EFFICIENCY AND NOISE LEVEL CERTIFICATIONS

Anex

be quiet! Dark Power 13 850W

Lab ID#: BQ85002146
Receipt Date: Feb 17, 2023
Test Date: Mar 3, 2023

Report: 23PS2146A
Report Date: Mar 7, 2023

DUT INFORMATION

Brand	be quiet!
Manufacturer (OEM)	FSP
Series	Dark Power 13
Model Number	P13-850W
Serial Number	334S2481000089
DUT Notes	

DUT SPECIFICATIONS

Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10-5
Rated Frequency (Hz)	50-60
Rated Power (W)	850
Type	ATX12V
Cooling	135mm Fluid Dynamic Bearing Fan (BQ SIW3-13525-HF)
Semi-Passive Operation	✗
Cable Design	Fully Modular

TEST EQUIPMENT

Electronic Loads	Chroma 63601-5 x2 Chroma 63600-2 63640-80-80 x10 63610-80-20
AC Sources	Chroma 6530, APM SP300VAC4000W-P
Power Analyzers	RS HMC8015, N4L PPA1530, N4L PPA5530
Oscilloscopes	Picoscope 4444, Rigol DS7014, Siglent SDS2104X PLUS
Sound Analyzer	Bruel & Kjaer 2270 G4
Microphone	Bruel & Kjaer Type 4955-A
Temperature Logger	Picoscope TC-08
Tachometer	UNI-T UT372
Multimeters	Keysight 34465A, Keithley 2015 - THD
UPS	FSP Champ Tower 3kVA, CyberPower OLS3000E 3kVA
Isolation Transformer	4kVA

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RESULTS

Temperature Range (°C /°F)	30-32 / 86-89.6
ErP Lot 3/6 Ready	✓
(EU) No 617/2013 Compliance	✓
ALPM (Alternative Low Power Mode) compatible	✓
ATX 3.0 Ready	✓

115V

Average Efficiency	92.087%
Efficiency With 10W (≤500W) or 2% (>500W)	72.474
Average Efficiency 5VSB	79.403%
Standby Power Consumption (W)	0.0577000
Average PF	0.990
Avg Noise Output	14.53 dB(A)
Efficiency Rating (ETA)	TITANIUM
Noise Rating (LAMBDA)	A++

230V

Average Efficiency	93.663%
Average Efficiency 5VSB	77.476%
Standby Power Consumption (W)	0.1464000
Average PF	0.958
Avg Noise Output	14.95 dB(A)
Efficiency Rating (ETA)	TITANIUM
Noise Rating (LAMBDA)	A++

POWER SPECIFICATIONS

Rail		3.3V	5V	12V(1)	12V(2)	12V(3)	12V(4)	5VSB	-12V
Max. Power	Amps	24	24	30	30	35	35	3	0.5
	Watts	120		840				15	6
Total Max. Power (W)		850							

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

Hold-Up Time (ms)	21.5
AC Loss to PWR_OK Hold Up Time (ms)	19.8
PWR_OK Inactive to DC Loss Delay (ms)	1.7

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CABLES AND CONNECTORS

Modular Cables

Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (600mm)	1	1	18-22AWG	No
4+4 pin EPS12V (700mm)	1	1	16AWG	No
8 pin EPS12V (700mm)	1	1	16AWG	No
2x 6+2 pin PCIe (600mm)	2	4	16AWG	No
12+4 pin PCIe (600mm) (600W)	1	1	16-28AWG	No
SATA (600mm+150mm+150mm)	2	6	18AWG	No
SATA (600mm+150mm+150mm+150mm)	1	4	18AWG	No
SATA (600mm+150mm) / 4-pin Molex (+150mm+150mm)	1	2 / 2	18AWG	No
AC Power Cord (1330mm) - C13 coupler	1	1	18AWG	-

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General Data	
Manufacturer (OEM)	FSP
PCB Type	Double-Sided
Primary Side	
Transient Filter	4x Y caps, 3x X caps, 2x CM chokes, 1x MOV (TVR14561), 2x Gas Discharge Tubes (SMD)
Inrush Protection	NTC Thermistor (SCK-056, 5Ohm) & Relay
Rectifier MOSFETs	4x STMicroelectronics STB57N65M (650V, 26.5A @ 100°C, Rds(on): 0.063Ohm)
APFC MOSFETs	2x Infineon IPA60R120P7 (650V, 16A @ 100°C, Rds(on): 0.12Ohm)
APFC Boost Diode	2x CREE C3D06060A(600V, 6A @ 154°C)
Bulk Cap(s)	1x Nippon Chemi-Con (420V, 470uF, 2000h @ 105°C, KMZ)1x Nippon Chemi-Con (420V, 330uF, 2000h @ 105°C, KMR)
Main Switchers	4x A&O AOTF190A60L (600V, 12A @ 100°C, Rds(on): 0.19Ohm)
IC Driver	2x Novosense Micro Labs NSi6602
APFC Controller	Infineon ICE2PCS02
Resonant Controller	Champion CM6901T2X
Topology	Primary side: Bridgless APFC, Full-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	
+12V MOSFETs	6x Toshiba TPHR8504PL (40V, 100A @ 100°C, Rds(on): 1.4mOhm)
5V & 3.3V	DC-DC Converters: 6x Infineon BSC0901NS (30V, 94A @ 100°C, Rds(on): 1.9mOhm) PWM Controller(s): uPI UP3861P
Filtering Capacitors	Electrolytic: 6x Nippon Chemi-Con (2-5,000 @ 105°C, KZE) 2x Rubycon (1-5,000 @ 105°C, ZL) 2x Rubycon (6-10000 @ 105°C, ZLH) Polymer: 12x Chemi-Con, 22x FPCAP
Supervisor IC	Weltrend WT7527RA (OVP, UVP, OCP, SCP, PG)
Fan Controller	APW9010
Fan Model	be quiet! Silent Wings BQ SIW3-13525-HF (140mm, 12V, 0.56A, Fluid Dynamic Bearing Fan)
5VSB Circuit	
Rectifiers	1x CET CEB04N7G FET (700V, 4A, Rds(on): 3.3Ohm, 1x Infineon BSC0901NS FET (30V, 94A @ 100°C, Rds(on): 1.9mOhm), 1x P15L50N5 SBR (50V, 15A)

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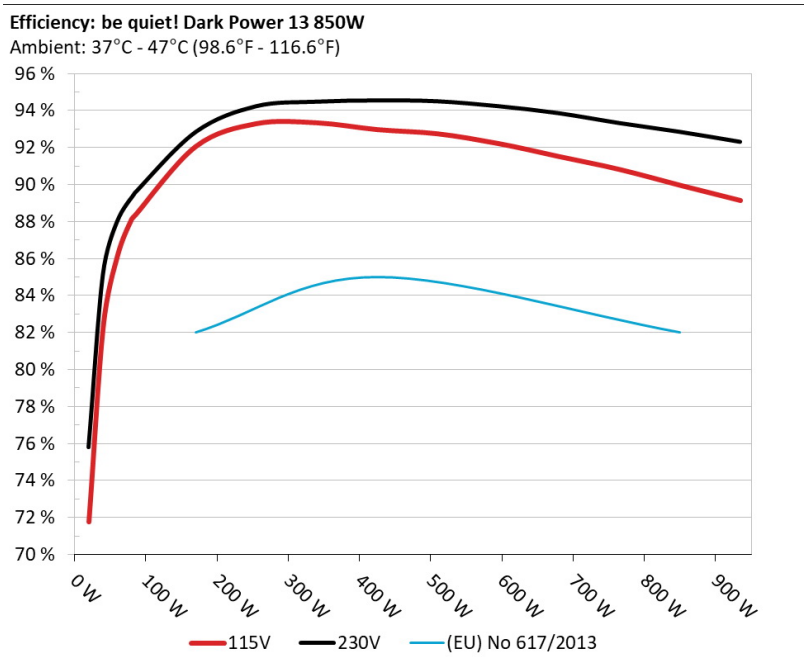
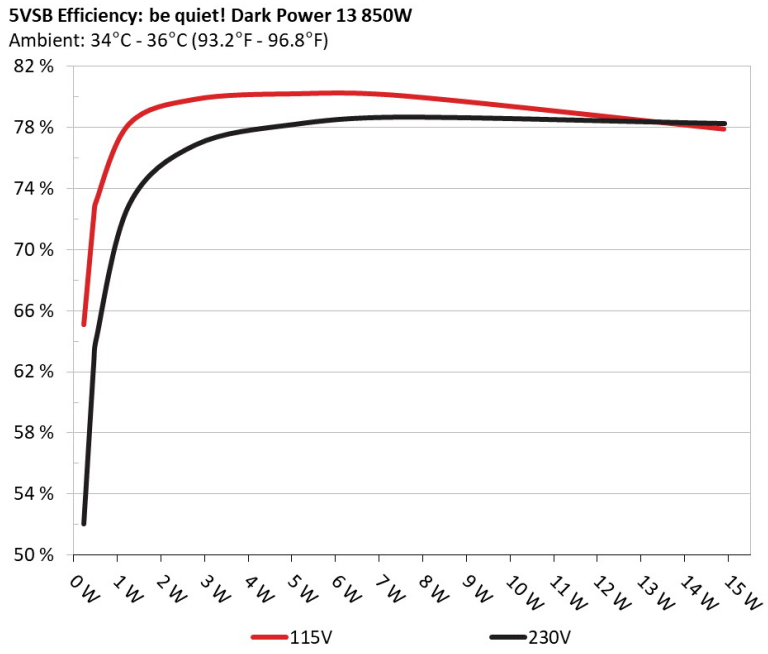
EFFICIENCY UNDER HIGH AMBIENT TEMPERATURE



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	0.229W	65.577%	0.029
	5.08V	0.351W		114.88V
2	0.09A	0.457W	72.694%	0.052
	5.079V	0.629W		114.88V
3	0.55A	2.783W	80.361%	0.229
	5.061V	3.464W		114.87V
4	1A	5.045W	80.715%	0.329
	5.045V	6.25W		114.88V
5	1.5A	7.541W	80.583%	0.391
	5.027V	9.358W		114.87V
6	3A	14.902W	78.406%	0.468
	4.968V	19.004W		114.87V

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

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.229W	52.55%	0.011
	5.08V	0.44W		229.78V
2	0.09A	0.457W	63.076%	0.018
	5.08V	0.728W		229.78V
3	0.55A	2.783W	77.329%	0.085
	5.061V	3.599W		229.78V
4	1A	5.044W	78.674%	0.143
	5.044V	6.413W		229.78V
5	1.5A	7.538W	79.148%	0.197
	5.025V	9.527W		229.78V
6	3A	14.91W	78.731%	0.308
	4.971V	18.942W		229.77V

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115V

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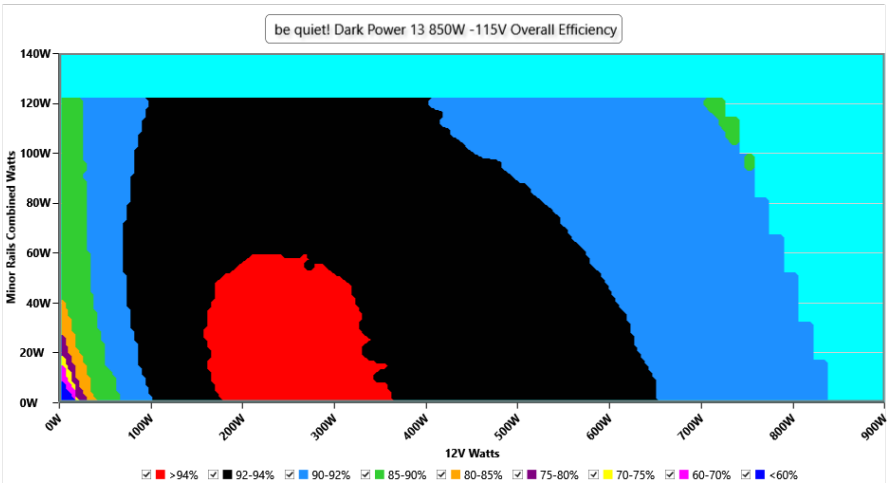
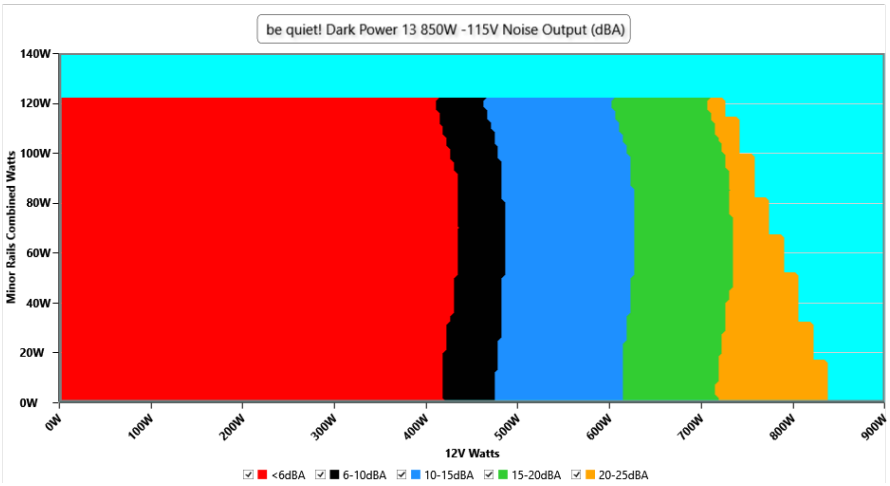
EFFICIENCY GRAPH 115V



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:	114.88 V	114.84 V	113.85 V	114.91 V	116.15 V	PASS
Mains Frequency:	60.00 Hz	59.98 Hz	59.40 Hz	60.01 Hz	60.60 Hz	PASS
Mains Voltage CF:	1.416	1.415	1.340	1.418	1.490	PASS
Mains Voltage THD:	0.17 %	0.12 %	N/A	0.23 %	2.00 %	PASS
Real Power:	0.058 W	-0.086 W	N/A	0.221 W	N/A	N/A
Apparent Power:	12.263 W	11.934 W	N/A	12.796 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%	5.252A	1.965A	1.969A	0.993A	84.998	88.345%	371	<6.0	40.23°C	0.966
	12.072V	5.088V	3.352V	5.037V	96.212				44.48°C	114.85V
20%	11.580A	2.95A	2.953A	1.194A	169.935	92.057%	385	<6.0	40.85°C	0.987
	12.006V	5.085V	3.353V	5.025V	184.597				45.53°C	114.82V
30%	18.237A	3.443A	3.448A	1.397A	254.941	93.29%	389	<6.0	41.13°C	0.992
	12.002V	5.082V	3.35V	5.01V	273.28				46.36°C	114.8V
40%	24.921A	3.94A	3.944A	1.603A	340.037	93.336%	445	8.8	41.8°C	0.994
	11.991V	5.077V	3.347V	4.992V	364.316				47.51°C	114.77V
50%	31.245A	4.927A	4.935A	1.808A	424.837	92.969%	497	12.4	42.37°C	0.995
	11.981V	5.074V	3.344V	4.979V	456.968				48.62°C	114.73V
60%	37.558A	5.917A	5.928A	2A	509.286	92.743%	570	12.2	42.71°C	0.995
	11.970V	5.07V	3.34V	4.965V	549.136				49.32°C	114.71V
70%	43.946A	6.91A	6.925A	2.223A	594.652	92.215%	652	15.8	43.17°C	0.995
	11.959V	5.066V	3.336V	4.949V	644.848				50.27°C	114.67V
80%	50.353A	7.905A	7.924A	2.329A	679.481	91.515%	738	22.3	43.62°C	0.995
	11.947V	5.061V	3.331V	4.938V	742.479				51.73°C	114.64V
90%	57.168A	8.402A	8.413A	2.435A	764.871	90.811%	1000	26.9	44.01°C	0.995
	11.936V	5.057V	3.328V	4.928V	842.268				53.22°C	114.6V
100%	63.734A	8.903A	8.933A	3.069A	849.706	89.959%	1309	34.6	45.21°C	0.994
	11.924V	5.054V	3.325V	4.887V	944.554				55.27°C	114.57V
110%	70.176A	9.902A	10.028A	3.072A	934.305	89.139%	1639	40.3	46.52°C	0.993
	11.914V	5.049V	3.321V	4.883V	1048.144				57.45°C	114.54V
CL1	1.998A	14.265A	14.311A	0.492A	146.404	87.767%	639	15.4	40.02°C	0.985
	12.008V	5.061V	3.333V	5.079V	166.81				45.49°C	114.83V
CL2	1.998A	23.069A	0.989A	0.491A	146.395	86.492%	664	16.1	41.44°C	0.985
	12.010V	5.054V	3.336V	5.093V	169.259				48.57°C	114.82V
CL3	1.994A	0.986A	22.308A	0.495A	105.715	84.307%	598	14.3	41°C	0.977
	12.032V	5.069V	3.327V	5.052V	125.392				50.31°C	114.84V
CL4	70.342A	0.987A	0.991A	0.498A	849.889	90.609%	986	26.7	45.03°C	0.994
	11.929V	5.068V	3.331V	5.023V	937.979				55.99°C	114.58V

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])	Temps (In/Out)	PF/AC Volts
20W	1.234A	0.491A	0.491A	0.197A	19.989	74.315%	315	<6.0	36.52°C	0.843
	12.029V	5.095V	3.361V	5.086V	26.9				39.58°C	114.89V
40W	2.718A	0.687A	0.688A	0.295A	39.989	83.805%	318	<6.0	37.39°C	0.918
	12.026V	5.094V	3.359V	5.079V	47.718				40.69°C	114.88V
60W	4.200A	0.883A	0.884A	0.394A	59.989	87.223%	321	<6.0	38.97°C	0.949
	12.030V	5.092V	3.357V	5.072V	68.776				42.57°C	114.87V
80W	5.670A	1.08A	1.082A	0.494A	79.932	88.676%	327	<6.0	39.22°C	0.962
	12.045V	5.09V	3.355V	5.065V	90.133				43.17°C	114.86V

RIPPLE MEASUREMENTS 115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	8.49mV	12.52mV	13.61mV	11.51mV	Pass
20% Load	9.77mV	12.98mV	15.04mV	10.69mV	Pass
30% Load	40.20mV	13.49mV	17.03mV	11.46mV	Pass
40% Load	36.26mV	20.95mV	32.43mV	16.32mV	Pass
50% Load	16.37mV	15.63mV	20.21mV	11.10mV	Pass
60% Load	14.84mV	16.14mV	18.06mV	11.46mV	Pass
70% Load	15.50mV	16.30mV	19.08mV	12.27mV	Pass
80% Load	16.06mV	16.91mV	19.59mV	13.14mV	Pass
90% Load	17.91mV	18.13mV	21.43mV	12.84mV	Pass
100% Load	25.41mV	20.79mV	24.06mV	14.24mV	Pass
110% Load	27.45mV	21.61mV	26.43mV	14.58mV	Pass
Crossload1	13.04mV	15.07mV	19.54mV	12.55mV	Pass
Crossload2	10.95mV	21.71mV	18.98mV	11.56mV	Pass
Crossload3	9.26mV	13.59mV	16.93mV	10.85mV	Pass
Crossload4	25.57mV	21.37mV	21.32mV	13.61mV	Pass

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230V

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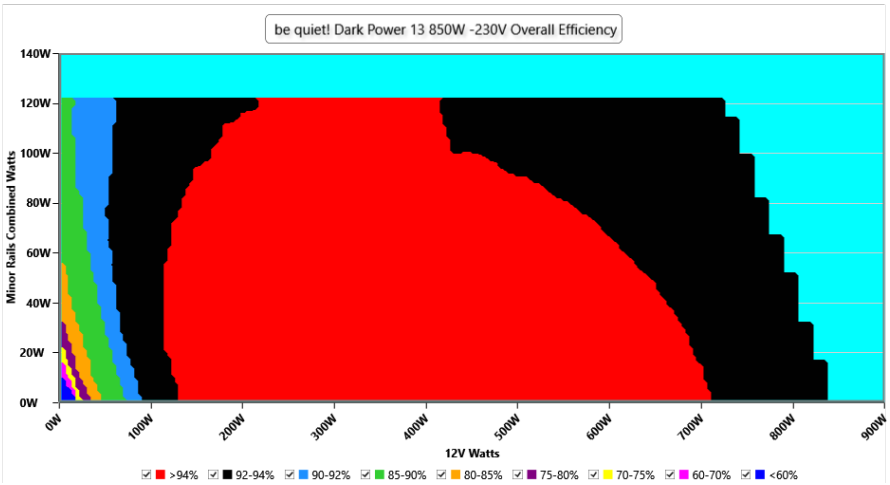
EFFICIENCY GRAPH 230V



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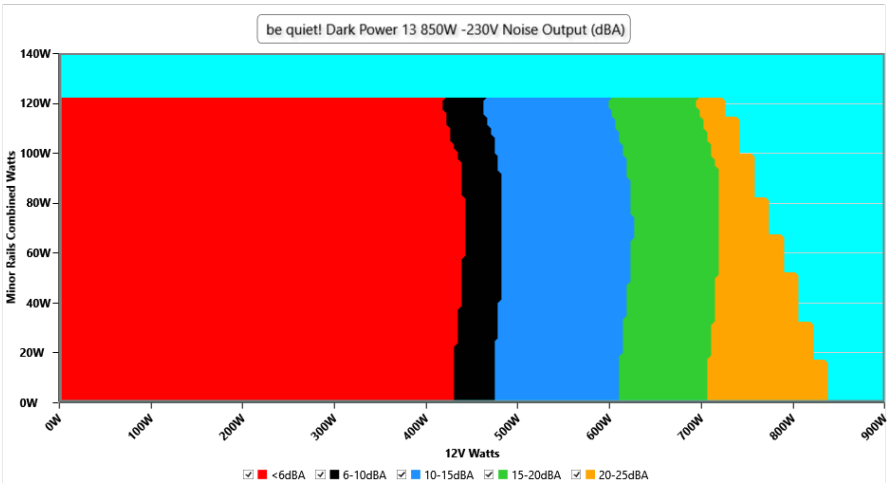
NOISE GRAPH 230V



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 -230V

Detailed Results

	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	229.76 V	229.73 V	227.70 V	229.82 V	232.30 V	PASS
Mains Frequency:	50.00 Hz	50.00 Hz	49.50 Hz	50.00 Hz	50.50 Hz	PASS
Mains Voltage CF:	1.416	1.415	1.340	1.417	1.490	PASS
Mains Voltage THD:	0.15 %	0.12 %	N/A	0.21 %	2.00 %	PASS
Real Power:	0.146 W	-0.108 W	N/A	0.450 W	N/A	N/A
Apparent Power:	41.126 W	40.807 W	N/A	41.949 W	N/A	N/A
Power Factor:	0.001	N/A	N/A	N/A	N/A	N/A

INFO

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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%	5.258A	1.965A	1.968A	0.992A	84.994	89.289%	333	<6.0	39.83°C	0.846
	12.055V	5.088V	3.354V	5.038V	95.184				44.18°C	229.76V
20%	11.576A	2.949A	2.952A	1.194A	169.923	92.836%	330	<6.0	41.03°C	0.937
	12.009V	5.086V	3.354V	5.026V	183.037				45.68°C	229.75V
30%	18.232A	3.443A	3.447A	1.397A	254.923	94.236%	339	<6.0	41.1°C	0.966
	12.005V	5.083V	3.351V	5.011V	270.515				46.24°C	229.74V
40%	24.913A	3.937A	3.943A	1.602A	340.009	94.481%	402	<6.0	41.38°C	0.974
	11.994V	5.08V	3.348V	4.995V	359.873				46.89°C	229.72V
50%	31.238A	4.926A	4.934A	1.807A	424.803	94.552%	480	11.2	42.13°C	0.977
	11.983V	5.075V	3.344V	4.98V	449.278				48.17°C	229.71V
60%	37.552A	5.92A	5.928A	2A	509.272	94.503%	558	11.4	42.66°C	0.98
	11.971V	5.068V	3.34V	4.963V	538.893				49.21°C	229.69V
70%	43.943A	6.913A	6.925A	2.223A	594.657	94.243%	649	15.7	43.52°C	0.981
	11.959V	5.063V	3.336V	4.947V	630.982				50.55°C	229.67V
80%	50.348A	7.905A	7.924A	2.328A	679.476	93.863%	741	22.7	43.85°C	0.981
	11.948V	5.061V	3.331V	4.939V	723.905				51.88°C	229.66V
90%	57.165A	8.407A	8.413A	2.436A	764.868	93.327%	999	26.9	44.33°C	0.981
	11.937V	5.055V	3.328V	4.926V	819.551				53.36°C	229.64V
100%	63.726A	8.903A	8.932A	3.069A	849.68	92.853%	1327	35.7	45.31°C	0.981
	11.926V	5.054V	3.325V	4.887V	915.085				55.34°C	229.63V
110%	70.167A	9.902A	10.027A	3.071A	934.279	92.316%	1601	39.8	46.59°C	0.98
	11.915V	5.049V	3.321V	4.883V	1012.043				57.49°C	229.61V
CL1	1.997A	14.263A	14.309A	0.492A	146.392	88.667%	584	13.2	41.2°C	0.93
	12.013V	5.062V	3.334V	5.079V	165.103				46.65°C	229.75V
CL2	1.996A	23.065A	0.989A	0.491A	146.378	87.429%	619	14.9	40.73°C	0.931
	12.014V	5.055V	3.337V	5.093V	167.428				47.82°C	229.75V
CL3	1.994A	0.986A	22.303A	0.495A	105.701	85.232%	568	12.1	41.38°C	0.893
	12.035V	5.07V	3.328V	5.052V	124.016				50.48°C	229.76V
CL4	70.322A	0.986A	0.99A	0.498A	849.807	93.473%	936	26.3	45.38°C	0.981
	11.931V	5.068V	3.331V	5.023V	909.149				55.99°C	229.63V

Anex

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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	1.232A	0.49A	0.491A	0.197A	19.987	75.823%	319	<6.0	36.51°C	0.454
	12.037V	5.096V	3.362V	5.086V	26.361				39.56°C	229.78V
40W	2.716A	0.687A	0.688A	0.295A	39.988	85.125%	321	<6.0	37.95°C	0.659
	12.029V	5.094V	3.36V	5.079V	46.978				41.25°C	229.77V
60W	4.202A	0.883A	0.884A	0.394A	59.988	88.005%	322	<6.0	38.08°C	0.771
	12.021V	5.092V	3.358V	5.072V	68.168				41.57°C	229.77V
80W	5.680A	1.08A	1.081A	0.493A	79.929	89.56%	321	<6.0	39.36°C	0.835
	12.025V	5.091V	3.356V	5.065V	89.209				43.23°C	229.77V

RIPPLE MEASUREMENTS 230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	9.47mV	12.62mV	14.32mV	12.69mV	Pass
20% Load	10.18mV	13.54mV	16.06mV	11.25mV	Pass
30% Load	41.53mV	14.66mV	17.24mV	11.56mV	Pass
40% Load	37.43mV	21.92mV	31.92mV	18.05mV	Pass
50% Load	16.01mV	16.81mV	22.35mV	11.92mV	Pass
60% Load	14.22mV	15.99mV	18.16mV	11.61mV	Pass
70% Load	15.25mV	16.91mV	20.10mV	12.28mV	Pass
80% Load	15.96mV	18.24mV	20.46mV	12.84mV	Pass
90% Load	17.09mV	18.65mV	20.87mV	12.33mV	Pass
100% Load	25.64mV	23.03mV	24.00mV	15.19mV	Pass
110% Load	26.39mV	21.97mV	25.57mV	15.85mV	Pass
Crossload1	14.81mV	15.63mV	19.14mV	12.88mV	Pass
Crossload2	10.85mV	22.12mV	20.15mV	12.02mV	Pass
Crossload3	9.92mV	14.00mV	19.59mV	10.59mV	Pass
Crossload4	24.67mV	21.11mV	21.99mV	13.44mV	Pass

Anex

be quiet! Dark Power 13 850W

Top side

Power specifications label

CERTIFICATIONS 115V

CYBENETICS TITANIUM

CYBENETICS A++

CERTIFICATIONS 230V

CYBENETICS TITANIUM 230v

CYBENETICS A++ 230v

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