CL = Cable Loss
AG = Amplifier Gain
NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation Example:

Given receiver input reading of 51.5 dB μ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu\text{V/m}))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

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Limits

FCC Spurious Emissions Limits

Limits below 1 GHz:

Class A limits

Frequency(MHz)	Quasi-peak Limit (dB μ V/m)	Measurement Distance (meters)	Quasi-peak Limit (dB μ V/m)	Measurement Distance (meters)
30 to 88	40	10	49.5	3
88-216	43.5	10	54	3
216-960	46.4	10	56.5	3
960-1000	49.5	10	60	3

Class B limits

Frequency(MHz)	Quasi-peak Limit (dB μ V/m)	Measurement Distance (meters)	Quasi-peak Limit (dB μ V/m)	Measurement Distance (meters)
30 to 88	29.5	10	40	3
88-216	33	10	43.5	3
216-960	35.6	10	46	3
960-1000	43.5	10	54	3

Limits above 1GHz:

Frequency(MHz)	Average Limit (dB μ V/m)	Peak Limit (dB μ V/m)	Measurement Distance (meters)	Class (A/B)
1 000 to 6000	54	74	3	Class B

Frequency(MHz)	Average Limit (dB μ V/m)	Peak Limit (dB μ V/m)	Measurement Distance (meters)	Class (A/B)
1 000 to 6000	60	80	3	Class A

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2.1.1.1. Measurement Results: 30-1000MHz

Model:	SU Pro, SU Air	Configuration tested:	POE PS
Input power:	120V/60Hz	Standard:	FCC

RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS



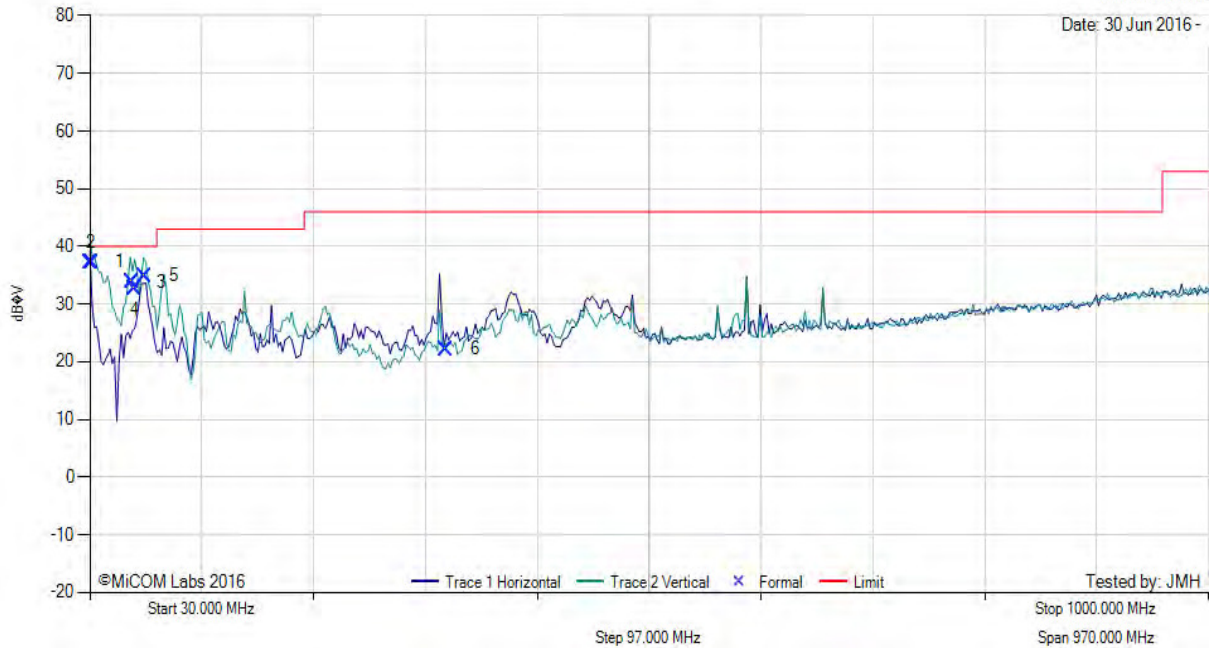
Variant: NA, Test Freq: 0.00 MHz, Antenna: 50 Ohm Term, Power Setting: NA, Duty Cycle (%): NA

Measurement Distance: 3m

Sweep Time: 170 ms

RBW: 120 KHz
VBW: 300 KHz

Date: 30 Jun 2016 -



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	PoI	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	30.16	43.56	3.42	-9.72	37.26	MaxQP	Vertical	101	90	40.0	-2.7	Pass
2	31.22	44.33	3.43	-10.61	37.15	MaxQP	Vertical	103	82	40.0	-2.9	Pass
3	66.34	53.62	3.68	-23.51	33.79	MaxQP	Vertical	100	14	40.0	-6.2	Pass
4	69.30	52.08	3.70	-23.19	32.59	MaxQP	Vertical	109	47	40.0	-7.4	Pass
5	77.56	54.47	3.76	-23.37	34.86	MaxQP	Vertical	117	265	40.0	-5.1	Pass
6	338.99	33.59	4.82	-16.20	22.21	MaxQP	Horizontal	100	111	46.0	-23.8	Pass

Test Notes: EUT on table power by POE PS. Ports Term with 50 ohms

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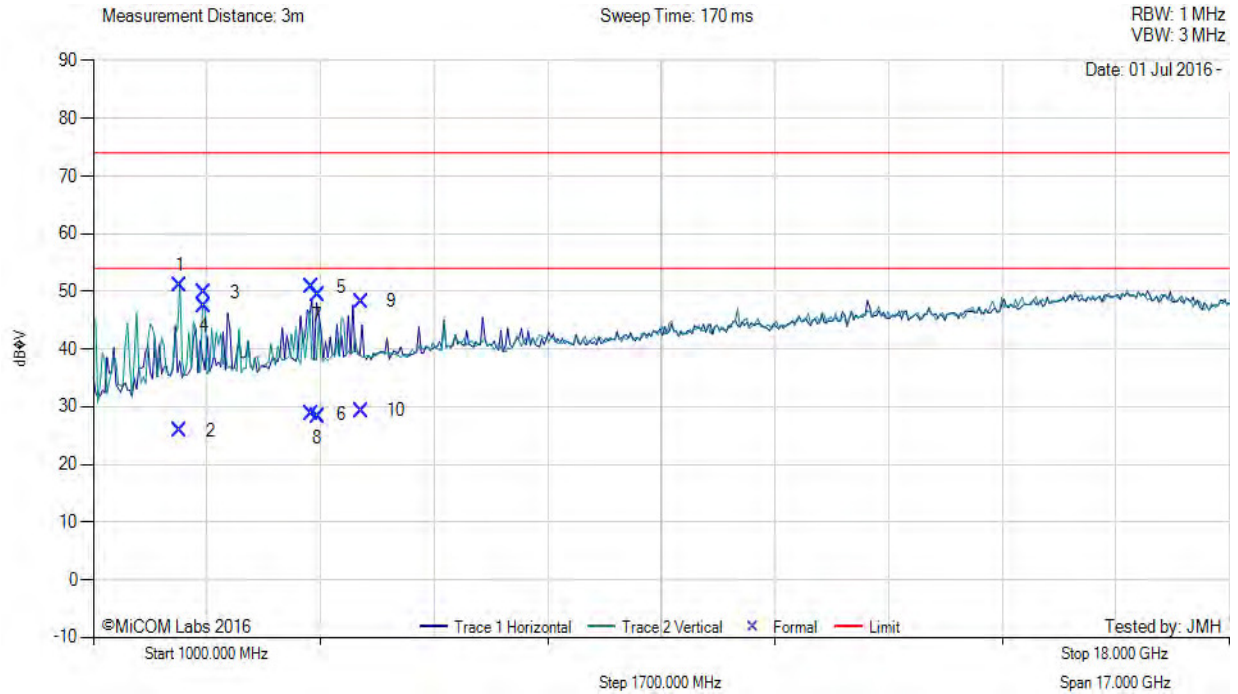
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Measurement Results: 1000-18000 MHz

Model:	SU Pro, SU Air	Configuration tested:	POE PS
Input power:	120V/60Hz	Standard:	FCC/ICES003



Variant: Dig Em, Test Freq: 0.00 MHz, Antenna: 50 Ohm Term, Power Setting: NA, Duty Cycle (%): 99



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	2299.74	60.51	2.67	-12.19	50.99	Max Peak	Vertical	141	335	74.0	-23.0	Pass
2	2299.74	35.32	2.67	-12.19	25.80	Max Avg	Vertical	141	335	54.0	-28.2	Pass
3	2663.99	58.28	2.79	-11.31	49.76	Max Peak	Vertical	107	303	74.0	-24.2	Pass
4	2663.99	56.01	2.79	-11.31	47.49	Max Avg	Vertical	107	303	54.0	-6.5	Pass
5	4257.69	58.71	3.41	-11.40	50.72	Max Peak	Horizontal	100	266	74.0	-23.3	Pass
6	4257.69	36.67	3.41	-11.40	28.68	Max Avg	Horizontal	100	266	54.0	-25.3	Pass
7	4354.28	57.49	3.41	-11.50	49.40	Max Peak	Horizontal	193	273	74.0	-24.6	Pass
8	4354.28	36.31	3.41	-11.50	28.22	Max Avg	Horizontal	193	273	54.0	-25.8	Pass
9	5005.17	56.13	3.63	-11.55	48.21	Max Peak	Horizontal	169	272	74.0	-25.8	Pass
10	5005.17	37.26	3.63	-11.55	29.34	Max Avg	Horizontal	169	272	54.0	-24.7	Pass

Test Notes: EUT on 150 cm table powered by 24V POE, EUT had up to 3GHz clock

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2.1.2. AC Mains Power Input/Output Ports

Scope

This test assesses the ability of the EUT to limit its internal noise from being present on the AC mains power input/output ports.

Test Method

The test method shall be in accordance with CISPR 22 and the Artificial Mains Networks (AMNs) shall be connected to the AC mains power source.

The measurement frequency range extends from 150 kHz to 30 MHz. When the EUT is a transmitter operating at frequencies below 30 MHz, then the exclusion band for transmitters applies for measurements in the transmit mode of operation.

Test Procedure

The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

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Limits

The equipment shall meet the class B limits given in CISPR 22. Alternatively, for equipment intended to be used in telecommunication centres only, the class A limits given in CISPR 22 may be used.

Class B Emissions

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Class A Emissions

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

Traceability

All conducted emission measurements are traceable to national standards. The uncertainty of measurement at a confidence level of not less than 95 %, with a coverage factor of k=2, in the range 9 kHz – 30 MHz (Average & Quasi-peak) is ± 2.64 dB.

Laboratory Measurement Uncertainty	
Measurement uncertainty	± 2.64 dB

Method
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'

Test Summary

EUT performed in Compliance with FCC Part 15B/ICES003 performance limits.

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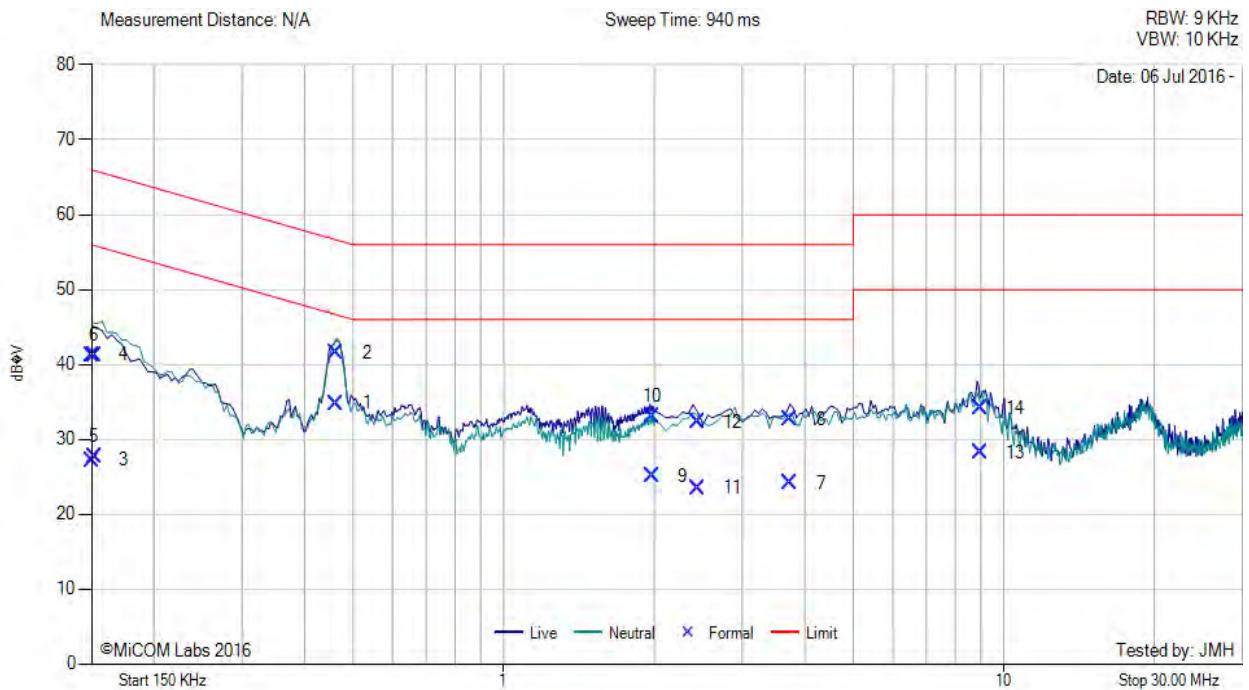
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2.1.2.1. Measurement Results

Model Number	SU Pro, SU Air	Engineer	JMH
Variant	AC Wireline 110VAC, 60Hz	Temp (°C)	21
Freq. Range	0.150 MHz - 30 MHz	Rel. Hum.(%)	38
Power Setting	NA	Press. (mBars)	1002
Antenna	N/A		
Test Notes 1	POE PS G0720-240-100		
Test Notes 2	Class B Limits FCC 110VAC, 60Hz		



Variant: , Test Freq: 0.00 MHz



Num	Frequency MHz	Raw dBµV	Cable Loss	Factor dB	Total Correction dBµV	Corrected Value dBµV	Measurement Type	Line	Limit dBµV	Margin dB	Pass /Fail
1	0.463	24.78	0.07	9.93	10.00	34.78	Max Avg	Neutral	47.1	-12.3	Pass
2	0.463	31.61	0.07	9.93	10.00	41.61	Max Qp	Neutral	57.1	-15.5	Pass
3	0.151	17.23	0.05	9.92	9.97	27.20	Max Avg	Neutral	56.0	-28.8	Pass
4	0.151	31.30	0.05	9.92	9.97	41.27	Max Qp	Neutral	66.0	-24.7	Pass
5	0.152	17.66	0.05	9.92	9.97	27.63	Max Avg	Live	55.9	-28.3	Pass
6	0.152	31.16	0.05	9.92	9.97	41.13	Max Qp	Live	65.9	-24.8	Pass
7	3.741	13.94	0.23	10.04	10.27	24.21	Max Avg	Live	46.0	-21.8	Pass
8	3.741	22.36	0.23	10.04	10.27	32.63	Max Qp	Live	56.0	-23.4	Pass
9	1.979	14.92	0.19	9.97	10.16	25.08	Max Avg	Live	46.0	-20.9	Pass
10	1.979	22.86	0.19	9.97	10.16	33.02	Max Qp	Live	56.0	-23.0	Pass
11	2.439	13.33	0.21	9.99	10.20	23.53	Max Avg	Live	46.0	-22.5	Pass
12	2.439	22.15	0.21	9.99	10.20	32.35	Max Qp	Live	56.0	-23.7	Pass
13	8.979	17.55	0.44	10.20	10.64	28.19	Max Avg	Live	50.0	-21.8	Pass
14	8.979	23.53	0.44	10.20	10.64	34.17	Max Qp	Live	60.0	-25.8	Pass

Test Notes: EUT powered by POE PS G0720-240-100, 120V 60 Hz

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