Anex

Bitfenix Formula Gold 650W (#2)

Lab ID#: 210
Receipt Date: May 27, 2018
Test Date: Jun 9, 2018

Report:
Report Date: Jun 11, 2018

DUT INFORMATION

Brand	Bitfenix
Manufacturer (OEM)	Channel Well Technology
Series	Formula Gold Series
Model Number	BF650G
Serial Number	735Q00228
DUT Notes	

DUT SPECIFICATIONS

Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10
Rated Frequency (Hz)	47-63
Rated Power (W)	650
Type	ATX12V
Cooling	120mm Rifle Bearing Fan (DF1202512SEMN)
Semi-Passive Operation	✗
Cable Design	Fixed cables

TEST EQUIPMENT

Electronic Loads	Chroma 6314A x2 63123A x6 63102A 63101A	Chroma 63601-5 x2 Chroma 63600-2 63640-80-80 x10 63610-80-20
AC Sources	Chroma 6530, Chroma 61604	
Power Analyzers	N4L PPA1530, N4L PPA5530	
Oscilloscopes	Picoscope 4444 & 3424, Keysight DSOX3024A, Rigol DS2072A	
Voltmeter	Keithley 2015 THD 6.5 Digit	
Sound Analyzer	Bruel & Kjaer 2250-L G4	
Microphone	Bruel & Kjaer Type 4955-A, Bruel & Kjaer Type 4189	
Data Loggers	Picoscope TC-08 x2, Labjack U3-HV 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	89.555%
Efficiency With 10W (≤500W) or 2% (>500W)	0.000
Average Efficiency 5VSB	77.896%
Standby Power Consumption (W)	0.0489137
Average PF	0.985
Avg Noise Output	15.94 dB(A)
Efficiency Rating (ETA)	PLATINUM
Noise Rating (LAMBDA)	A+

230V

Average Efficiency	90.941%
Average Efficiency 5VSB	77.944%
Standby Power Consumption (W)	0.0772634
Average PF	0.950
Avg Noise Output	15.48 dB(A)
Efficiency Rating (ETA)	GOLD
Noise Rating (LAMBDA)	A+

POWER SPECIFICATIONS

Rail		3.3V	5V	12V1	12V2	12V3	12V4	5VSB	-12V
Max. Power	Amps	20	20	25	25	30	30	2.5	0.3
	Watts	100		650				12.5	3.6
Total Max. Power (W)		650							

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

Hold-Up Time (ms)	19.6
AC Loss to PWR_OK Hold Up Time (ms)	16.1
PWR_OK Inactive to DC Loss Delay (ms)	3.5

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CABLES AND CONNECTORS

Captive Cables

Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (650mm)	1	1	18-22AWG	No
4+4 pin EPS12V (670mm+150mm)	1	2	18AWG	No
6+2 pin PCIe (570mm+150mm)	2	4	18AWG	No
SATA (500mm+150mm+150mm+150mm)	1	4	18AWG	No
SATA (500mm+150mm) / 4 pin Molex (+150mm+150mm)	2	4 / 4	18AWG	No

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General Data	
Manufacturer (OEM)	CWT
Platform Model	GPS (Modified)
Primary Side	
Transient Filter	4x Y caps, 2x X caps, 2x CM chokes, 1x MOV, 1x CAP004DG
Inrush Protection	NTC Thermistor & Relay
Bridge Rectifier(s)	1x GBU1006 (800V, 10A @ 100°C)
APFC MOSFETS	2x Champion GP28S50G (500 V, 28 A @ 150°C, 0.125 Ohm)
APFC Boost Diode	1x STTH8S06D (600V, 8A @ 175°C)
Hold-up Cap(s)	1x Nichicon (400V, 680uF, 105°C, GG series, 2000h @ 105°C)
Main Switchers	2x Champion CMS6020
APFC Controller	Champion CM6502S & CM03X Green PFC controller
LLC Resonant Controller	Champion CM6901
Topology	Primary side: Half-Bridge & LLC Resonant Converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	
+12V MOSFETS	4x Inte ational Rectifier IRFH7004TRPBF (40 V, 164 A @ 100°C, 1.4Ohm)
5V & 3.3V	DC-DC Converters: 2x UBIQ QM3006D FETs (30 V, 57 A @ 100°C, 5.5Ohm) 2x UBIQ QM3016D FETs (30 V, 68 A @ 100°C, 4Ohm) PWM Controller: ANPEC APW7159C
Filtering Capacitors	Electrolytics: Chemi-Con (105°C, KY series, KZE series) Polymers: FPCAP (Japan)
Supervisor IC	Sytronix ST9S429-PG14 (OCP [2x 12V channels, OVP, UVP, PG), Weltrend WD7518D (OCP [2x 12V channels], SCP) & UTC LM393G
Fan Model	Martech DF1202512SEMN (120 mm, 12 V, 0.37 A, 2000 RPM, Fluid Dynamic Bearing)
5VSB Circuit	
Standby PWM Controller	TinySwitch-LT TNY177PN (18W Peak)

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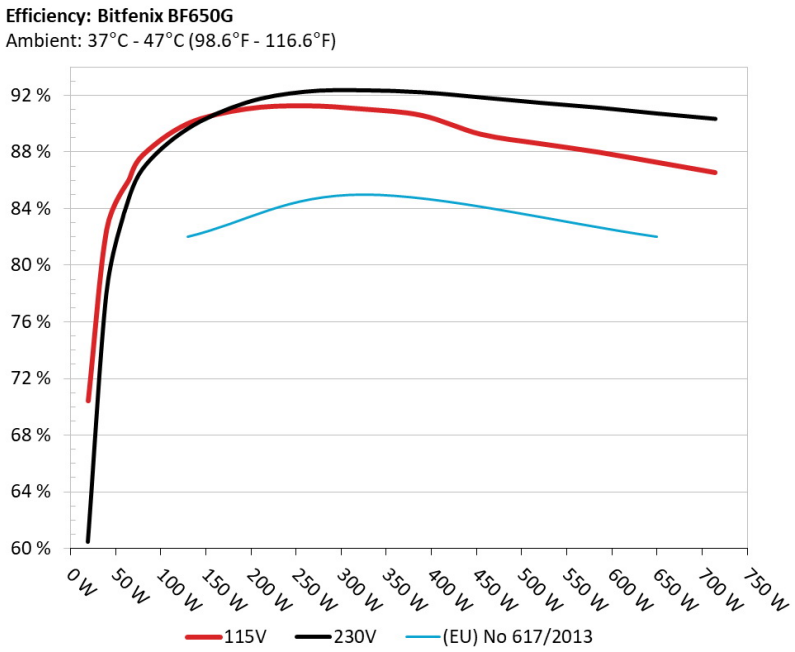
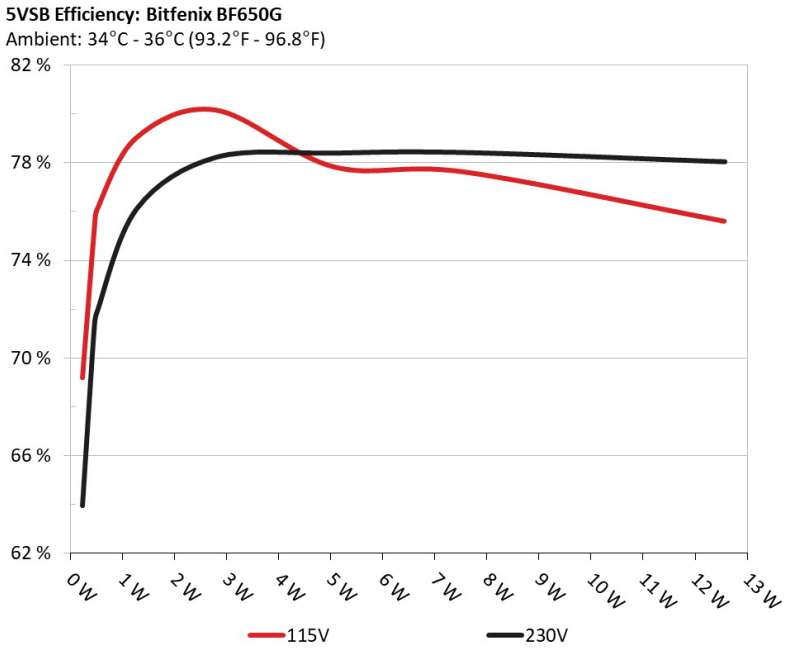
EFFICIENCY UNDER HIGH AMBIENT TEMPERATURE



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	0.229	69.184%	0.024
	5.089V	0.331		115.28V
2	0.090A	0.458	75.329%	0.044
	5.088V	0.608		115.28V
3	0.550A	2.793	80.166%	0.218
	5.078V	3.484		115.27V
4	1.000A	5.066	77.831%	0.331
	5.067V	6.509		115.27V
5	1.500A	7.579	77.622%	0.401
	5.053V	9.764		115.27V
6	2.499A	12.562	75.606%	0.469
	5.026V	16.615		115.25V

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

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.229	63.966%	0.009
	5.089V	0.358		230.67V
2	0.090A	0.458	71.340%	0.016
	5.089V	0.642		230.67V
3	0.550A	2.793	78.213%	0.086
	5.078V	3.571		230.73V
4	1.000A	5.066	78.385%	0.147
	5.066V	6.463		230.73V
5	1.500A	7.578	78.407%	0.205
	5.052V	9.665		230.73V
6	2.499A	12.564	78.032%	0.290
	5.027V	16.101		230.78V

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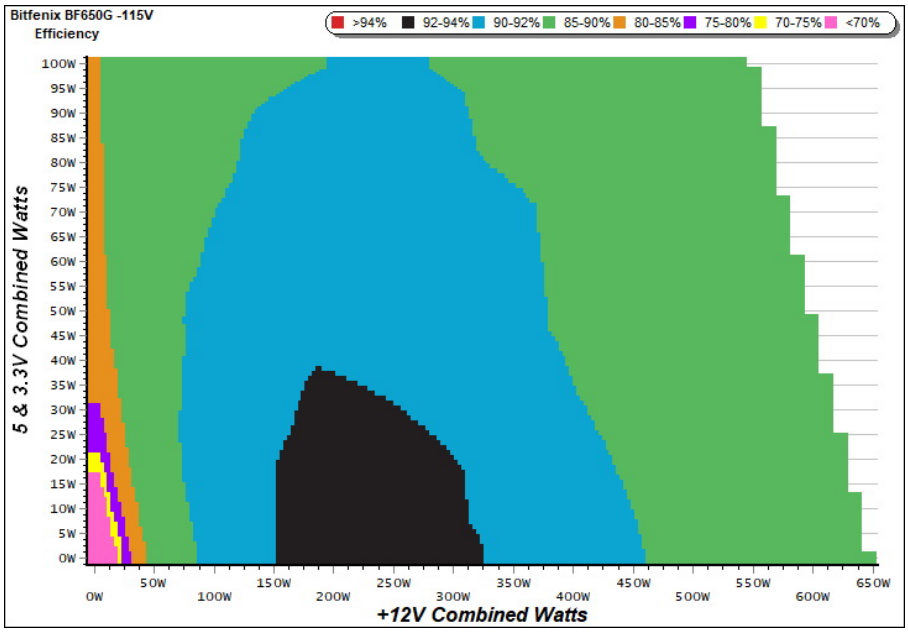
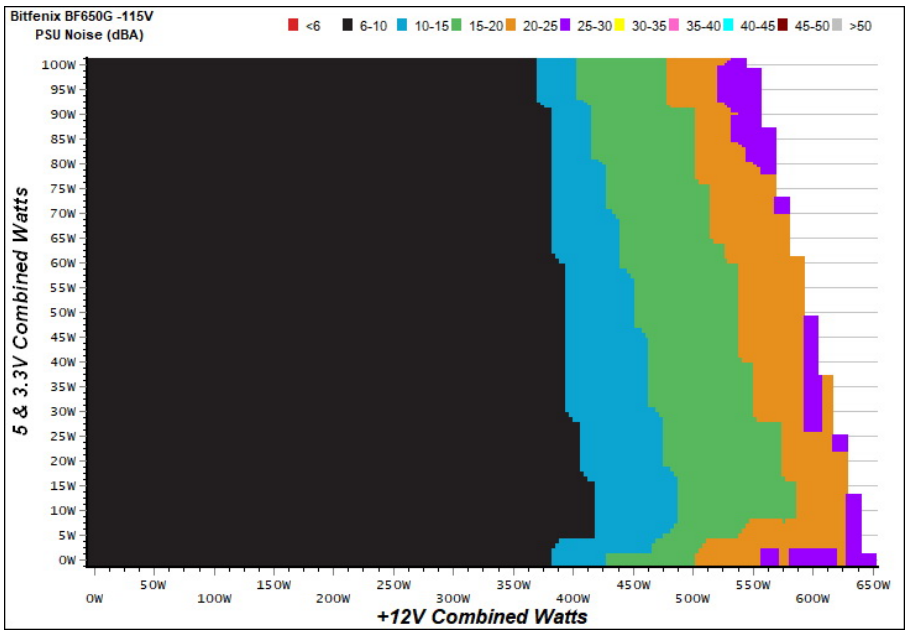
EFFICIENCY GRAPH 115V



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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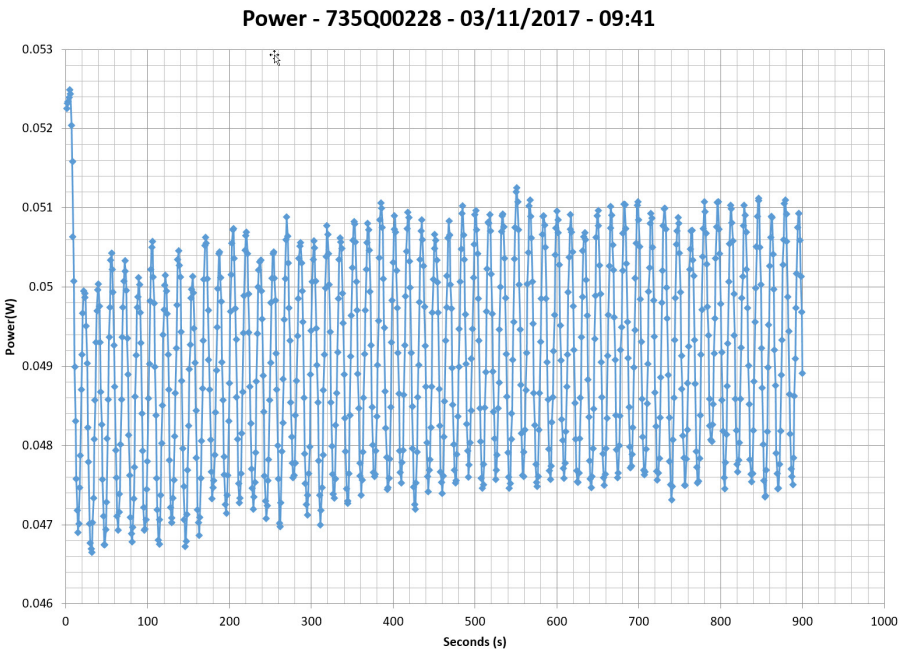
VAMPIRE POWER -115V



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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Bitfenix Formula Gold 650W (#2)

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	3.567A	1.980A	1.974A	0.990A	64.753	86.052%	480	9.6	38.08°C	0.959
	12.097V	5.050V	3.344V	5.054V	75.249				45.18°C	115.29V
2	8.137A	2.970A	2.961A	1.190A	129.268	90.016%	480	9.6	38.36°C	0.980
	12.090V	5.048V	3.343V	5.042V	143.605				46.78°C	115.20V
3	13.107A	3.468A	3.441A	1.392A	194.387	91.064%	480	9.6	38.87°C	0.986
	12.084V	5.047V	3.341V	5.031V	213.462				49.08°C	115.11V
4	18.083A	3.965A	3.949A	1.594A	259.620	91.288%	480	9.6	39.58°C	0.988
	12.079V	5.045V	3.340V	5.020V	284.396				52.09°C	115.12V
5	22.727A	4.957A	4.941A	1.798A	324.910	91.053%	480	9.6	40.56°C	0.990
	12.074V	5.044V	3.339V	5.007V	356.836				54.02°C	115.02V
6	27.315A	5.952A	5.933A	2.003A	389.451	90.605%	480	9.6	41.00°C	0.990
	12.068V	5.041V	3.338V	4.995V	429.834				55.06°C	114.93V
7	31.981A	6.948A	6.921A	2.209A	454.770	89.278%	984	25.5	42.15°C	0.990
	12.059V	5.039V	3.337V	4.982V	509.385				56.69°C	114.93V
8	36.652A	7.943A	7.917A	2.415A	520.071	88.618%	1190	31.4	43.44°C	0.991
	12.050V	5.037V	3.335V	4.970V	586.871				58.18°C	114.83V
9	41.728A	8.441A	8.399A	2.418A	584.994	88.013%	1515	37.0	44.04°C	0.992
	12.042V	5.035V	3.334V	4.964V	664.665				59.07°C	114.73V
10	46.740A	8.941A	8.913A	2.523A	649.727	87.297%	1844	41.9	45.32°C	0.993
	12.035V	5.034V	3.332V	4.956V	744.270				60.44°C	114.63V
11	52.149A	8.943A	8.915A	2.526A	714.562	86.572%	2043	44.7	47.29°C	0.994
	12.030V	5.033V	3.331V	4.950V	825.394				62.69°C	114.62V
CL1	0.736A	12.001A	12.000A	0.000A	109.403	85.213%	505	8.9	44.29°C	0.978
	12.090V	5.033V	3.342V	5.059V	128.388				54.92°C	115.22V
CL2	54.173A	1.001A	1.001A	1.000A	665.843	87.905%	2043	44.7	46.35°C	0.993
	12.044V	5.038V	3.333V	5.004V	757.458				58.93°C	114.62V

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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	1.179A	0.493A	0.474A	0.197A	19.337	70.442%	480	9.6	0.830
	12.094V	5.053V	3.345V	5.081V	27.451				115.35V
2	2.440A	0.989A	0.985A	0.394A	39.811	82.554%	480	9.6	0.923
	12.099V	5.052V	3.345V	5.074V	48.224				115.32V
3	3.631A	1.484A	1.462A	0.592A	59.307	86.093%	480	9.6	0.952
	12.097V	5.050V	3.344V	5.066V	68.887				115.30V
4	4.890A	1.980A	1.972A	0.791A	79.738	87.801%	480	9.6	0.966
	12.095V	5.050V	3.343V	5.059V	90.817				115.28V

RIPPLE MEASUREMENTS 115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	10.7 mV	6.1 mV	5.0 mV	11.0 mV	Pass
20% Load	15.8 mV	6.6 mV	5.4 mV	12.1 mV	Pass
30% Load	17.9 mV	7.2 mV	6.1 mV	13.1 mV	Pass
40% Load	19.4 mV	8.1 mV	7.3 mV	13.9 mV	Pass
50% Load	19.7 mV	9.8 mV	10.4 mV	14.1 mV	Pass
60% Load	21.6 mV	15.0 mV	10.9 mV	17.6 mV	Pass
70% Load	22.9 mV	11.9 mV	13.7 mV	25.9 mV	Pass
80% Load	22.8 mV	12.5 mV	12.4 mV	18.5 mV	Pass
90% Load	25.0 mV	14.5 mV	13.1 mV	17.2 mV	Pass
100% Load	25.8 mV	14.3 mV	13.6 mV	17.8 mV	Pass
110% Load	26.2 mV	18.0 mV	17.9 mV	18.5 mV	Pass
Crossload 1	18.0 mV	15.4 mV	18.8 mV	7.5 mV	Pass
Crossload 2	23.9 mV	11.2 mV	12.0 mV	17.2 mV	Pass

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230V

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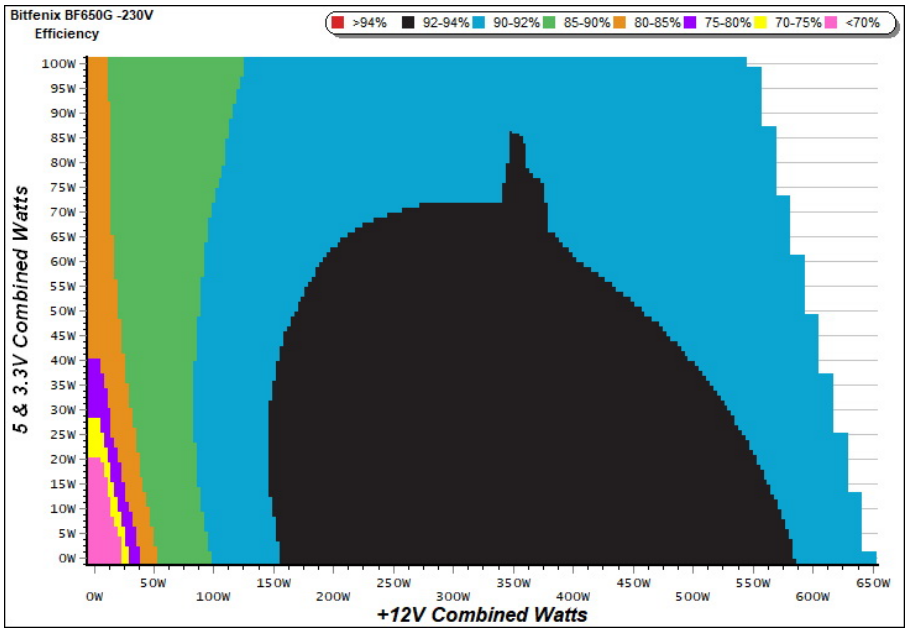
EFFICIENCY GRAPH 230V



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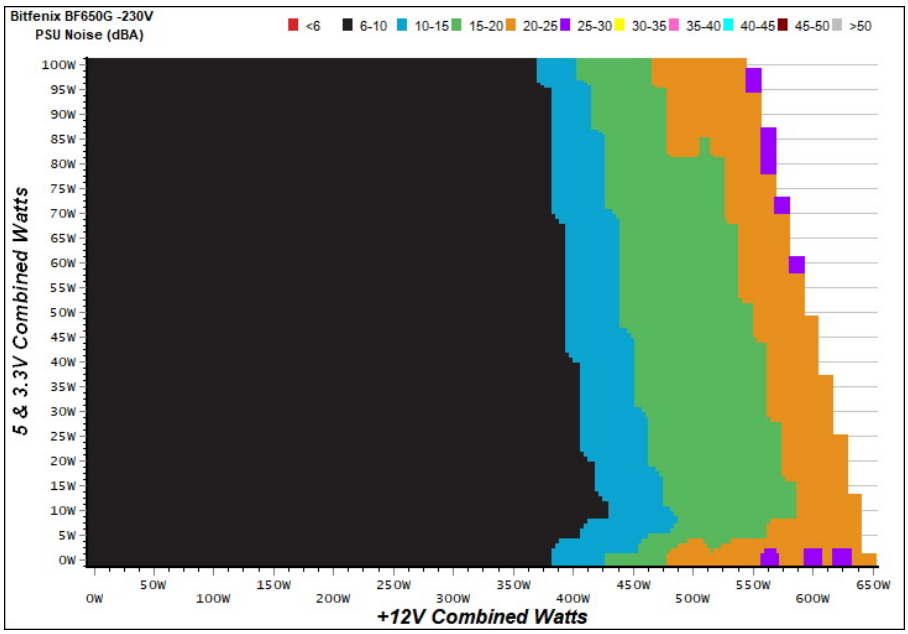
NOISE GRAPH 230V



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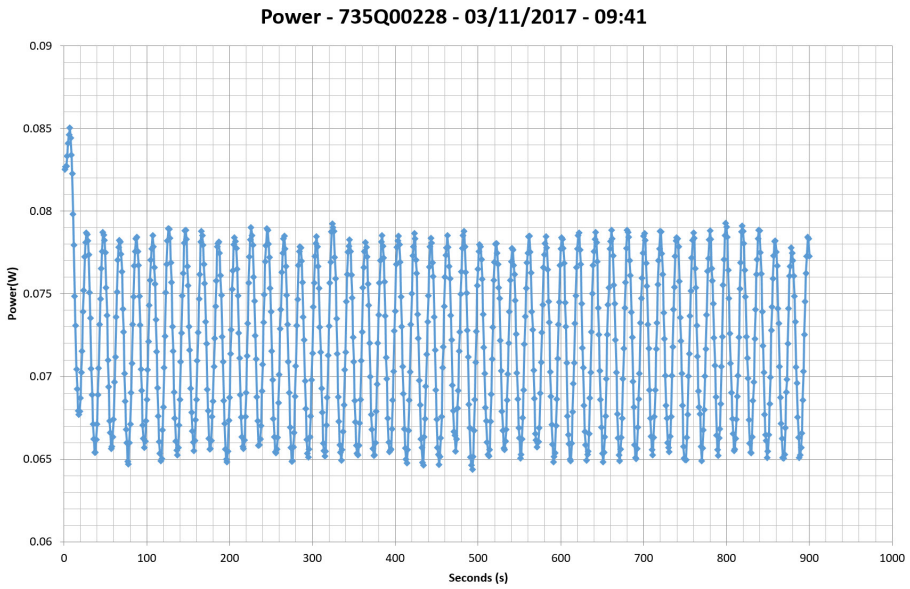
VAMPIRE POWER -230V



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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
1	3.584A	1.983A	1.975A	0.990A	64.945	83.381%	480	9.6	40.14°C	0.818
	12.093V	5.045V	3.341V	5.051V	77.889				46.24°C	230.33V
2	8.154A	2.978A	2.966A	1.192A	129.455	89.408%	480	9.6	40.61°C	0.915
	12.085V	5.040V	3.338V	5.036V	144.791				47.14°C	230.34V
3	13.118A	3.478A	3.448A	1.394A	194.551	91.292%	480	9.6	41.03°C	0.947
	12.085V	5.036V	3.336V	5.023V	213.108				48.84°C	230.34V
4	18.092A	3.977A	3.958A	1.597A	259.738	92.088%	480	9.6	41.15°C	0.961
	12.079V	5.032V	3.333V	5.010V	282.055				49.58°C	230.33V
5	22.743A	4.974A	4.953A	1.802A	325.007	92.070%	553	11.7	41.96°C	0.970
	12.070V	5.027V	3.330V	4.995V	352.999				51.06°C	230.32V
6	27.344A	5.975A	5.951A	2.008A	389.515	91.920%	740	17.0	42.16°C	0.974
	12.058V	5.022V	3.326V	4.981V	423.753				51.77°C	230.30V
7	32.020A	6.978A	6.953A	2.216A	454.824	91.586%	985	25.8	42.96°C	0.977
	12.046V	5.017V	3.322V	4.966V	496.611				53.10°C	230.30V
8	36.701A	7.984A	7.958A	2.424A	520.111	91.160%	1220	31.9	43.98°C	0.980
	12.035V	5.011V	3.318V	4.951V	570.545				54.64°C	230.30V
9	41.790A	8.493A	8.453A	2.428A	585.038	90.807%	1545	36.8	44.93°C	0.981
	12.025V	5.005V	3.313V	4.943V	644.266				56.25°C	230.30V
10	46.822A	9.002A	8.980A	2.535A	649.776	90.368%	1799	41.7	45.45°C	0.982
	12.015V	4.999V	3.308V	4.932V	719.032				57.25°C	230.29V
11	52.253A	9.016A	8.993A	2.539A	714.607	89.989%	2043	44.7	46.43°C	0.983
	12.007V	4.992V	3.302V	4.924V	794.104				58.64°C	230.29V
CL1	0.144A	12.000A	12.001A	0.000A	102.039	84.109%	480	9.6	42.43°C	0.894
	12.081V	5.026V	3.332V	5.049V	121.318				52.44°C	230.29V
CL2	54.181A	1.000A	0.999A	1.000A	664.768	91.179%	1830	41.9	45.11°C	0.983
	12.024V	5.002V	3.310V	4.987V	729.082				56.74°C	230.29V

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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	1.205A	0.493A	0.478A	0.197A	19.670	60.382%	480	9.6	0.565
	12.100V	5.051V	3.344V	5.080V	32.576				230.32V
2	2.460A	0.993A	0.987A	0.395A	40.067	77.715%	480	9.6	0.711
	12.094V	5.049V	3.343V	5.072V	51.556				230.32V
3	3.648A	1.488A	1.464A	0.593A	59.519	83.406%	480	9.6	0.798
	12.093V	5.046V	3.342V	5.064V	71.361				230.33V
4	4.907A	1.984A	1.977A	0.792A	79.943	86.606%	480	9.6	0.851
	12.090V	5.045V	3.341V	5.055V	92.307				230.33V

RIPPLE MEASUREMENTS 230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	6.8 mV	7.0 mV	9.1 mV	10.6 mV	Pass
20% Load	9.8 mV	8.1 mV	9.4 mV	11.9 mV	Pass
30% Load	27.4 mV	9.4 mV	10.2 mV	12.7 mV	Pass
40% Load	17.1 mV	10.3 mV	14.8 mV	13.7 mV	Pass
50% Load	16.5 mV	9.7 mV	12.0 mV	14.0 mV	Pass
60% Load	17.9 mV	11.1 mV	11.4 mV	17.5 mV	Pass
70% Load	19.7 mV	12.3 mV	13.0 mV	24.6 mV	Pass
80% Load	21.4 mV	12.8 mV	13.9 mV	17.7 mV	Pass
90% Load	22.9 mV	14.9 mV	13.9 mV	16.2 mV	Pass
100% Load	31.5 mV	17.1 mV	16.0 mV	17.5 mV	Pass
110% Load	32.4 mV	24.1 mV	20.6 mV	18.3 mV	Pass
Crossload 1	17.1 mV	16.1 mV	21.7 mV	10.9 mV	Pass
Crossload 2	26.1 mV	15.2 mV	13.3 mV	16.6 mV	Pass

Anex

Bitfenix Formula Gold 650W (#2)

Top side

Power specifications label

CERTIFICATIONS 115V

Aristeidis Bitziopoulos
Lab Director

CERTIFICATIONS 230V