EFFICIENCY AND NOISE LEVEL CERTIFICATIONS

Anex

be quiet! Pure Power 11 FM 1000W

Lab ID#: BQ10001987
Receipt Date: Feb 10, 2022
Test Date: Mar 9, 2022

Report: 22PS1987A
Report Date: Mar 9, 2022

DUT INFORMATION

Brand	be quiet!
Manufacturer (OEM)	HEC
Series	Pure Power 11 FM
Model Number	L11-FM-1000W
Serial Number	325H1480009912
DUT Notes	

DUT SPECIFICATIONS

Rated Voltage (Vrms)	100-240
Rated Current (Arms)	50-60
Rated Frequency (Hz)	12-6
Rated Power (W)	1000
Type	ATX12V
Cooling	120mm Rifle Bearing Fan (BQ QF2-12025-HS)
Semi-Passive Operation	✗
Cable Design	Fully Modular

TEST EQUIPMENT

Electronic Loads	Chroma 63601-5 x4 Chroma 63600-2 x2 63640-80-80 x20 63610-80-20 x2
AC Sources	Chroma 6530, Keysight AC6804B
Power Analyzers	N4L PPA1530 x2, R&S HMC8015
Sound Analyzer	Bruel & Kjaer 2270 G4
Microphone	Bruel & Kjaer Type 4955-A
Data Loggers	Picoscope TC-08 x2, Labjack U3-HV x2
Tachometer	UNI-T UT372 x2
Digital Multimeter	Keysight U1273AX, Fluke 289, Keithley 2015 - THD
UPS	CyberPower OLS3000E 3kVA x2
Transformer	3kVA x2

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RESULTS

Temperature Range (°C /°F)	30-32 / 86-89.6
ErP Lot 3/6 Ready	✓
(EU) No 617/2013 Compliance	✓

115V

Average Efficiency	88.846%
Efficiency With 10W (≤500W) or 2% (>500W)	74.828
Average Efficiency 5VSB	81.001%
Standby Power Consumption (W)	0.0633000
Average PF	0.977
Avg Noise Output	30.99 dB(A)
Efficiency Rating (ETA)	GOLD
Noise Rating (LAMBDA)	Standard++

230V

Average Efficiency	91.050%
Average Efficiency 5VSB	79.958%
Standby Power Consumption (W)	0.1171000
Average PF	0.940
Avg Noise Output	30.90 dB(A)
Efficiency Rating (ETA)	PLATINUM
Noise Rating (LAMBDA)	Standard++

POWER SPECIFICATIONS

Rail		3.3V	5V	12V(1)	12V(2)	5VSB	-12V
Max. Power	Amps	22	22	46	42	3	0.3
	Watts	120		999.6		15	3.6
Total Max. Power (W)		1000					

HOLD-UP TIME & POWER OK SIGNAL (230V)

Hold-Up Time (ms)	18.9
AC Loss to PWR_OK Hold Up Time (ms)	15.9
PWR_OK Inactive to DC Loss Delay (ms)	3

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CABLES AND CONNECTORS

Modular Cables

Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (550mm)	1	1	16-22AWG	No
4+4 pin EPS12V (600mm)	1	1	18AWG	No
8 pin EPS12V (600mm)	1	1	18AWG	No
6+2 pin PCIe (500mm+150mm)	2	4	16-18AWG	No
2x 6+2 pin PCIe (500mm)	1	2	16AWG	No
SATA (500mm+150mm+150mm+150mm)	2	8	18AWG	No
SATA (500mm+150mm) / 4-pin Molex (+150mm+150mm) / FDD (+150mm)	1	2 / 2 / 1	18-20AWG	No
AC Power Cord (1360mm) - C13 coupler	1	1	18AWG	-

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General Data	-
Manufacturer (OEM)	HEC
PCB Type	Double Sided
Primary Side	-
Transient Filter	4x Y caps, 3x X caps, 2x CM chokes, 1x MOV, 1x Power Integrations CAP200G (Discharge IC)
Inrush Protection	NTC Thermistor SCK-056 (5 Ohm) & Relay
Bridge Rectifier(s)	2x GBU15JL (600V, 15A @ 115°C)
APFC MOSFETs	3x Infineon IPA60R120P7 (600V, 16A @ 100°C, Rds(on): 0.12Ohm)
APFC Boost Diode	1x CREE C6D10065A (650V, 10A @ 155°C)
Bulk Cap(s)	2x Teapo (400V, 470uF each or 940uF, 2,000h @ 105°C, LG)
Main Switchers	2x On Semiconductor NTPF110N65S3HF (650V, 19.5A @ 100°C, Rds(on): 0.11Ohm)
APFC Controller	Champion CM6500UNX & CM03AX
Resonant Controller	Champion CM6901T6X
Topology	Primary side: APFC, Half-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	-
+12V MOSFETs	6x Nexperia PSMN1R0-40YLD (40V, 198A @ 100°C, Rds(on): 1.1mOhm)
5V & 3.3V	DC-DC Converters
Filtering Capacitors	Electrolytic: 14x Teapo (1-3,000 @ 105°C, SC), 1x Elite (105°C, EM) Polymer: 6x Teapo, 6x Elite, 16x no info
Supervisor IC	Weltrend WT7527RT (OCP, OVP, UVP, SCP, PG)
Fan Model	be quiet! BQ QF2-12025-HS (120mm, 12V, 0.30A, Rifle Bearing Fan)
5VSB Circuit	-
Rectifier	1x SECOS SMPD1060L SBR (60V, 10A)
Standby PWM Controller	Excelliance MOS EM8569D

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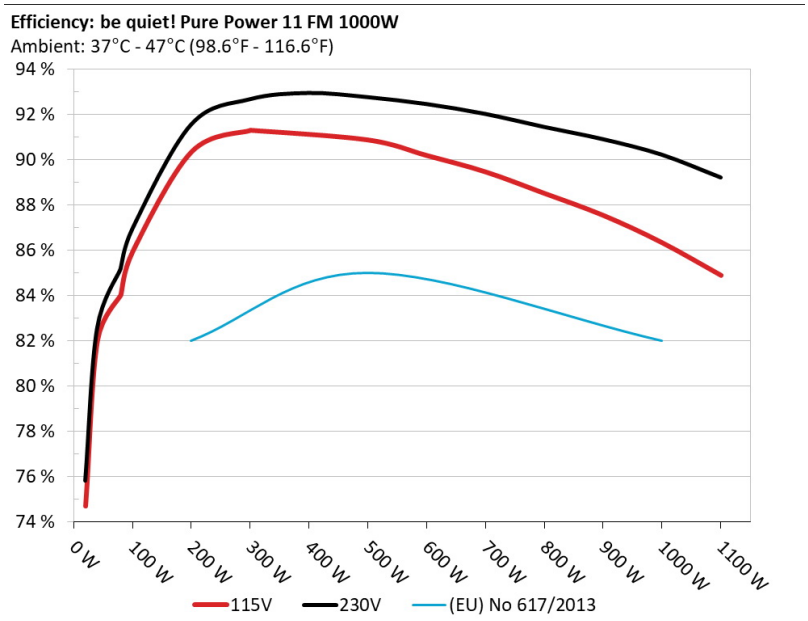
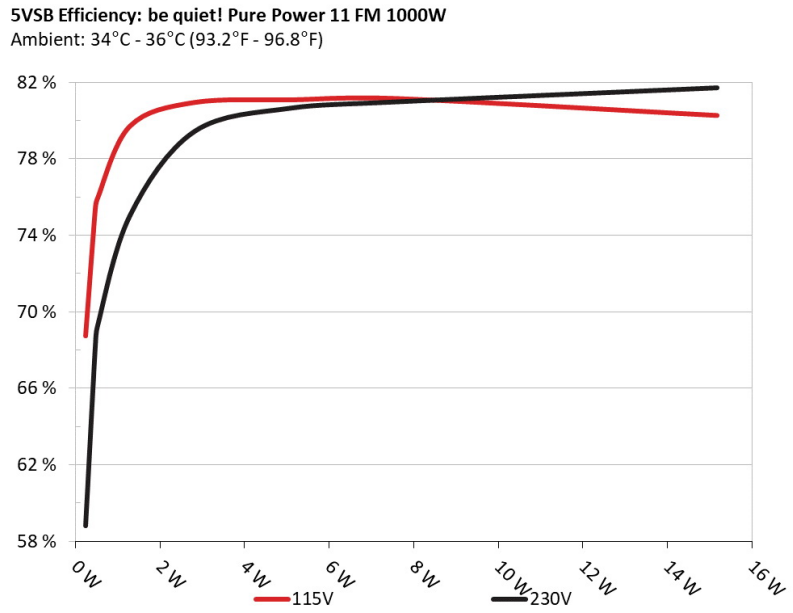
EFFICIENCY UNDER HIGH AMBIENT TEMPERATURE



INFO

The PSU`s efficiency under high ambient temperatures with 115V and 230V input. For this graph the results of the 10-110% load regulation table are used

5VSB EFFICIENCY



INFO

This graph depicts the efficiency levels of the 5VSB rail with 115V and 230V input

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5VSB EFFICIENCY -115V (ERP LOT 3/6 & CEC)

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.23W	68.72%	0.027
	5.112V	0.335W		115.14V
2	0.09A	0.46W	75.412%	0.05
	5.11V	0.61W		115.14V
3	0.55A	2.806W	80.954%	0.233
	5.101V	3.464W		115.13V
4	1A	5.093W	81.09%	0.335
	5.092V	6.28W		115.12V
5	1.5A	7.625W	81.153%	0.391
	5.083V	9.397W		115.12V
6	3A	15.163W	80.273%	0.465
	5.054V	18.889W		115.12V

5VSB EFFICIENCY -230V (ERP LOT 3/6 & CEC)

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.23W	58.824%	0.01
	5.111V	0.392W		230.37V
2	0.09A	0.46W	68.244%	0.017
	5.11V	0.675W		230.37V
3	0.55A	2.806W	79.42%	0.084
	5.101V	3.533W		230.36V
4	1A	5.093W	80.64%	0.143
	5.092V	6.314W		230.36V
5	1.5A	7.625W	80.968%	0.197
	5.082V	9.417W		230.36V
6	3A	15.162W	81.698%	0.301
	5.053V	18.556W		230.36V

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115V

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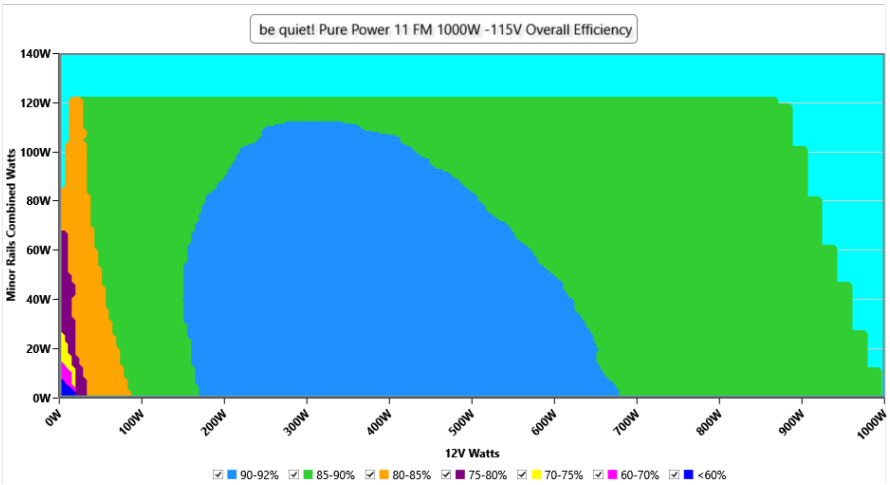
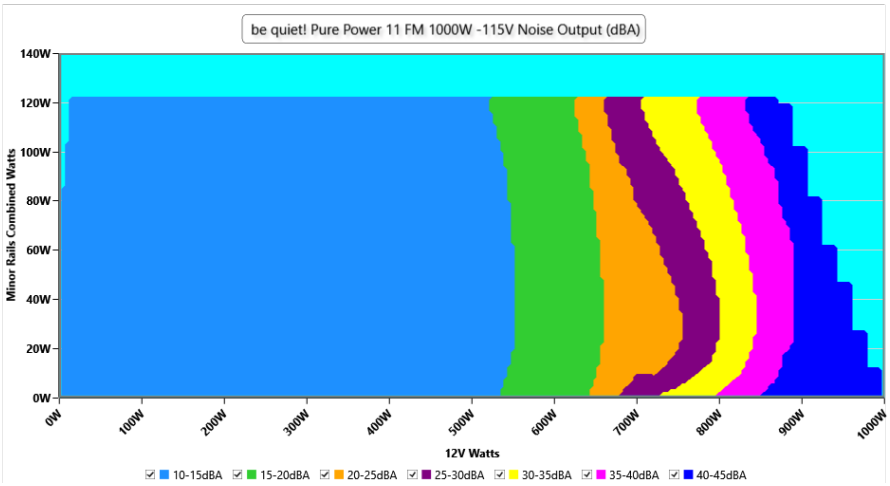
EFFICIENCY GRAPH 115V



INFO

This graph depicts the PSU's efficiency throughout its entire operational range. For the generation of the efficiency and noise graphs we set our loaders to auto mode through our custom-made software before trying thousands of possible load combinations

NOISE GRAPH 115V



INFO

The PSU's noise in its entire operational range and under 30-32 °C ambient is depicted in this graph. The X axis represents the load on the +12V rail(s) while the Y axis is the load on the minor rails

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VAMPIRE POWER -115V

Detailed Results

	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	115.14 V	115.14 V	113.85 V	115.17 V	116.15 V	PASS
Mains Frequency:	60.00 Hz	60.00 Hz	59.40 Hz	60.01 Hz	60.60 Hz	PASS
Mains Voltage CF:	1.415	1.415	1.340	1.416	1.490	PASS
Mains Voltage THD:	0.13 %	0.11 %	N/A	0.15 %	2.00 %	PASS
Real Power:	0.063 W	0.057 W	N/A	0.068 W	N/A	N/A
Apparent Power:	12.150 W	12.148 W	N/A	12.154 W	N/A	N/A
Power Factor:	0.005	N/A	N/A	N/A	N/A	N/A

INFO

This graph is generated by the PPA Standby Power Analysis software which takes full control of the power analyzer during the whole procedure. This application features all of the EN50564 & IEC62301 test limits for standby power software testing

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10-110% LOAD TESTS 115V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
10%	6.488A	2A	2.008A	0.982A	100.01	85.933%	707	11.1	40.75°C	0.952
	12.084V	5V	3.287V	5.095V	116.38				44.77°C	115.11V
20%	14.032A	3.003A	3.014A	1.181A	199.965	90.34%	706	11.1	40.85°C	0.969
	12.048V	4.997V	3.285V	5.082V	221.353				45.24°C	115.09V
30%	21.932A	3.505A	3.517A	1.381A	300.018	91.291%	707	11.1	41.68°C	0.97
	12.036V	4.994V	3.284V	5.07V	328.639				46.47°C	115.06V
40%	29.819A	4.008A	4.022A	1.582A	399.719	91.298%	708	11.2	42.13°C	0.975
	12.023V	4.991V	3.282V	5.059V	437.815				47.14°C	115.03V
50%	37.379A	5.014A	5.031A	1.784A	499.381	90.87%	708	11.2	42.26°C	0.98
	12.009V	4.987V	3.28V	5.047V	549.557				47.82°C	115V
60%	45.025A	6.021A	6.041A	1.986A	599.921	90.182%	763	13.6	43.31°C	0.984
	11.996V	4.984V	3.278V	5.036V	665.233				49.65°C	114.97V
70%	52.622A	7.029A	7.051A	2.19A	699.66	89.459%	951	21.1	43.71°C	0.988
	11.983V	4.981V	3.276V	5.024V	782.099				50.81°C	114.94V
80%	60.307A	8.002A	8.061A	2.294A	799.527	88.511%	1589	36.1	43.94°C	0.99
	11.968V	4.978V	3.275V	5.014V	903.313				51.98°C	114.92V
90%	68.349A	8.544A	8.555A	2.398A	899.519	87.542%	1854	40.4	44.81°C	0.992
	11.954V	4.974V	3.273V	5.004V	1027.525				54.11°C	114.89V
100%	76.209A	9.052A	9.078A	3.01A	999.533	86.337%	1847	40.3	45.25°C	0.993
	11.939V	4.972V	3.271V	4.985V	1157.718				55.53°C	114.86V
110%	84.039A	10.063A	10.183A	3.015A	1100.151	84.887%	1845	40.3	46.73°C	0.994
	11.921V	4.968V	3.27V	4.976V	1296.045				58.1°C	114.82V
CL1	0.116A	14.459A	14.539A	0A	121.29	83.001%	794	14.9	41.11°C	0.962
	12.082V	4.993V	3.28V	5.094V	146.132				46.35°C	115.1V
CL2	0.115A	22.005A	0A	0A	111.391	81.608%	724	11.7	40.92°C	0.955
	12.086V	4.999V	3.284V	5.105V	136.496				47.94°C	115.1V
CL3	0.115A	0A	22.084A	0A	73.985	75.621%	713	11.4	41.25°C	0.959
	12.083V	5.001V	3.287V	5.094V	97.838				50.39°C	115.12V
CL4	83.715A	0A	0A	0A	1000.175	86.993%	1860	40.6	45.67°C	0.993
	11.947V	4.984V	3.281V	5.059V	1149.72				57.05°C	114.86V

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20-80W LOAD TESTS 115V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
20W	1.230A	0.499A	0.501A	0.196A	20.003	74.695%	705	11.0	37.25°C	0.851
	12.077V	5.007V	3.291V	5.11V	26.777				39.53°C	115.14V
40W	2.708A	0.699A	0.702A	0.294A	40.002	81.994%	704	11.0	37.53°C	0.913
	12.073V	5.004V	3.29V	5.108V	48.784				40.24°C	115.13V
60W	4.186A	0.9A	0.903A	0.392A	60	84.021%	704	11.0	38.51°C	0.933
	12.072V	5.003V	3.288V	5.106V	71.415				41.61°C	115.13V
80W	5.655A	1.1A	1.104A	0.49A	79.959	84.239%	708	11.2	39.2°C	0.957
	12.083V	5.002V	3.288V	5.107V	94.919				42.65°C	115.12V

RIPPLE MEASUREMENTS 115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	8.27mV	5.11mV	3.89mV	8.11mV	Pass
20% Load	15.49mV	5.37mV	4.10mV	8.31mV	Pass
30% Load	12.00mV	4.61mV	3.89mV	8.51mV	Pass
40% Load	12.26mV	4.96mV	4.15mV	8.92mV	Pass
50% Load	13.89mV	4.91mV	4.45mV	8.51mV	Pass
60% Load	14.25mV	5.42mV	5.01mV	8.87mV	Pass
70% Load	16.29mV	5.93mV	5.01mV	10.86mV	Pass
80% Load	17.77mV	6.65mV	9.11mV	11.22mV	Pass
90% Load	20.28mV	7.67mV	9.52mV	9.84mV	Pass
100% Load	24.19mV	10.05mV	11.12mV	13.04mV	Pass
110% Load	35.40mV	18.09mV	16.95mV	23.64mV	Pass
Crossload1	12.38mV	7.19mV	11.20mV	9.48mV	Pass
Crossload2	11.49mV	7.31mV	6.14mV	7.19mV	Pass
Crossload3	26.30mV	7.36mV	11.41mV	7.85mV	Pass
Crossload4	23.39mV	18.72mV	6.48mV	18.94mV	Pass

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230V

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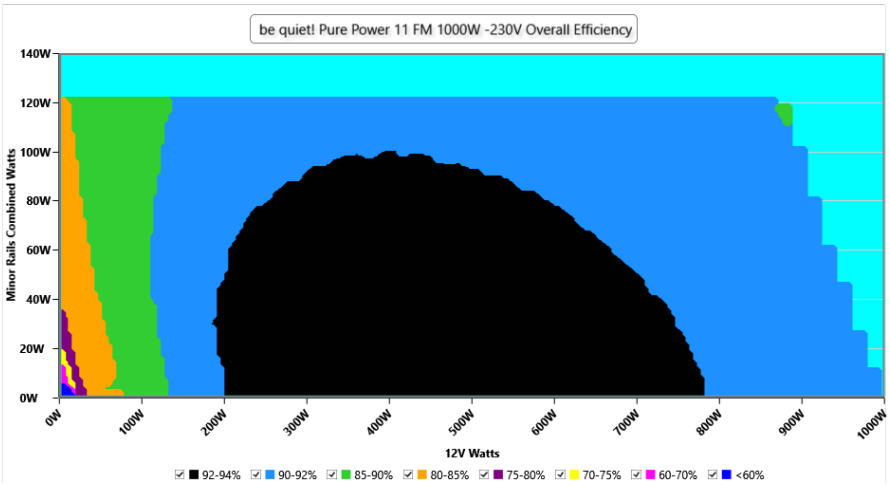
EFFICIENCY GRAPH 230V



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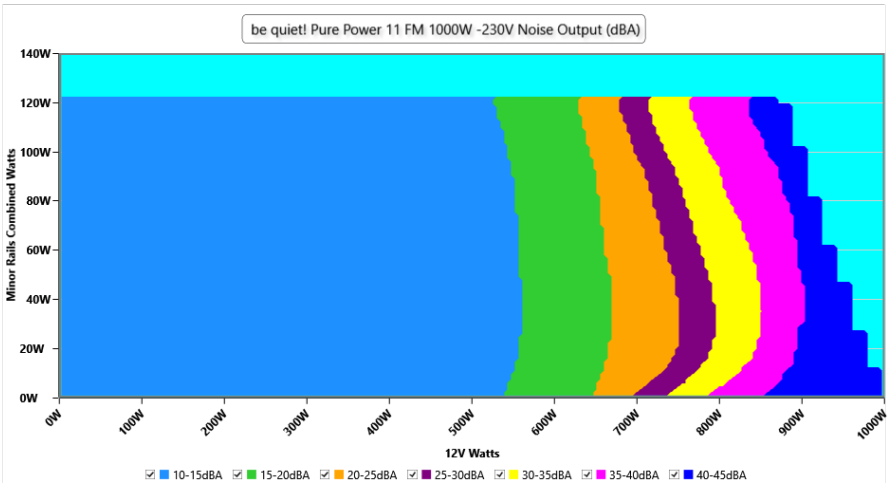
NOISE GRAPH 230V



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VAMPIRE POWER -230V

Detailed Results

	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	230.37 V	230.35 V	227.70 V	230.38 V	232.30 V	PASS
Mains Frequency:	50.00 Hz	50.00 Hz	49.50 Hz	50.01 Hz	50.50 Hz	PASS
Mains Voltage CF:	1.415	1.415	1.340	1.416	1.490	PASS
Mains Voltage THD:	0.15 %	0.13 %	N/A	0.16 %	2.00 %	PASS
Real Power:	0.117 W	0.102 W	N/A	0.131 W	N/A	N/A
Apparent Power:	40.602 W	40.596 W	N/A	40.612 W	N/A	N/A
Power Factor:	0.003	N/A	N/A	N/A	N/A	N/A

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10-110% LOAD TESTS 230V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
10%	6.490A	2.001A	2.008A	0.982A	100.009	86.948%	707	11.1	41.01°C	0.837
	12.081V	4.999V	3.286V	5.094V	115.022				45.22°C	230.35V
20%	14.036A	3.003A	3.015A	1.181A	199.963	91.562%	704	11.0	41.53°C	0.914
	12.045V	4.996V	3.284V	5.081V	218.388				45.94°C	230.34V
30%	21.938A	3.507A	3.52A	1.381A	300.004	92.679%	703	10.9	42.6°C	0.935
	12.032V	4.991V	3.282V	5.069V	323.709				47.32°C	230.33V
40%	29.827A	4.009A	4.023A	1.582A	399.72	92.953%	709	11.2	42.66°C	0.948
	12.020V	4.99V	3.281V	5.058V	430.022				47.7°C	230.32V
50%	37.389A	5.014A	5.03A	1.784A	499.461	92.77%	760	13.4	43.3°C	0.956
	12.007V	4.988V	3.28V	5.046V	538.384				48.97°C	230.3V
60%	45.039A	6.02A	6.04A	1.987A	600.008	92.465%	881	18.1	43.81°C	0.963
	11.994V	4.984V	3.279V	5.034V	648.893				49.84°C	230.29V
70%	52.640A	7.029A	7.051A	2.191A	699.727	92.029%	1109	25.4	43.95°C	0.966
	11.980V	4.981V	3.276V	5.022V	760.34				50.97°C	230.27V
80%	60.331A	8.003A	8.063A	2.295A	799.585	91.454%	1642	37.4	44.32°C	0.969
	11.965V	4.977V	3.274V	5.012V	874.311				52.45°C	230.26V
90%	68.374A	8.547A	8.557A	2.399A	899.564	90.914%	1852	40.4	44.79°C	0.972
	11.950V	4.973V	3.272V	5.003V	989.468				54.07°C	230.24V
100%	76.237A	9.056A	9.081A	3.011A	999.563	90.231%	1853	40.4	45.21°C	0.975
	11.935V	4.969V	3.27V	4.983V	1107.793				55.66°C	230.23V
110%	84.058A	10.065A	10.184A	3.016A	1100.081	89.222%	1851	40.3	47.18°C	0.977
	11.918V	4.967V	3.269V	4.974V	1232.976				57.96°C	230.22V
CL1	0.116A	14.464A	14.544A	0A	121.297	83.658%	845	17.0	42.86°C	0.872
	12.080V	4.992V	3.279V	5.093V	144.994				48.95°C	230.35V
CL2	0.115A	22.01A	0A	0A	111.394	82.364%	750	13.0	43.16°C	0.862
	12.087V	4.998V	3.283V	5.108V	135.247				50.21°C	230.34V
CL3	0.115A	0A	22.084A	0A	73.987	76.386%	715	11.5	44.57°C	0.807
	12.083V	5.001V	3.287V	5.094V	96.852				52.63°C	230.35V
CL4	83.714A	0A	0A	0A	1000.04	90.717%	1860	40.6	45.69°C	0.975
	11.946V	4.986V	3.283V	5.059V	1102.377				55.84°C	230.23V

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20-80W LOAD TESTS 230V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
20W	1.230A	0.5A	0.501A	0.196A	20	75.832%	693	10.5	37.41°C	0.45
	12.073V	5.005V	3.29V	5.11V	26.372				39.6°C	230.36V
40W	2.708A	0.7A	0.702A	0.294A	39.999	82.542%	699	10.8	38.12°C	0.636
	12.069V	5.003V	3.289V	5.107V	48.46				40.87°C	230.35V
60W	4.186A	0.9A	0.903A	0.392A	59.997	85.175%	697	10.7	38.84°C	0.738
	12.069V	5.001V	3.288V	5.105V	70.447				41.96°C	230.35V
80W	5.655A	1.1A	1.104A	0.49A	79.955	85.279%	705	11.0	40.07°C	0.801
	12.082V	5.001V	3.287V	5.106V	93.755				43.93°C	230.35V

RIPPLE MEASUREMENTS 230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	9.20mV	5.17mV	4.14mV	7.85mV	Pass
20% Load	15.95mV	5.27mV	4.20mV	8.56mV	Pass
30% Load	12.05mV	5.06mV	4.15mV	8.87mV	Pass
40% Load	12.31mV	4.81mV	4.30mV	8.62mV	Pass
50% Load	13.89mV	5.11mV	4.50mV	8.66mV	Pass
60% Load	15.17mV	5.47mV	4.40mV	8.21mV	Pass
70% Load	16.80mV	5.98mV	5.12mV	11.16mV	Pass
80% Load	17.26mV	6.44mV	8.44mV	10.25mV	Pass
90% Load	19.26mV	6.70mV	8.91mV	9.49mV	Pass
100% Load	25.98mV	7.19mV	9.59mV	10.78mV	Pass
110% Load	27.87mV	7.48mV	10.16mV	12.28mV	Pass
Crossload1	12.06mV	7.75mV	10.73mV	10.39mV	Pass
Crossload2	11.24mV	7.21mV	6.19mV	7.44mV	Pass
Crossload3	63.13mV	8.18mV	11.46mV	12.69mV	Pass
Crossload4	26.26mV	7.07mV	5.13mV	11.40mV	Pass

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Top side

Power specifications label

CERTIFICATIONS 115V

CERTIFICATIONS 230V