EFFICIENCY AND NOISE LEVEL CERTIFICATIONS

Anex

Thermaltake Toughpower GF2 ARGB 650W

Lab ID#: TT65001817
Receipt Date: Feb 22, 2021
Test Date: Mar 23, 2021

Report: 21PS1817A
Report Date: Apr 14, 2021

DUT INFORMATION

Brand	Thermaltake
Manufacturer (OEM)	High Power
Series	Toughpower GF2 ARGB
Model Number	TTP-650AH3FSG-A
Serial Number	PSTPD0650F3FAGU2XR000166
DUT Notes	

DUT SPECIFICATIONS

Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10
Rated Frequency (Hz)	50-60
Rated Power (W)	650
Type	ATX12V
Cooling	140mm Hydraulic Bearing Fan [TT-1425 (A1425S12S-2)]
Semi-Passive Operation	✓ (selectable)
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
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	88.679%
Efficiency With 10W (≤500W) or 2% (>500W)	50.868
Average Efficiency 5VSB	78.559%
Standby Power Consumption (W)	0.0705409
Average PF	0.994
Avg Noise Output	34.51 dB(A)
Efficiency Rating (ETA)	GOLD
Noise Rating (LAMBDA)	Standard++

230V

Average Efficiency	90.118%
Average Efficiency 5VSB	77.347%
Standby Power Consumption (W)	0.1201250
Average PF	0.965
Avg Noise Output	34.33 dB(A)
Efficiency Rating (ETA)	GOLD
Noise Rating (LAMBDA)	Standard++

POWER SPECIFICATIONS

Rail		3.3V	5V	12V	5VSB	-12V
Max. Power	Amps	22	22	54.2	3	0.3
	Watts	120		650	15	3.6
Total Max. Power (W)		650				

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

Hold-Up Time (ms)	20.3
AC Loss to PWR_OK Hold Up Time (ms)	17.5
PWR_OK Inactive to DC Loss Delay (ms)	2.8

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CABLES AND CONNECTORS

Modular Cables

Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (610mm)	1	1	18AWG	No
4+4 pin EPS12V (660mm)	1	1	16AWG	No
8 pin EPS12V (660mm)	1	1	16AWG	No
6+2 pin PCIe (500mm+160mm)	2	4	16-18AWG	No
SATA (510mm+160mm+160mm)	3	9	18AWG	No
4-pin Molex (500mm+150mm+150mm+150mm)	1	4	18AWG	No
FDD Adapter (+160mm)	1	1	22AWG	No
ARGB Sync Cable (610mm+160mm)	1	2	26AWG	No
AC Power Cord (1400mm) - C13 coupler	1	1	18AWG	-

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General Data	-
Manufacturer (OEM)	High Power
PCB Type	Double Sided
Primary Side	-
Transient Filter	4x Y caps, 2x X caps, 2x CM chokes, 1x MOV, 1x Champion CMD02X (Discharge IC)
Inrush Protection	-
Bridge Rectifier(s)	2x HY GBU1506L (600V, 15A @ 100°C)
APFC MOSFETs	2x Infineon IPA60R230P6 (600V, 10.7A @ 100°C, Rds(on): 0.23Ohm)
APFC Boost Diode	1x Infineon IDH06G65C5 (650V, 6A @ 145°C)
Bulk Cap(s)	2x Nichicon (400V, 330uF each or 660uF combined, 2,000h @ 105°C, GG)
Main Switchers	2x Infineon IPA60R280P7S (600V, 8A @ 100°C, Rds(on): 0.28Ohm)
APFC Controller	Infineon ICE3PCS01G
Resonant Controller	Champion CM6901X
Topology	Primary side: APFC, Half-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	-
+12V MOSFETs	4x Infineon BSC027N04LS (40V, 88A @ 100°C, Rds(on): 2.7mOhm)
5V & 3.3V	DC-DC Converters: 6x Infineon BSC0906NS (30V, 40A @ 100°C, Rds(on): 4.5mOhm) PWM Controller(s): ANPEC APW7159C
Filtering Capacitors	Electrolytic: 3x Nippon Chemi-Con (1-5,000h @ 105°C, KZE), 4x Nippon Chemi-Con (4-10,000h @ 105°C, KY), 2x Rubycon (3-6,000h @ 105°C, YXG), 1x Rubycon (6-10,000h @ 105°C, ZLH) Polymer: 15x FPCAP, 2x NIC
Supervisor IC	WT7527RA (OCP, OVP, UVP, SCP, PG)
Fan Model	Thermaltake TT-1425 A1425S12S-2 (140mm, 12V, 0.70A, Hydraulic Bearing Fan)
Fan Controller	STC STC15W401AS
5VSB Circuit	-
Rectifier	1x PFC P10V45SP SBR (45V, 10A), UTC 2N70L FET (700V, 2A, 6.3Ohm)
Standby PWM Controller	SI8016HSP8
-12V	-
Rectifier	1x KEC KIA7912PI (-12V, 1A)

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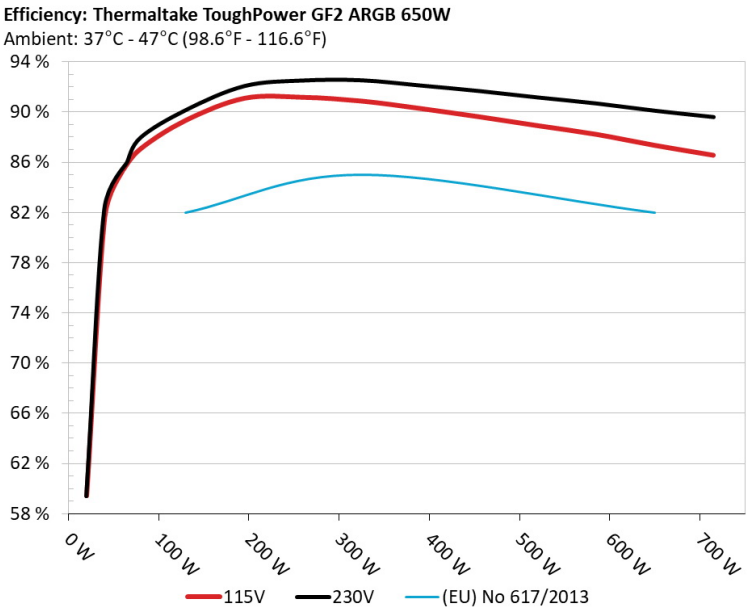
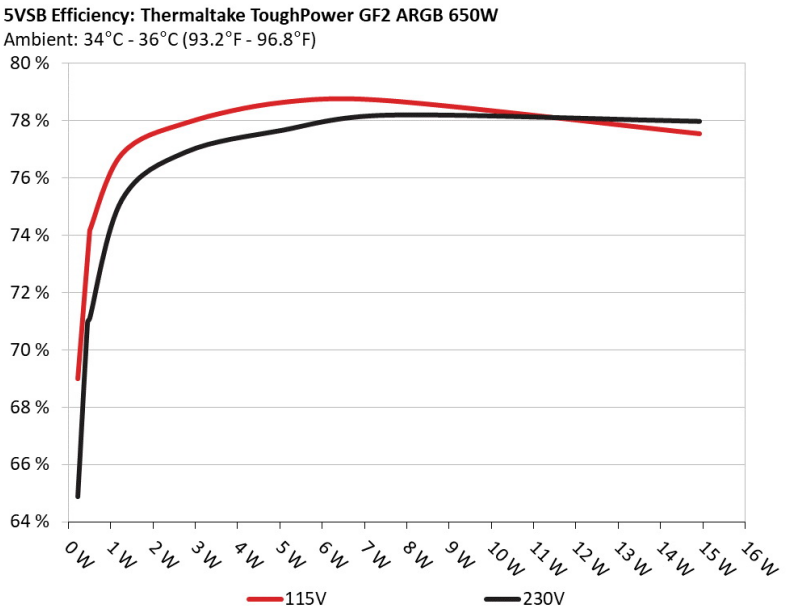
EFFICIENCY UNDER HIGH AMBIENT TEMPERATURE



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	68.976%	0.050
	5.096V	0.332		115.15V
2	0.090A	0.459	74.152%	0.090
	5.095V	0.619		115.15V
3	0.550A	2.793	77.908%	0.281
	5.077V	3.585		115.14V
4	1.000A	5.060	78.620%	0.329
	5.059V	6.436		115.14V
5	1.500A	7.559	78.682%	0.356
	5.039V	9.607		115.14V
6	2.999A	14.925	77.528%	0.413
	4.976V	19.251		115.13V

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

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.229	64.873%	0.016
	5.096V	0.353		230.35V
2	0.090A	0.459	70.943%	0.030
	5.095V	0.647		230.32V
3	0.550A	2.793	76.900%	0.145
	5.076V	3.632		230.34V
4	1.000A	5.059	77.652%	0.217
	5.058V	6.515		230.33V
5	1.500A	7.557	78.181%	0.267
	5.038V	9.666		230.33V
6	3.000A	14.923	77.964%	0.344
	4.975V	19.141		230.32V

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115V

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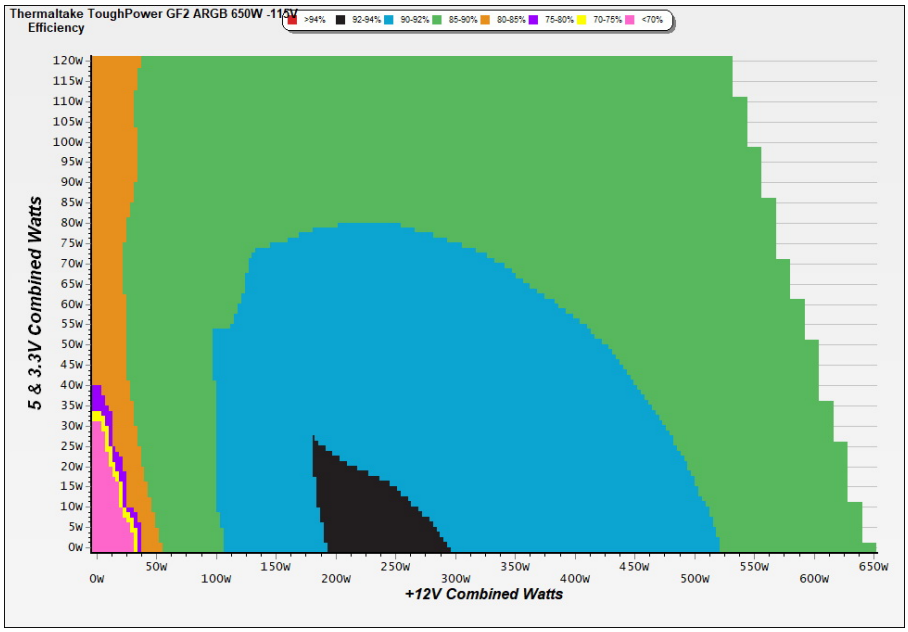
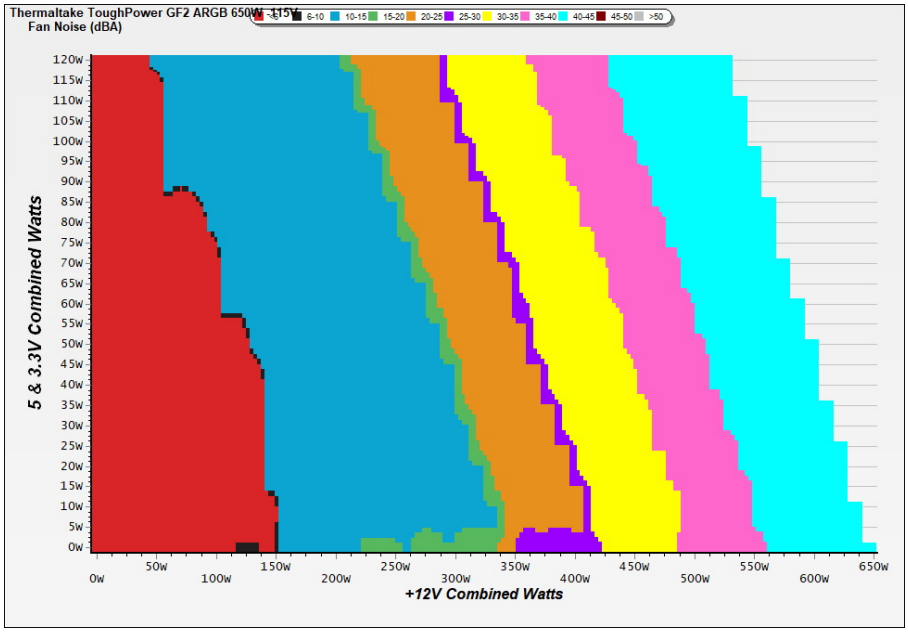
EFFICIENCY GRAPH 115V



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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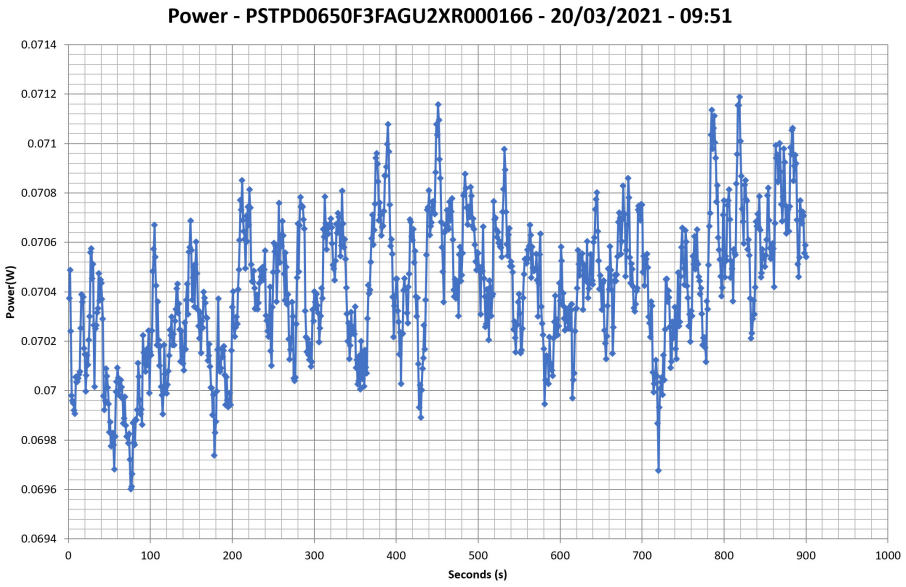
VAMPIRE POWER -115V



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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Thermaltake Toughpower GF2 ARGB 650W

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	3.601A	1.984A	1.985A	0.992A	64.955	85.360%	0	<6.0	44.86°C	0.975
	12.038V	5.041V	3.326V	5.042V	76.095				40.85°C	115.29V
2	8.236A	2.976A	2.978A	1.196A	130.008	89.342%	601	13.3	40.92°C	0.989
	12.034V	5.038V	3.324V	5.020V	145.518				45.85°C	115.18V
3	13.210A	3.479A	3.477A	1.400A	195.009	91.095%	609	13.6	41.31°C	0.995
	12.032V	5.034V	3.322V	5.002V	214.073				46.81°C	115.13V
4	18.197A	3.976A	3.977A	1.606A	260.010	91.168%	612	14.0	41.58°C	0.997
	12.024V	5.031V	3.320V	4.982V	285.198				47.70°C	115.11V
5	22.844A	4.974A	4.972A	1.815A	325.045	90.866%	616	14.1	41.74°C	0.997
	12.018V	5.028V	3.317V	4.961V	357.721				48.59°C	115.13V
6	27.445A	5.973A	5.974A	2.000A	389.336	90.284%	884	25.6	42.15°C	0.997
	12.011V	5.024V	3.315V	4.941V	431.234				50.18°C	115.12V
7	32.126A	6.973A	6.975A	2.237A	454.762	89.619%	1086	31.9	43.35°C	0.998
	12.004V	5.021V	3.313V	4.918V	507.439				52.29°C	115.11V
8	36.816A	7.975A	7.976A	2.451A	520.100	88.907%	1206	35.5	43.54°C	0.998
	11.997V	5.018V	3.310V	4.896V	584.992				52.56°C	115.12V
9	41.908A	8.477A	8.464A	2.458A	585.033	88.218%	1490	41.3	44.89°C	0.998
	11.991V	5.015V	3.308V	4.883V	663.170				54.43°C	115.16V
10	46.734A	8.979A	8.985A	3.098A	649.867	87.342%	1492	41.1	45.42°C	0.998
	11.986V	5.012V	3.306V	4.844V	744.048				55.53°C	115.12V
11	52.157A	8.984A	8.986A	3.106A	714.702	86.556%	1493	41.1	46.36°C	0.998
	11.983V	5.010V	3.304V	4.831V	825.714				57.26°C	115.12V
CL1	0.121A	14.002A	14.001A	0.000A	118.285	82.215%	623	14.5	41.43°C	0.989
	12.036V	5.029V	3.315V	5.038V	143.873				48.25°C	115.18V
CL2	54.172A	1.000A	1.002A	1.000A	663.411	88.228%	1490	41.3	45.73°C	0.998
	12.001V	5.023V	3.314V	4.949V	751.928				55.52°C	115.13V

Anex

Thermaltake Toughpower GF2 ARGB 650W

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	1.232A	0.496A	0.495A	0.197A	19.983	59.427%	0	<6.0	0.925
	12.039V	5.043V	3.328V	5.085V	33.626				115.22V
2	2.466A	0.992A	0.989A	0.394A	39.973	81.643%	0	<6.0	0.956
	12.036V	5.042V	3.328V	5.073V	48.961				115.22V
3	3.702A	1.488A	1.487A	0.593A	60.003	85.186%	0	<6.0	0.972
	12.035V	5.041V	3.327V	5.061V	70.438				115.24V
4	4.932A	1.983A	1.984A	0.793A	79.953	87.080%	0	<6.0	0.977
	12.035V	5.040V	3.326V	5.048V	91.816				115.27V

RIPPLE MEASUREMENTS 115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	26.70mV	7.50mV	4.90mV	5.80mV	Pass
20% Load	17.50mV	7.20mV	4.90mV	6.20mV	Pass
30% Load	9.00mV	7.20mV	5.20mV	5.70mV	Pass
40% Load	7.20mV	8.10mV	5.60mV	6.00mV	Pass
50% Load	7.50mV	8.70mV	6.30mV	6.20mV	Pass
60% Load	9.50mV	9.50mV	6.80mV	6.70mV	Pass
70% Load	9.90mV	11.00mV	7.20mV	6.90mV	Pass
80% Load	11.30mV	11.70mV	14.30mV	8.20mV	Pass
90% Load	11.50mV	12.30mV	15.10mV	8.20mV	Pass
100% Load	14.50mV	14.00mV	17.40mV	9.60mV	Pass
110% Load	16.60mV	14.10mV	17.00mV	10.20mV	Pass
Crossload1	16.50mV	9.70mV	15.50mV	16.30mV	Pass
Crossload2	15.80mV	12.20mV	8.90mV	8.30mV	Pass

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230V

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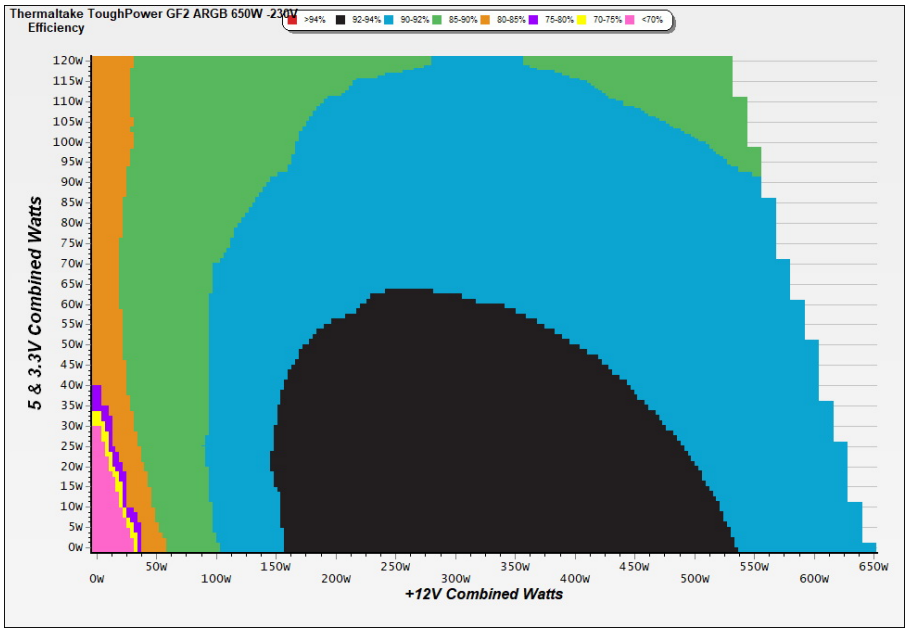
EFFICIENCY GRAPH 230V



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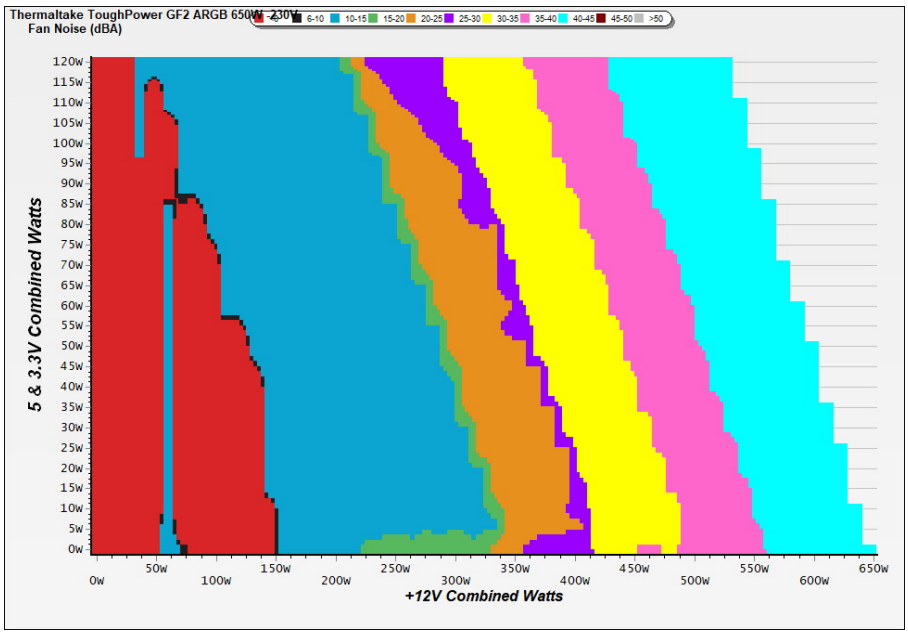
NOISE GRAPH 230V



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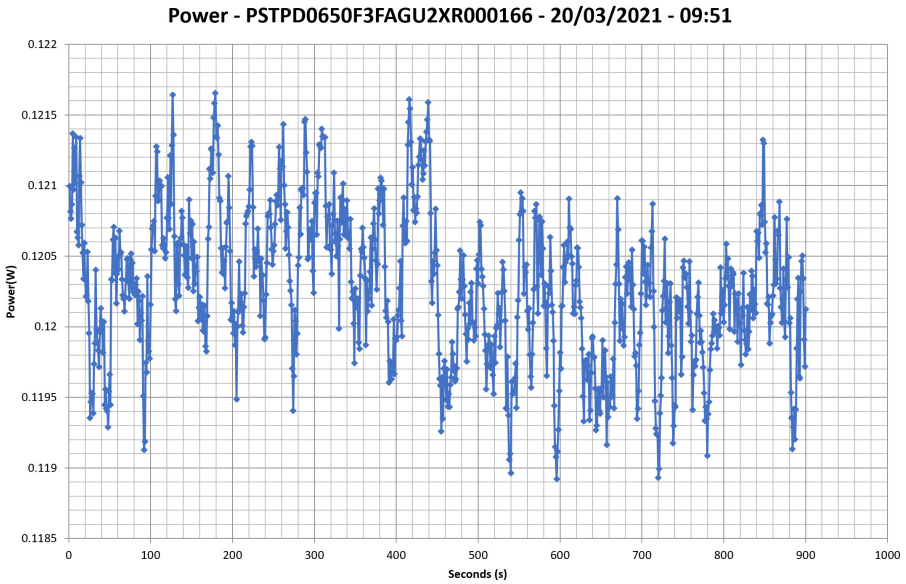
VAMPIRE POWER -230V



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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	3.602A	1.985A	1.985A	0.992A	64.962	85.593%	610	13.8	40.53°C	0.829
	12.037V	5.040V	3.325V	5.040V	75.896				44.14°C	230.38V
2	8.240A	2.980A	2.978A	1.196A	130.033	90.150%	611	13.8	40.71°C	0.926
	12.030V	5.036V	3.323V	5.019V	144.240				44.78°C	230.39V
3	13.216A	3.478A	3.477A	1.400A	195.040	92.067%	613	14.0	41.45°C	0.953
	12.030V	5.033V	3.321V	5.000V	211.846				46.03°C	230.39V
4	18.203A	3.978A	3.977A	1.607A	260.048	92.512%	615	14.1	41.91°C	0.965
	12.022V	5.030V	3.319V	4.980V	281.097				47.17°C	230.40V
5	22.852A	4.974A	4.976A	1.816A	325.080	92.527%	617	14.5	42.27°C	0.978
	12.015V	5.027V	3.317V	4.958V	351.337				48.14°C	230.41V
6	27.459A	5.974A	5.973A	2.000A	389.406	92.117%	888	25.9	42.87°C	0.983
	12.008V	5.023V	3.314V	4.938V	422.730				49.80°C	230.41V
7	32.138A	6.975A	6.974A	2.238A	454.833	91.674%	1087	31.9	43.17°C	0.988
	12.002V	5.020V	3.312V	4.915V	496.140				50.80°C	230.40V
8	36.829A	7.977A	7.976A	2.453A	520.137	91.158%	1209	35.6	44.11°C	0.991
	11.994V	5.016V	3.309V	4.894V	570.590				53.04°C	230.41V
9	41.921A	8.480A	8.466A	2.459A	585.059	90.681%	1494	41.2	44.71°C	0.993
	11.988V	5.013V	3.307V	4.881V	645.184				53.99°C	230.41V
10	46.752A	8.983A	8.984A	3.098A	649.883	90.100%	1497	41.0	45.87°C	0.995
	11.982V	5.010V	3.305V	4.843V	721.293				55.69°C	230.39V
11	52.170A	8.986A	8.991A	3.106A	714.706	89.599%	1499	40.9	47.24°C	0.997
	11.980V	5.008V	3.304V	4.830V	797.673				57.89°C	230.39V
CL1	0.121A	14.001A	14.001A	0.000A	118.253	83.095%	627	14.8	42.44°C	0.924
	12.034V	5.027V	3.315V	5.037V	142.311				48.17°C	230.39V
CL2	54.183A	1.000A	1.000A	1.000A	663.263	91.044%	1494	41.2	46.06°C	0.995
	11.996V	5.021V	3.313V	4.949V	728.507				55.54°C	230.40V

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Thermaltake Toughpower GF2 ARGB 650W

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	1.232A	0.496A	0.494A	0.197A	19.994	59.380%	0	<6.0	0.634
	12.050V	5.044V	3.329V	5.084V	33.671				230.38V
2	2.464A	0.992A	0.992A	0.395A	39.983	82.297%	0	<6.0	0.733
	12.044V	5.043V	3.328V	5.071V	48.584				230.38V
3	3.701A	1.487A	1.487A	0.593A	60.011	85.974%	0	<6.0	0.813
	12.042V	5.042V	3.327V	5.058V	69.801				230.38V
4	4.930A	1.984A	1.984A	0.793A	79.960	87.955%	608	13.6	0.865
	12.041V	5.040V	3.326V	5.045V	90.910				230.38V

RIPPLE MEASUREMENTS 230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	26.00mV	7.30mV	4.60mV	5.80mV	Pass
20% Load	16.70mV	7.50mV	4.80mV	5.60mV	Pass
30% Load	8.40mV	8.00mV	5.00mV	5.80mV	Pass
40% Load	7.10mV	8.40mV	5.50mV	6.00mV	Pass
50% Load	7.00mV	8.70mV	6.20mV	6.00mV	Pass
60% Load	8.80mV	9.50mV	6.40mV	6.70mV	Pass
70% Load	9.30mV	10.80mV	7.20mV	6.60mV	Pass
80% Load	10.50mV	12.40mV	14.50mV	7.50mV	Pass
90% Load	11.90mV	12.50mV	15.50mV	7.50mV	Pass
100% Load	14.80mV	13.80mV	16.60mV	9.60mV	Pass
110% Load	16.00mV	14.50mV	17.90mV	10.70mV	Pass
Crossload1	15.20mV	9.20mV	15.00mV	15.70mV	Pass
Crossload2	14.80mV	12.30mV	9.10mV	8.20mV	Pass

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Anex

Thermaltake Toughpower GF2 ARGB 650W

Top side

Power specifications label

CERTIFICATIONS 115V

CERTIFICATIONS 230V