

## Anex

Be quiet! Pure Power 11 FM 650W

Lab ID#: BQ65001796  
Receipt Date: Feb 10, 2021  
Test Date: Feb 22, 2021

Report: 21PS1796A

Report Date: Feb 23, 2021

### DUT INFORMATION

Brand	Be quiet!
Manufacturer (OEM)	Channel Well Technology
Series	Pure Power 11 FM
Model Number	L11-FM-650W
Serial Number	318L0500000093
DUT Notes	

### DUT SPECIFICATIONS

Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10-5
Rated Frequency (Hz)	50-60
Rated Power (W)	650
Type	ATX12V
Cooling	120mm Rifle Bearing Fan (BQ QF2-12025-MS)
Semi-Passive Operation	X
Cable Design	Fully Modular

### POWER SPECIFICATIONS

Rail		3.3V	5V	12V(1)	12V(2)	5VSB	-12V
Max. Power	Amps	20	20	32	28	3	0.3
	Watts	120		650		15	3.6
Total Max. Power (W)		650					

### CABLES AND CONNECTORS

#### Modular Cables

Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (550mm)	1	1	16-18AWG	No
4 pin EPS12V (600mm)	1	1	16AWG	No
4+4 pin EPS12V (600mm)	1	1	16AWG	No
6+2 pin PCIe (500mm+150mm)	2	4	16-18AWG	No
SATA (500mm+150mm+150mm)	1	3	18AWG	No
SATA (500mm+150mm+150mm+150mm)	1	4	18AWG	No
SATA (500mm+150mm) / 4-pin Molex (+150mm+150mm) / FDD (+150mm)	1	2 / 2 / 1	18-20AWG	No
AC Power Cord (1400mm) - C13 coupler	1	1	18AWG	-

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General Data	-
Manufacturer (OEM)	CWT
PCB Type	Double Sided
Primary Side	-
Transient Filter	4x Y caps, 2x X caps, 2x CM chokes, 1x MOV
Inrush Protection	NTC Thermistor SCK-075 (70hm) & Relay
Bridge Rectifier(s)	1x GBJ1506 (600V, 15A @ 100°C)
APFC MOSFETs	2x ON Semiconductor FCPF165N65S3 (650V, 12.3A @ 100°C, Rds(on): 0.165Ohm)
APFC Boost Diode	1x ON Semiconductor FFSP0665A (650V, 6A @ 153°C)
Bulk Cap(s)	2x Teapo (400V, 270uF & 330uF each or 600uF combined, 2,000h @ 85°C, LH)
Main Switchers	2x ON Semiconductor FCPF190N60E (600V, 13.1A @ 100°C, Rds(on): 0.19Ohm)
No Load Consumption FET	1x Sync Power SPN5003 (500V, 20mA @ 70°C, Rds(on): 2500hm)
APFC Controller	Champion CM6500UNX
Resonant Controller	Champion CU6901VAC
Topology	Primary side: APFC, Half-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	-
+12V MOSFETs	4x ON Semiconductor NTMFS5C430N (40V, 131A @ 100°C, Rds(on): 1.7mOhm)
5V & 3.3V	DC-DC Converters: 2x UBIQ QM3054M6 (30V, 61A @ 100°C, Rds(on): 4.8mOhm) & 2x UBIQ QN3107M6N (30V, 70A @ 100°C, Rds(on): 2.6mOhm) PWM Controller(s): uPI-Semi uP3861P
Change Over Switch	1x Sync Power SPN3006 MOSFET (30V, 57A @ 100°C, Rds(on): 5.5mOhm)
Filtering Capacitors	Electrolytic: 7x Teapo (1-3,000h @ 105°C, SC), 1x Elite (2-5,000h @ 105°C, ED), 1x Teapo (1-5,000h @ 105°C, SJ), 7x Teapo (4-10,000h @ 105°C, TA) Polymer: 18x APAQ
Supervisor IC	Weltrend WT7527RT (OCP, OVP, UVP, SCP, PG)
Fan Model	be quiet! BQ QF2-12025-MS (120mm, 12V, 0.20A, Rifle Bearing Fan)
5VSB Circuit	-
Rectifier	1x Silan Microelectronics SVF4N65RDTR FET (650V, 2.5A @ 100°C, Rds(on): 2.7Ohm) & 1x PS1045L SBR (45V, 10A)
Standby PWM Controller	On-Bright OB5282

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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	88.766%
Efficiency With 10W ( $\leq 500W$ ) or 2% ( $> 500W$ )	71.820
Average Efficiency 5VSB	78.946%
Standby Power Consumption (W)	0.0405408
Average PF	0.991
Avg Noise Output	21.21 dB(A)
Efficiency Rating (ETA)	GOLD
Noise Rating (LAMBDA)	A

#### 230V

Average Efficiency	90.793%
Average Efficiency 5VSB	78.668%
Standby Power Consumption (W)	0.0601721
Average PF	0.963
Avg Noise Output	21.75 dB(A)
Efficiency Rating (ETA)	GOLD
Noise Rating (LAMBDA)	A

### 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
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

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

Hold-Up Time (ms)	22.5
AC Loss to PWR_OK Hold Up Time (ms)	19.3
PWR_OK Inactive to DC Loss Delay (ms)	3.2

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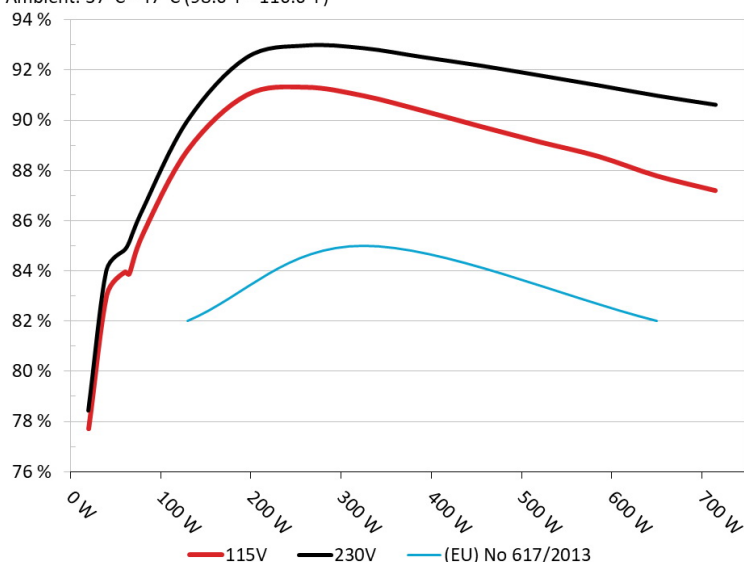
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### EFFICIENCY UNDER HIGH AMBIENT TEMPERATURE

**Efficiency: be quiet! Pure Power 11 FM 650W**

Ambient: 37°C - 47°C (98.6°F - 116.6°F)



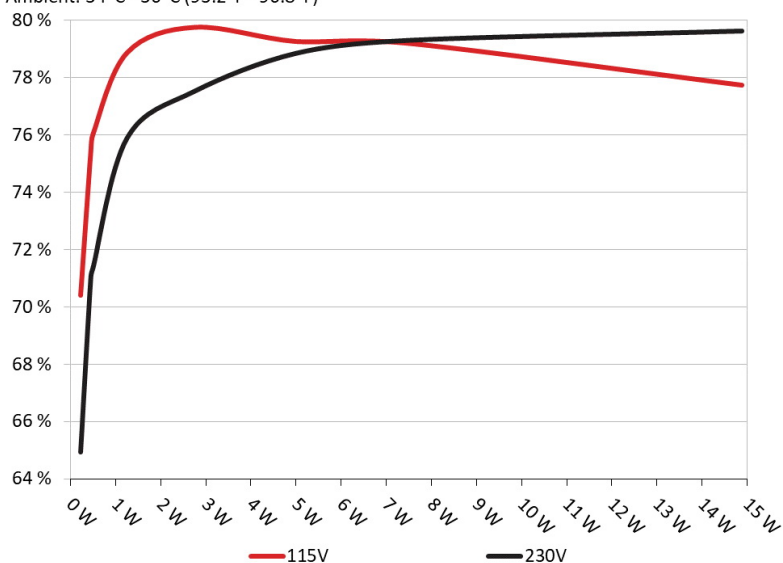
#### INFO

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

**5VSB Efficiency: be quiet! Pure Power 11 FM 650W**

Ambient: 34°C - 36°C (93.2°F - 96.8°F)



#### 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	0.226	70.405%	0.032
	5.012V	0.321		115.12V
2	0.090A	0.451	75.418%	0.060
	5.011V	0.598		115.12V
3	0.550A	2.752	79.745%	0.268
	5.003V	3.451		115.12V
4	1.000A	4.996	79.251%	0.372
	4.995V	6.304		115.12V
5	1.501A	7.480	79.187%	0.435
	4.984V	9.446		115.12V
6	3.002A	14.879	77.730%	0.514
	4.956V	19.142		115.12V

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

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.226	64.943%	0.011
	5.016V	0.348		230.29V
2	0.090A	0.451	71.024%	0.019
	5.013V	0.635		230.29V
3	0.550A	2.752	77.521%	0.103
	5.003V	3.550		230.29V
4	1.000A	4.997	78.842%	0.171
	4.996V	6.338		230.29V
5	1.500A	7.483	79.294%	0.232
	4.987V	9.437		230.29V
6	3.001A	14.884	79.619%	0.343
	4.960V	18.694		230.30V

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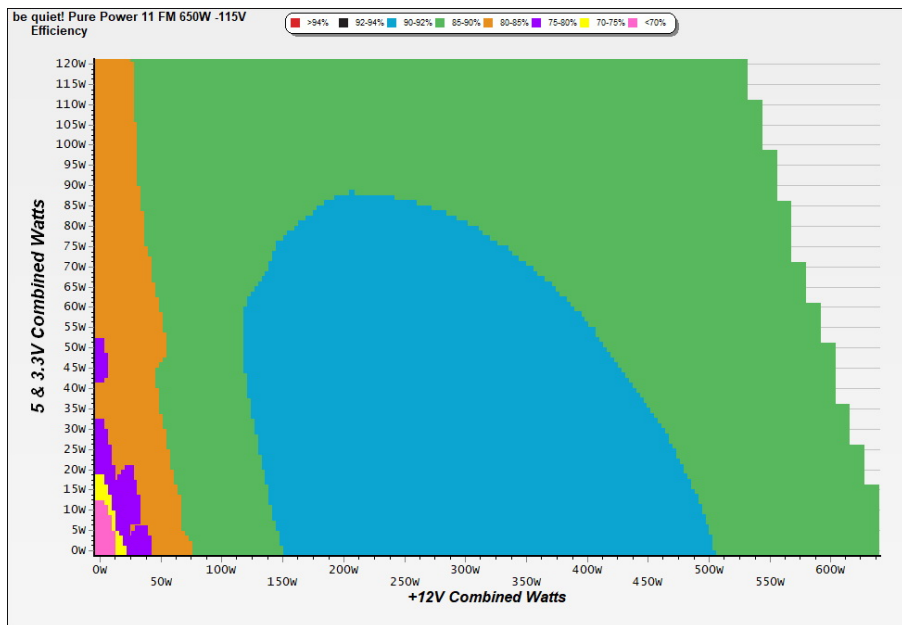
# 115V

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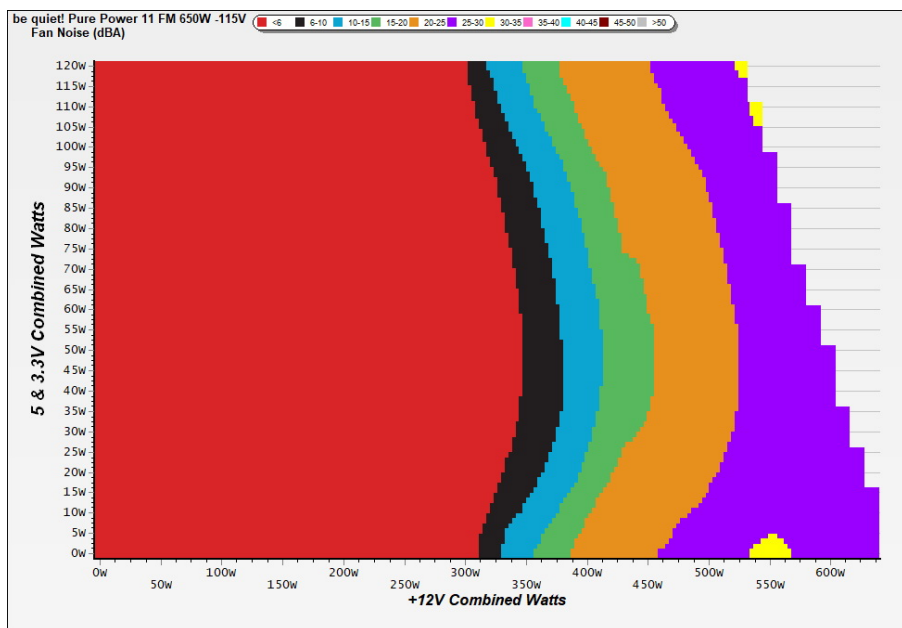
### EFFICIENCY GRAPH 115V



#### 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

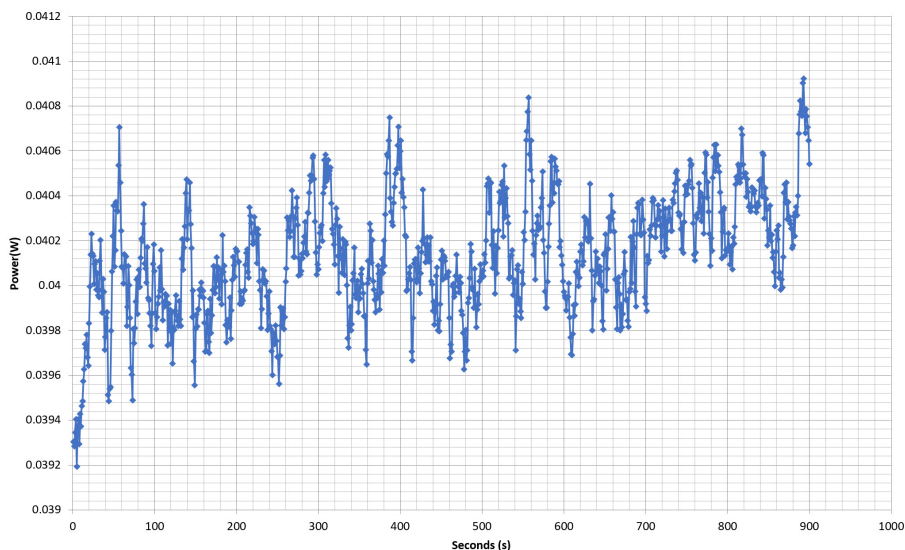
The PSU's noise in its entire operational range and under 30-32 °C ambient is depicted in this graph. The X axis represents the load on the +12V rail(s) while the Y axis is the load on the minor rails

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### VAMPIRE POWER -115V

Power - 318L0500000093 - 15/02/2021 - 11:44



#### 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
1	3.589A	1.983A	1.993A	0.996A	64.955	83.877%	502	<6.0	40.89°C	0.975
	12.080V	5.044V	3.309V	5.023V	77.441				45.22°C	115.12V
2	8.165A	2.975A	2.995A	1.196A	130.012	88.821%	507	<6.0	40.93°C	0.991
	12.138V	5.042V	3.307V	5.018V	146.376				46.19°C	115.12V
3	13.104A	3.472A	3.493A	1.397A	195.013	90.997%	509	<6.0	41.90°C	0.994
	12.131V	5.041V	3.305V	5.012V	214.307				48.00°C	115.12V
4	18.060A	3.970A	3.995A	1.599A	260.019	91.313%	509	<6.0	42.48°C	0.996
	12.116V	5.039V	3.303V	5.005V	284.756				49.32°C	115.12V
5	22.692A	4.963A	4.998A	1.800A	325.053	90.967%	630	9.5	42.87°C	0.994
	12.099V	5.037V	3.302V	5.000V	357.329				50.49°C	115.11V
6	27.285A	5.959A	5.997A	2.000A	389.426	90.386%	874	18.5	43.01°C	0.994
	12.081V	5.036V	3.301V	4.995V	430.848				51.20°C	115.08V
7	31.956A	6.956A	7.003A	2.205A	454.797	89.745%	1182	27.7	44.13°C	0.995
	12.069V	5.034V	3.299V	4.989V	506.767				52.72°C	115.08V
8	36.599A	7.950A	8.005A	2.408A	520.083	89.131%	1344	31.9	44.46°C	0.996
	12.068V	5.032V	3.298V	4.984V	583.504				53.62°C	115.08V
9	41.640A	8.450A	8.489A	2.409A	585.005	88.557%	1590	36.2	45.73°C	0.996
	12.068V	5.030V	3.297V	4.982V	660.600				55.26°C	115.09V
10	46.407A	8.950A	9.011A	3.022A	649.874	87.780%	1689	38.1	45.77°C	0.997
	12.071V	5.028V	3.295V	4.965V	740.343				56.20°C	115.09V
11	51.780A	8.953A	9.016A	3.022A	714.743	87.195%	1687	38.1	46.63°C	0.997
	12.071V	5.027V	3.294V	4.964V	819.703				57.51°C	115.08V
CL1	0.117A	14.001A	14.001A	0.000A	118.118	82.743%	927	21.0	42.77°C	0.990
	12.134V	5.041V	3.294V	5.058V	142.752				50.35°C	115.15V
CL2	54.183A	1.000A	0.999A	1.000A	667.702	88.335%	1688	38.1	45.38°C	0.997
	12.077V	5.029V	3.300V	5.009V	755.871				56.34°C	115.09V

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## Anex

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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])	PF/AC Volts
1	1.233A	0.497A	0.498A	0.198A	19.984	77.704%	493	<6.0	0.848
	12.028V	5.044V	3.311V	5.041V	25.718				115.11V
2	2.464A	0.991A	0.999A	0.397A	39.973	83.031%	496	<6.0	0.945
	12.040V	5.044V	3.311V	5.037V	48.142				115.11V
3	3.696A	1.486A	1.494A	0.596A	60.003	83.948%	497	<6.0	0.972
	12.057V	5.044V	3.310V	5.032V	71.476				115.11V
4	4.901A	1.983A	1.994A	0.796A	79.953	85.451%	497	<6.0	0.981
	12.110V	5.043V	3.310V	5.027V	93.566				115.12V

### RIPPLE MEASUREMENTS 115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	5.80mV	4.00mV	4.50mV	6.20mV	Pass
20% Load	6.30mV	4.20mV	4.90mV	6.40mV	Pass
30% Load	9.40mV	4.40mV	6.20mV	7.00mV	Pass
40% Load	7.80mV	4.30mV	5.20mV	6.90mV	Pass
50% Load	7.30mV	4.90mV	5.50mV	7.40mV	Pass
60% Load	8.50mV	5.20mV	5.90mV	7.90mV	Pass
70% Load	9.10mV	8.10mV	12.10mV	10.70mV	Pass
80% Load	9.90mV	8.20mV	16.00mV	11.30mV	Pass
90% Load	10.90mV	7.20mV	11.90mV	9.70mV	Pass
100% Load	16.90mV	7.50mV	13.60mV	11.90mV	Pass
110% Load	18.50mV	7.60mV	14.20mV	12.60mV	Pass
Crossload1	7.10mV	5.20mV	12.50mV	7.50mV	Pass
Crossload2	16.40mV	6.70mV	8.10mV	11.30mV	Pass

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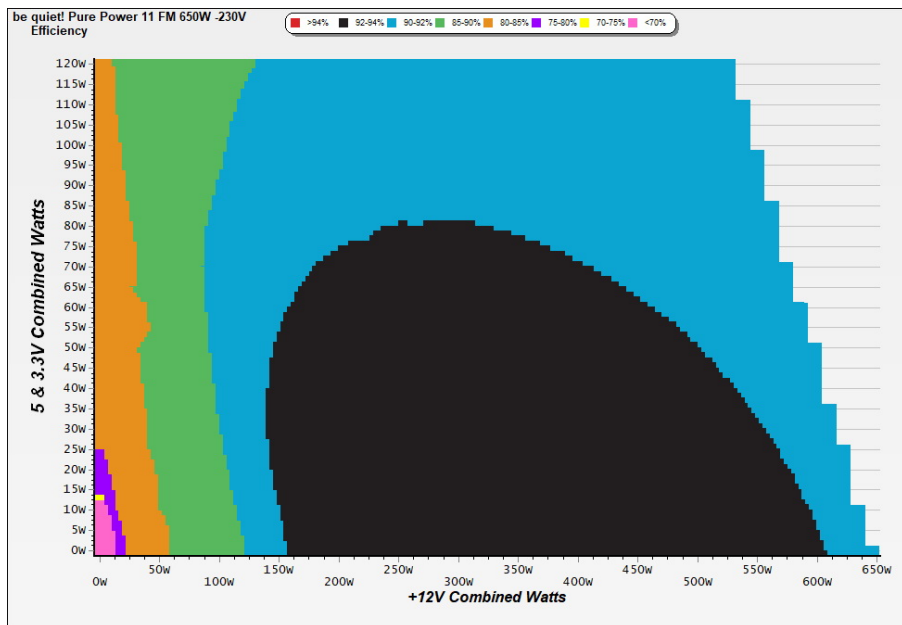
# 230V

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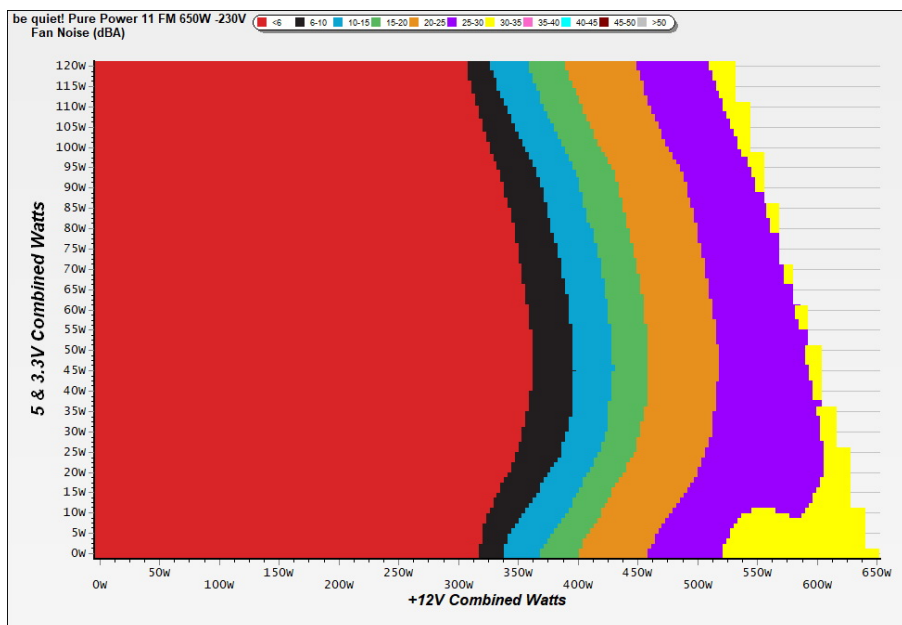
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### NOISE GRAPH 230V



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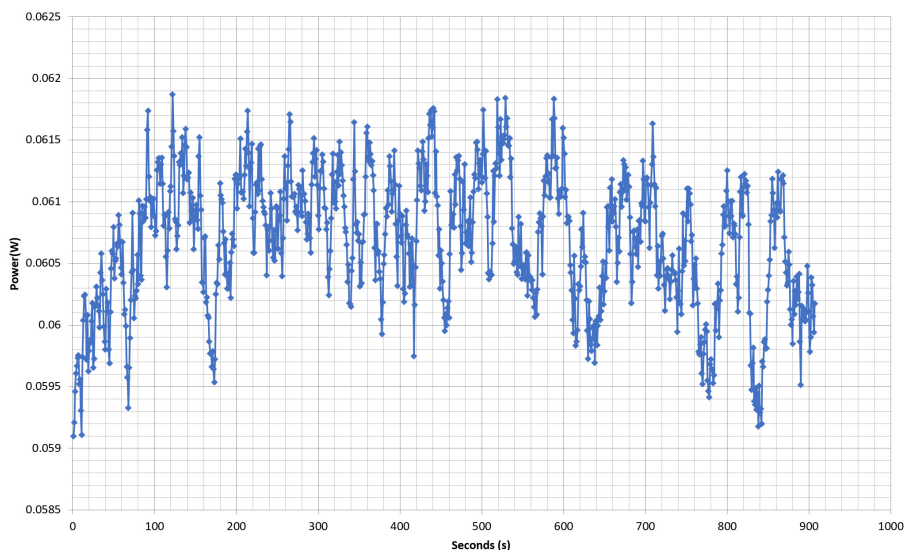
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### 10-110% LOAD TESTS 230V

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1	3.590A	1.982A	1.996A	0.996A	64.957	85.130%	498	<6.0	40.02°C	0.816
	12.076V	5.044V	3.309V	5.023V	76.303				44.18°C	230.33V
2	8.168A	2.975A	2.994A	1.196A	130.015	90.008%	501	<6.0	40.87°C	0.928
	12.134V	5.043V	3.307V	5.018V	144.449				45.67°C	230.30V
3	13.107A	3.472A	3.495A	1.397A	195.017	92.505%	503	<6.0	41.06°C	0.960
	12.128V	5.041V	3.305V	5.012V	210.817				46.64°C	230.29V
4	18.065A	3.970A	3.994A	1.598A	260.021	92.989%	504	<6.0	41.35°C	0.974
	12.113V	5.039V	3.304V	5.006V	279.627				47.77°C	230.27V
5	22.701A	4.963A	4.997A	1.800A	325.056	92.881%	505	<6.0	41.98°C	0.981
	12.094V	5.038V	3.303V	5.001V	349.971				48.82°C	230.28V
6	27.293A	5.959A	6.000A	2.000A	389.450	92.532%	792	15.7	42.46°C	0.985
	12.078V	5.036V	3.301V	4.995V	420.881				50.30°C	230.28V
7	31.965A	6.954A	7.005A	2.205A	454.816	92.185%	1102	25.8	42.97°C	0.987
	12.066V	5.035V	3.299V	4.990V	493.375				51.52°C	230.29V
8	36.607A	7.951A	8.005A	2.408A	520.120	91.795%	1328	31.3	43.46°C	0.989
	12.066V	5.033V	3.298V	4.984V	566.613				52.59°C	230.30V
9	41.639A	8.449A	8.493A	2.409A	585.044	91.399%	1674	37.8	44.38°C	0.990
	12.069V	5.031V	3.296V	4.982V	640.098				53.83°C	230.31V
10	46.417A	8.948A	9.010A	3.021A	649.813	90.990%	1691	38.5	45.86°C	0.991
	12.067V	5.029V	3.296V	4.966V	714.156				56.18°C	230.30V
11	51.787A	8.952A	9.015A	3.022A	714.718	90.628%	1690	38.5	46.71°C	0.992
	12.069V	5.027V	3.294V	4.965V	788.629				57.48°C	230.33V
CL1	0.115A	14.002A	14.001A	0.000A	118.127	83.790%	948	20.9	41.95°C	0.926
	12.133V	5.042V	3.295V	5.059V	140.979				48.97°C	230.35V
CL2	54.182A	1.000A	0.998A	1.000A	667.525	91.576%	1686	38.1	45.72°C	0.991
	12.074V	5.029V	3.300V	5.009V	728.929				55.95°C	230.32V

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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])	PF/AC Volts
1	1.233A	0.496A	0.500A	0.198A	19.986	78.444%	496	<6.0	0.452
	12.028V	5.044V	3.310V	5.041V	25.478				230.35V
2	2.466A	0.990A	0.995A	0.397A	39.976	84.022%	495	<6.0	0.671
	12.039V	5.045V	3.310V	5.037V	47.578				230.34V
3	3.699A	1.486A	1.494A	0.596A	60.006	84.837%	496	<6.0	0.794
	12.048V	5.044V	3.310V	5.032V	70.731				230.34V
4	4.905A	1.982A	1.995A	0.796A	79.956	86.438%	498	<6.0	0.861
	12.101V	5.044V	3.309V	5.028V	92.501				230.34V

### RIPPLE MEASUREMENTS 230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	8.40mV	4.10mV	4.70mV	5.90mV	Pass
20% Load	6.30mV	4.40mV	5.10mV	6.10mV	Pass
30% Load	8.80mV	4.10mV	5.60mV	6.00mV	Pass
40% Load	8.70mV	4.50mV	5.40mV	7.30mV	Pass
50% Load	7.70mV	4.50mV	5.40mV	6.90mV	Pass
60% Load	9.00mV	5.70mV	6.40mV	8.20mV	Pass
70% Load	9.60mV	8.10mV	13.70mV	10.60mV	Pass
80% Load	9.70mV	8.30mV	17.90mV	10.50mV	Pass
90% Load	10.70mV	7.10mV	12.10mV	9.30mV	Pass
100% Load	18.20mV	7.30mV	13.40mV	10.50mV	Pass
110% Load	19.80mV	7.70mV	13.90mV	11.20mV	Pass
Crossload1	7.90mV	5.20mV	12.60mV	7.40mV	Pass
Crossload2	17.50mV	6.50mV	8.10mV	9.90mV	Pass

All data and graphs included in this test report can be used by any individual on the following conditions:

- > It should be mentioned that the test results are provided by Cybenetics
- > The link to the original test results document should be provided in any case

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# Anex



*Top side*

## Be quiet! Pure Power 11 FM 650W



Power specifications label

## CERTIFICATIONS 115V



## CERTIFICATIONS 230V



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