Thermaltake Toughpower GF A3 650W (HKC)

Serial Number PSTPD0650FNFAGEHPG000334

Lab ID TT65002261

Certification ID 252261

Test Result Report ID: 23PS2261A

Certificate Issue Date: Oct 16, 2023

Scheme: ETA-EMI PSU

115V: CYBENETICS PLATINUM

230V: CYBENETICS PLATINUM 230v

Scheme: LAMBDA PSU

115V: CYBENETICS A-

230V: CYBENETICS A- 230v

CYBENETICS ATX 3.0 PASS

Outside Validation Scope

General Information

Test Equipment

Electronic Loads	Chroma 63601-5 x2 Chroma 63600-2 Chroma 63640-80-80 x10 Chroma 63610-80-20
AC Sources	Chroma 6530, APM SP300VAC4000W-P, GW Instek ASR-3500
Power Analyzers	Rohde & Schwarz HMC8015 & NPA701
Oscilloscopes	Picoscope 4444, 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
EMI Analyzer	TekBox TBMR-110M-EU
Isolation Transformer	4kVA
UPS	FSP Champ Tower 3kVA, CyberPower OLS3000E 3kVA
Testing Methodology	Cybenetics PSU Test Protocol

DUT Information(Non-accredited measurements)

Product Identification Details	
Brand	Thermaltake
Model	Toughpower GF A3 650W (HKC)
OEM/ODM	HKC
Serial Number	PSTPD0650FNFAGEHPG000334
Product Specifications	
Manufacturer-Provided Information	
Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10

Rated Frequency (Hz)	50-60
Rated Power (W)	650
Operating Temperature (Continuous Full Load) (°C)	
Type	ATX12V
Cable Design	Fully Modular
Warranty	-
Cybenetics Measurements	
Dimensions (W x H x D)	
Weight	
Cooling	120mm Fluid Dynamic Bearing Fan [TT-1225 (AV-F12025HS)]
Semi-Passive Operation	✓ (selectable)
Cybenetics Testing Information	
Lab ID	TT65002261
Date of receipt	Aug 17, 2023
Testing Date	Oct 12, 2023
Report Issued Date	Oct 16, 2023
Engineer Name	-
Authorized By the Laboratory Technical Manager	Aristeidis Bitziopoulos
Signature	

Cables and Connectors(Non-accredited measurements)

Modular Cables				
Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (600mm)	1	1	18AWG	No
4+4 pin EPS12V (650mm+150mm)	1	2	18AWG	No
6+2 pin PCIe (500mm+150mm)	2	4	18AWG	No
12+4 pin PCIe (600mm) (300W)	1	1	18-26AWG	No
SATA (500mm+145mm+145mm+145mm)	2	8	18AWG	No
4-pin Molex (500mm+150+150mm+150mm)	1	4	18AWG	No
FDD Adapter (145mm)	1	1	22AWG	No

AC Power Cord (1380mm) - C13 coupler	1	1	18AWG	-

Power Specifications

Rail		3.3V	5V	12V	5VSB	-12V
Max. Power	Amps	20	20	51.4	3	0.3
	Watts	100		649.2	15	3.6
Total Max. Power (W)		650				

Parts Description

General Data	
Manufacturer (OEM)	HKC
PCB Type	Double-Sided
Primary Side	
Transient Filter	6x Y caps, 2x X caps, 2x CM chokes, 1x MOV
Inrush Protection	1x NTC Thermistor 2.5D-15 (2.5 Ohm @ 25°C) & Relay
Bridge Rectifier(s)	2x Diodes GBU1506 (800V, 15A @ 125°C)
APFC MOSFETs	2x LONTEN LSD65R180GT (650V, 20A @ 25°C, Rds(on): 0.018Ohm)
APFC Boost Diode	1x Global Power Tech. G3S06004J (600V, 11A @ 25°C)
Bulk Cap(s)	2x Rubycon (420V, 330uF each or 660uF combined, 2-3000h @ 105°C, MXH)
Main Switchers	2x MPVA20N50F (500V, 20A @ 25°C, Rds(on): 0.26Ohm)
APFC Controller	Champion CM6500UNX
Resonant Controller	Champion CM6901X
Topology	Primary side: APFC, Half-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	
+12V MOSFETs	4x Advanced Power Electronics AP4NA1R4CMT-A (45V, 39A @ 70°C, Rds(on): 1.4 mOhm)
5V & 3.3V	DC-DC Converters: 2x Advanced Power Electronics AP4024GEMT-HF (30V, 20.9A @ 70°C, Rds(on): 4.5mOhm) 2x Wayon WMB040N03LG2 (30V, 38A @ 100°C, Rds(on): 4.0mOhm) PWM Controller(s): 2x ANPEC APW7164

Filtering Capacitors	Electrolytic: 6x CapXon (3,000h @ 105°C, KF) 3x Teapo (3,000h @ 105°C, SC) Polymer:21x CapXon
Supervisor IC	IN1S3151 - SAG
Fan Model	TT-1225 (AV-F12025HS) (120mm, 12V, 0.3A, Sleeve Bearing Fan)
5VSB Circuit	
Rectifier	SB1045L (45V, 10A)
Standby PWM Controller	PN8141

Test Results

Temperature & Compliance Info

Temperature Range (°C /°F)	28-32 / 82.4-89.6
ErP Lot 3/6 Ready	✓
(EU) No 617/2013 Compliance	✓
ALPM (Alternative Low Power Mode) compatible	✓
ATX v3.0 Compliance	✓

Performance Summary

115V

Accredited	
Average Efficiency (>1450 load combinations)	89.122%
Average Noise Output (>1450 Load Combinations)	25.56dBA
Average PF (>1450 Load Combinations)	0.987
Efficiency With 10W (≤500W) or 2% (>500W) Load	64.582%
Standby Power Consumption	0.0573W
Non-Accredited	
12V Ripple (Full Load)	39.48mV
5V Ripple (Full Load)	16.37mV

3.3V Ripple (Full Load)	20.11mV
5VSB Ripple (Full Load)	11.02mV
12V Load Regulation	0.33%
5V Load Regulation	1.37%
3.3V Load Regulation	2.35%
5VSB Load Regulation	5.29%
Inrush Current	63.720A

230V

Accredited	
Average Efficiency (>1450 load combinations)	91.205%
Average Noise Output (>1450 Load Combinations)	25.29dBA
Average PF (>1450 Load Combinations)	0.938
Efficiency With 10W (≤500W) or 2% (>500W) Load	62.176%
Standby Power Consumption	0.1137W
Non-Accredited	
12V Ripple (Full Load)	38.10mV
5V Ripple (Full Load)	16.14mV
3.3V Ripple (Full Load)	19.93mV
5VSB Ripple (Full Load)	11.19mV
12V Load Regulation	0.33%
5V Load Regulation	1.31%
3.3V Load Regulation	2.32%
5VSB Load Regulation	5.29%
Inrush Current	133.200A
12V Transient Response (200%)	11.58V
5V Transient Response (200%)	4.967V
3.3V Transient Response (200%)	3.210V
5VSB Transient Response (200%)	4.940V
Hold-Up Time & PWR_OK Signal	25.90ms
AC Loss to PWR_OK Hold Up Time	20.00ms
PWR_OK Inactive to DC Loss Delay	5.90ms

PSU Timings: T1 (20% / 100%)	90.0ms	90.0ms
PSU Timings: T3 (20% / 100%)	122.0ms	123.0ms
OPP (21.52°C / 38.00°C)	150.13%	135.00%

Hold-Up Time & PWR_OK Signal

Hold-Up Time (ms)	25.9
AC Loss to PWR_OK Hold Up Time (ms)	20
PWR_OK Inactive to DC Loss Delay (ms)	5.9

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Tables

115V

Detailed Results						
	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	114.88 V	114.84 V	113.85 V	114.93 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	1.419	1.490	PASS
Mains Voltage THD:	0.14 %	0.11 %	N/A	0.18 %	2.00 %	PASS
Real Power:	0.057 W	-0.002 W	N/A	0.106 W	N/A	N/A
Apparent Power:	10.947 W	10.916 W	N/A	10.979 W	N/A	N/A
Power Factor:	0.007	N/A	N/A	N/A	N/A	N/A

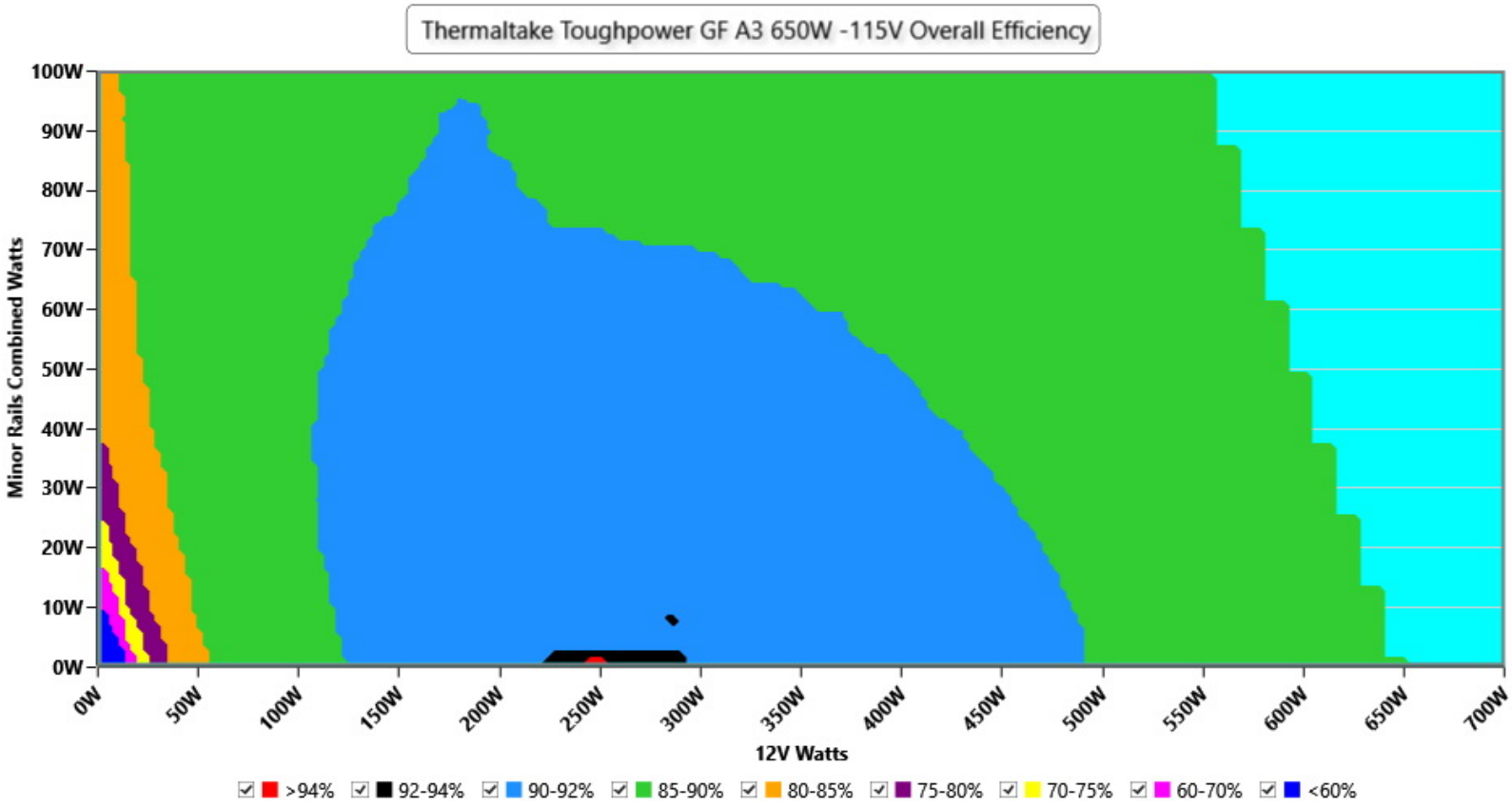
230V

Detailed Results						
	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	229.95 V	229.90 V	227.70 V	229.99 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	1.416	1.490	PASS
Mains Voltage THD:	0.13 %	0.11 %	N/A	0.16 %	2.00 %	PASS
Real Power:	0.114 W	0.064 W	N/A	0.170 W	N/A	N/A
Apparent Power:	37.395 W	37.354 W	N/A	37.441 W	N/A	N/A
Power Factor:	0.003	N/A	N/A	N/A	N/A	N/A

Efficiency Graph

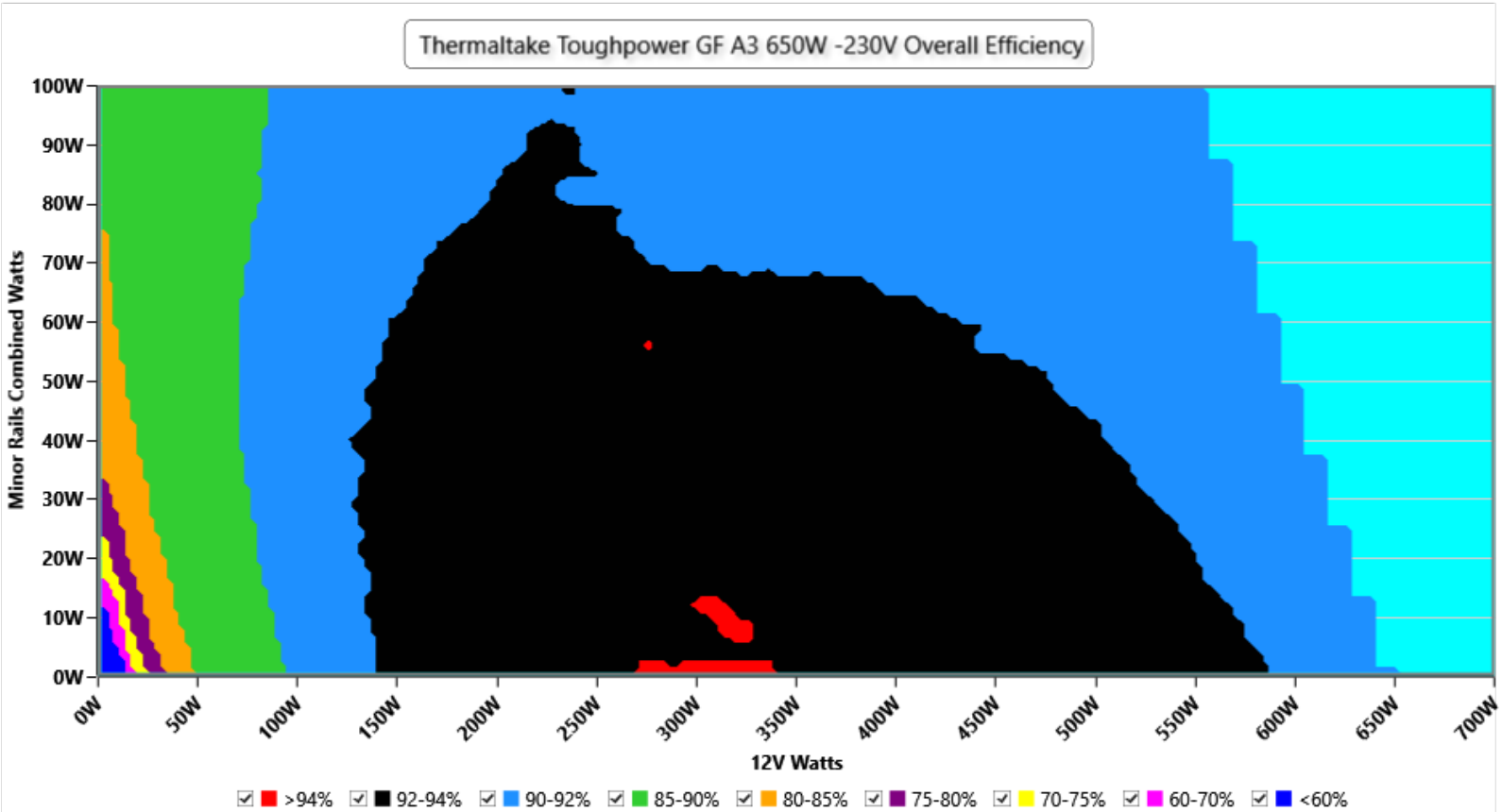
115V



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

230V

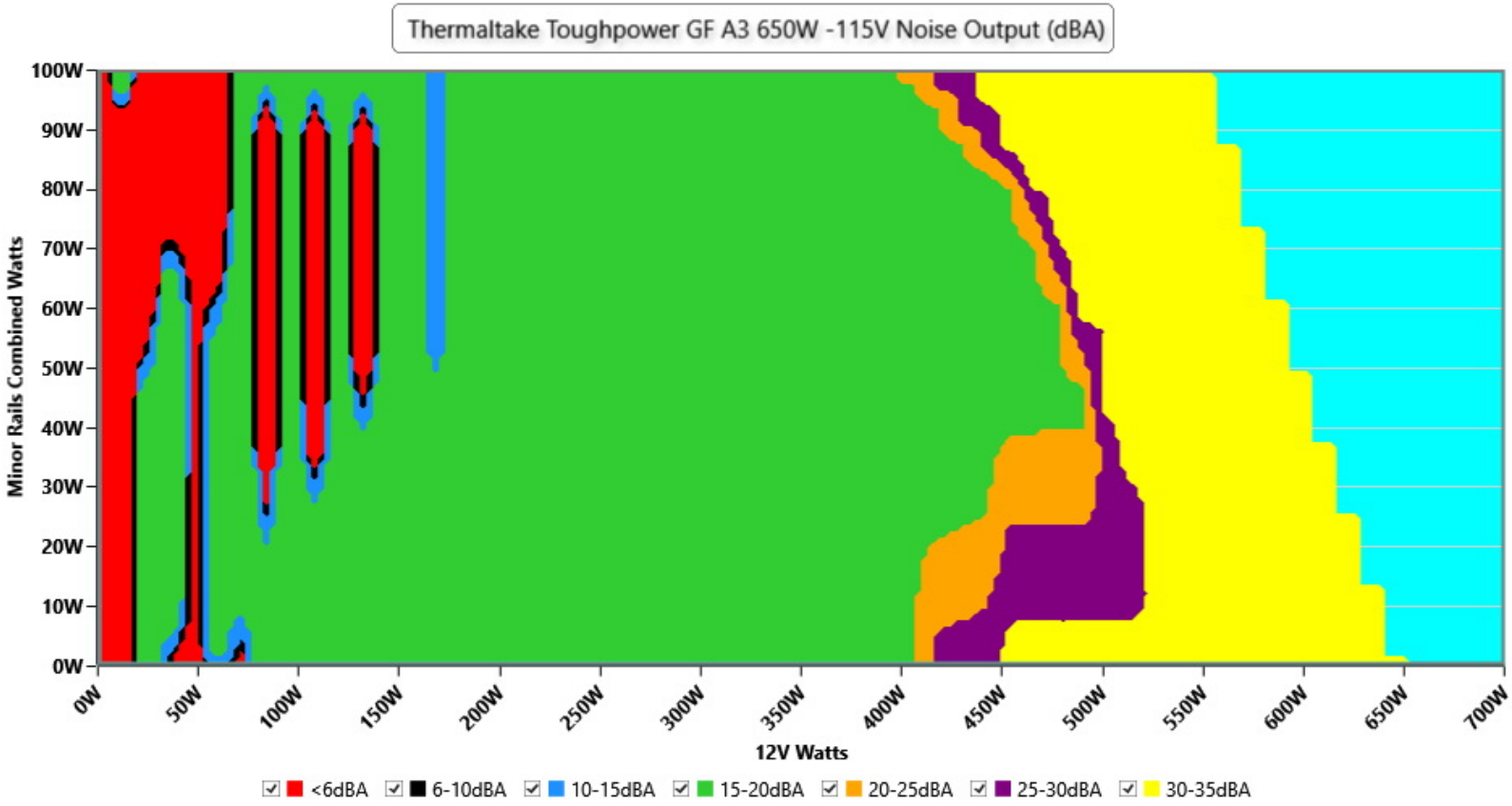


INFO

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

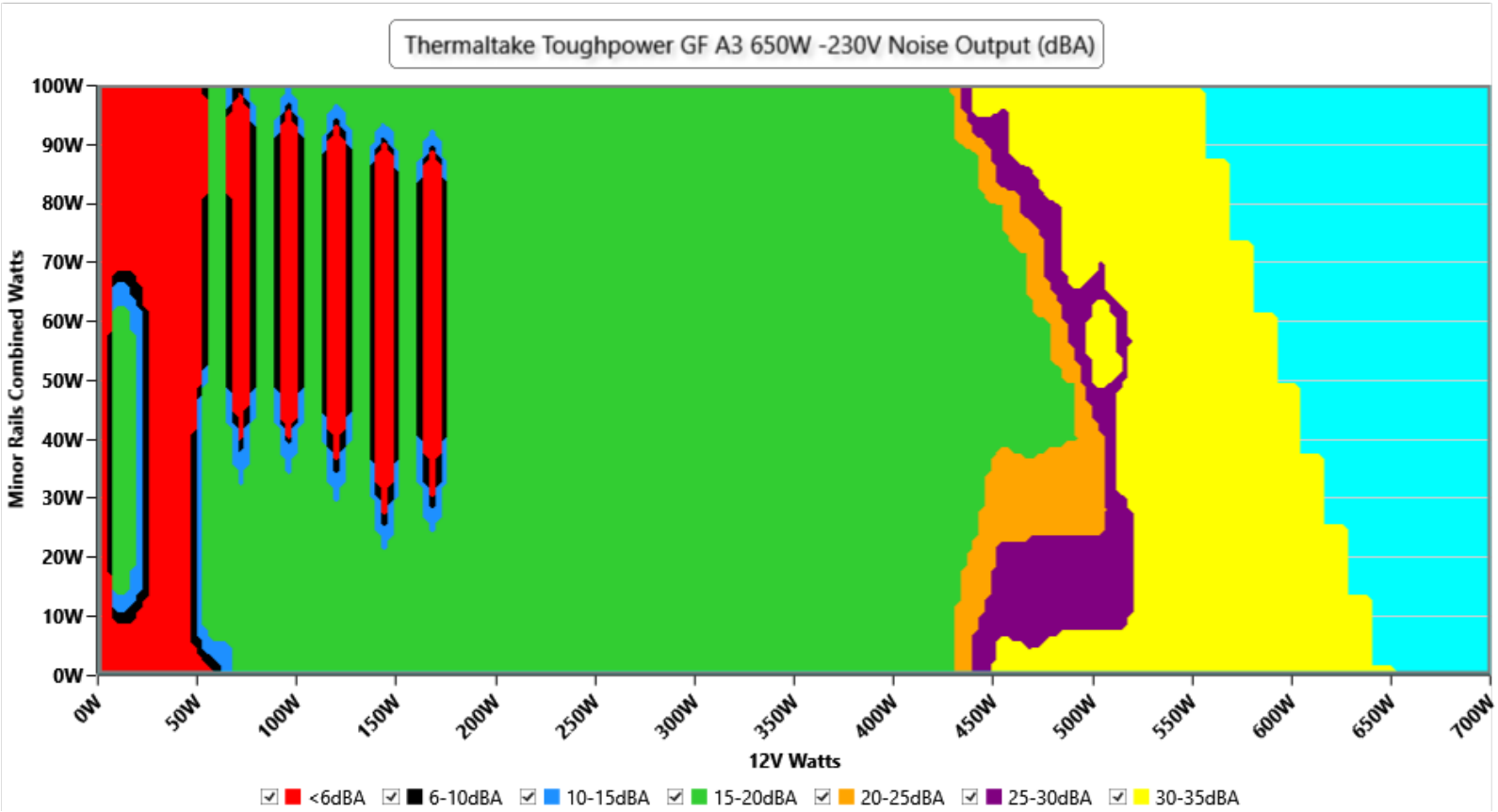
115V



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

230V

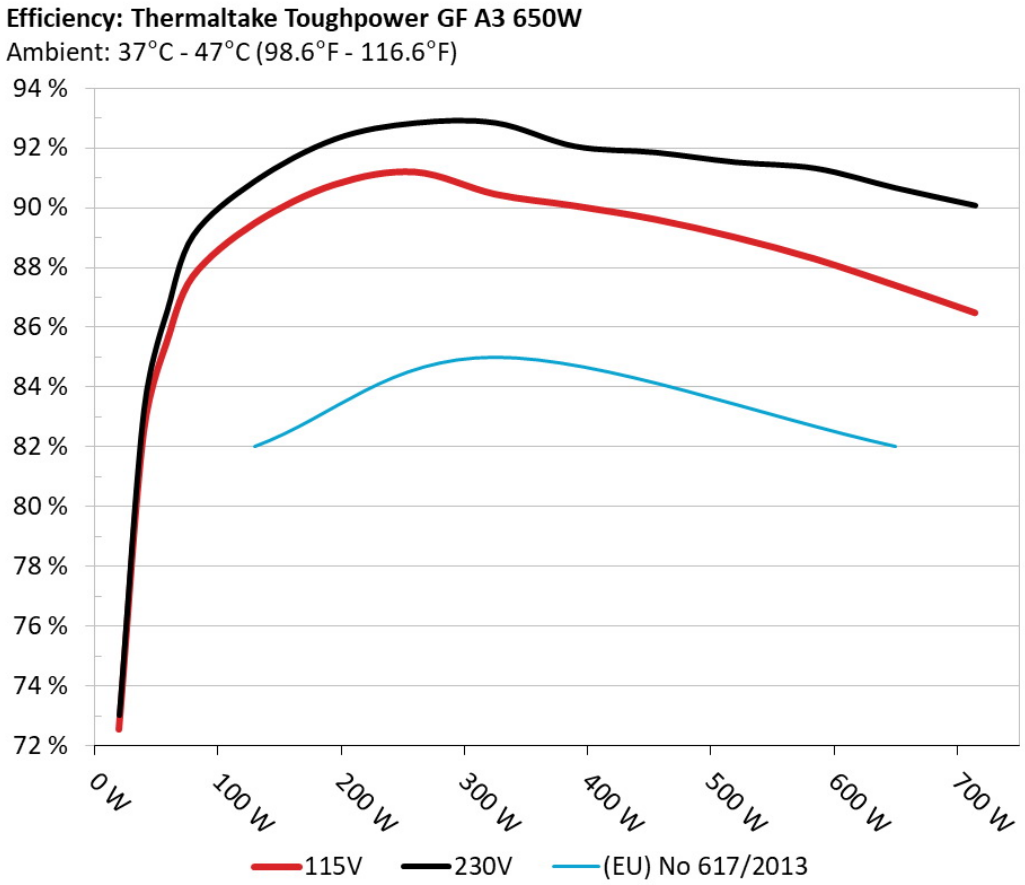


INFO

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

Indicative Performance

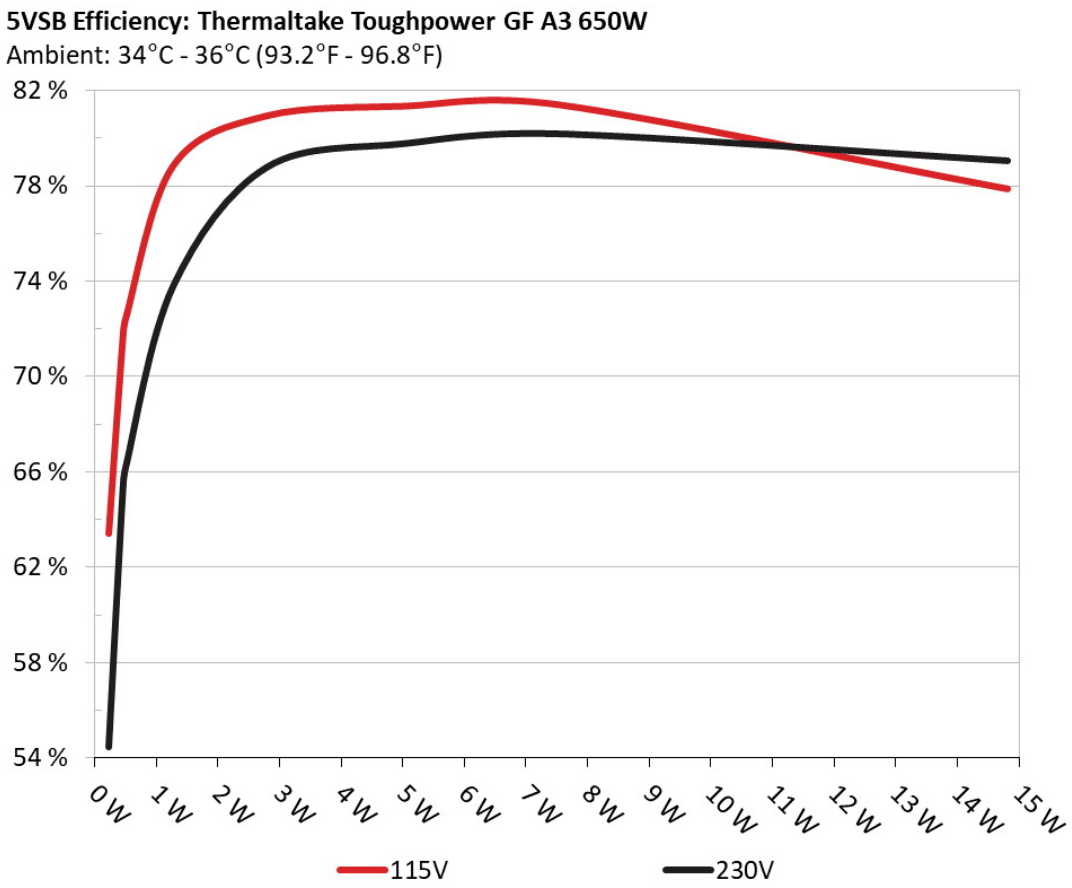
Efficiency under high ambient temperature



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

5VSB Efficiency (ERP LOT 3/6 & CEC)

115V

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.23W	63.68%	0.034
	5.106V	0.361W		114.87V
2	0.09A	0.459W	71.89%	0.06
	5.103V	0.639W		114.87V
3	0.55A	2.793W	81.186%	0.249
	5.078V	3.44W		114.87V
4	1A	5.053W	81.596%	0.327
	5.053V	6.193W		114.87V
5	1.5A	7.538W	81.65%	0.378
	5.025V	9.232W		114.87V
6	3A	14.818W	78.127%	0.446
	4.939V	18.967W		114.86V

230V

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.23W	54.71%	0.012
	5.106V	0.421W		229.95V
2	0.09A	0.459W	65.528%	0.02
	5.104V	0.701W		229.94V
3	0.55A	2.793W	79.042%	0.096
	5.079V	3.534W		229.94V
4	1A	5.054W	80.044%	0.159
	5.054V	6.315W		229.94V
5	1.5A	7.538W	80.449%	0.205
	5.025V	9.37W		229.94V
6	3A	14.819W	79.318%	0.308
	4.939V	18.683W		229.94V

Supplementary Tests (For Reference)

Typical 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%	3.608A	1.967A	1.971A	0.993A	64.999	85.67%	737	12.2	40.22°C	0.956
	12.031V	5.084V	3.349V	5.038V	75.872				44.23°C	114.84V
20%	8.236A	2.955A	2.964A	1.196A	129.932	89.473%	908	20.2	40.71°C	0.979
	12.025V	5.077V	3.34V	5.018V	145.219				45.03°C	114.82V
30%	13.218A	3.452A	3.466A	1.401A	194.936	90.77%	913	20.3	41.28°C	0.984
	12.020V	5.07V	3.332V	4.998V	214.758				46.02°C	114.8V
40%	18.211A	3.95A	3.969A	1.607A	260.015	91.189%	916	20.4	41.6°C	0.989
	12.015V	5.064V	3.326V	4.978V	285.14				46.65°C	114.78V
50%	22.845A	4.944A	4.973A	1.816A	325.002	90.449%	919	20.5	42.23°C	0.992
	12.015V	5.057V	3.318V	4.957V	359.321				47.74°C	114.75V
60%	27.431A	5.94A	5.982A	2A	389.206	90.06%	922	20.6	42.84°C	0.993
	12.013V	5.051V	3.31V	4.937V	432.162				48.86°C	114.73V
70%	32.106A	6.941A	6.996A	2.239A	454.643	89.61%	1128	27.4	43.08°C	0.995
	12.008V	5.044V	3.302V	4.913V	507.358				50.13°C	114.71V
80%	36.785A	7.944A	8.014A	2.348A	519.452	89.009%	1130	27.4	43.64°C	0.995
	12.004V	5.036V	3.294V	4.898V	583.598				51.72°C	114.68V
90%	41.863A	8.45A	8.52A	2.458A	584.839	88.28%	1548	36.1	44.02°C	0.996
	12.000V	5.029V	3.286V	4.882V	662.483				53.12°C	114.66V
100%	46.686A	8.961A	9.06A	3.102A	649.672	87.401%	1734	39.0	45.01°C	0.996
	11.994V	5.021V	3.278V	4.835V	743.322				55.09°C	114.63V
110%	51.381A	9.974A	10.186A	3.108A	714.295	86.483%	2069	43.8	46.71°C	0.997
	11.988V	5.013V	3.269V	4.826V	825.935				57.63°C	114.6V
CL1	0.115A	11.882A	11.932A	0A	101.273	84.512%	915	20.4	41.15°C	0.979
	12.026V	5.066V	3.327V	5.076V	119.834				46.61°C	114.83V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
CL2	0.115A	19.703A	0A	0A	101.364	83.054%	913	20.3	40.15°C	0.98
	12.029V	5.074V	3.345V	5.083V	122.046				47.24°C	114.83V
CL3	0.115A	0A	19.832A	0A	67.376	77.916%	913	20.3	41.59°C	0.963
	12.026V	5.081V	3.328V	5.079V	86.472				50.69°C	114.84V
CL4	54.120A	0A	0A	0A	649.478	88.727%	1340	32.3	45.54°C	0.996
	12.001V	5.042V	3.301V	5.035V	732.008				56.51°C	114.63V

The results above are not used in the certification process

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%	3.608A	1.967A	1.971A	0.993A	65.006	86.734%	759	13.5	40.2°C	0.729
	12.030V	5.085V	3.349V	5.037V	74.948				44.47°C	229.93V
20%	8.236A	2.955A	2.964A	1.196A	129.937	90.886%	913	20.3	40.93°C	0.878
	12.025V	5.078V	3.341V	5.018V	142.967				45.45°C	229.92V
30%	13.217A	3.451A	3.465A	1.4A	194.93	92.294%	915	20.4	41.21°C	0.928
	12.020V	5.071V	3.333V	4.998V	211.204				46.37°C	229.91V
40%	18.209A	3.949A	3.968A	1.607A	260.007	92.828%	918	20.5	41.94°C	0.951
	12.016V	5.066V	3.327V	4.978V	280.094				47.49°C	229.9V
50%	22.849A	4.943A	4.972A	1.816A	324.997	92.832%	922	20.6	42.32°C	0.965
	12.013V	5.059V	3.319V	4.957V	350.098				48.32°C	229.89V
60%	27.430A	5.939A	5.98A	2A	389.208	92.05%	924	20.6	42.7°C	0.973
	12.014V	5.052V	3.311V	4.937V	422.824				49.24°C	229.88V
70%	32.106A	6.939A	6.994A	2.239A	454.647	91.845%	1132	27.5	43.24°C	0.978
	12.009V	5.045V	3.303V	4.913V	495.016				50.3°C	229.87V
80%	36.782A	7.942A	8.012A	2.348A	519.456	91.519%	1133	27.5	43.79°C	0.982
	12.004V	5.038V	3.295V	4.897V	567.588				51.85°C	229.85V
90%	41.883A	8.455A	8.523A	2.455A	584.767	91.312%	1331	32.3	44.13°C	0.984
	11.992V	5.026V	3.285V	4.888V	640.406				53.19°C	229.85V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
100%	46.686A	8.959A	9.057A	3.102A	649.647	90.657%	1715	38.9	45.29°C	0.986
	11.994V	5.023V	3.279V	4.836V	716.603				55.34°C	229.83V
110%	51.378A	9.97A	10.182A	3.109A	714.282	90.072%	2073	43.8	46.72°C	0.987
	11.989V	5.015V	3.27V	4.825V	793.013				57.64°C	229.83V
CL1	0.115A	11.875A	11.925A	0A	101.282	85.785%	926	20.7	41.42°C	0.843
	12.031V	5.069V	3.329V	5.074V	118.062				46.93°C	229.93V
CL2	0.115A	19.696A	0A	0A	101.373	84.356%	918	20.5	40.9°C	0.846
	12.033V	5.076V	3.346V	5.081V	120.174				48.05°C	229.93V
CL3	0.115A	0A	19.824A	0A	67.38	79.086%	915	20.4	40.58°C	0.767
	12.029V	5.083V	3.329V	5.078V	85.199				49.64°C	229.94V
CL4	54.118A	0A	0A	0A	649.523	91.772%	1343	32.4	45.12°C	0.985
	12.002V	5.043V	3.301V	5.035V	707.76				56.06°C	229.83V

The results above are not used in the certification process

Light 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	0.492A	0.196A	19.993	72.56%	0	<6.0	39.91°C	0.794
	12.033V	5.09V	3.355V	5.091V	27.556				36.83°C	114.85V
40W	2.716A	0.688A	0.689A	0.295A	39.993	82.482%	0	<6.0	40.99°C	0.908
	12.033V	5.089V	3.354V	5.083V	48.486				37.78°C	114.85V
60W	4.198A	0.884A	0.886A	0.394A	59.992	85.986%	0	<6.0	42.57°C	0.947
	12.033V	5.087V	3.352V	5.075V	69.77				38.85°C	114.85V
80W	5.677A	1.082A	1.083A	0.493A	79.933	87.704%	0	<6.0	36.34°C	0.966
	12.031V	5.085V	3.35V	5.067V	91.139				40.3°C	114.84V

The results above are not used in the certification process

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	1.234A	0.491A	0.492A	0.196A	19.997	73.035%	0	<6.0	39.67°C	0.427
	12.030V	5.089V	3.355V	5.092V	27.384				36.58°C	229.94V
40W	2.718A	0.688A	0.689A	0.295A	39.999	83.26%	0	<6.0	41.01°C	0.588
	12.030V	5.089V	3.353V	5.083V	48.04				37.7°C	229.94V
60W	4.200A	0.885A	0.886A	0.394A	60	87.174%	0	<6.0	41.78°C	0.702
	12.030V	5.088V	3.352V	5.075V	68.825				38.27°C	229.93V
80W	5.678A	1.081A	1.083A	0.494A	79.948	89.079%	756	13.4	39.37°C	0.779
	12.031V	5.086V	3.35V	5.066V	89.75				43.16°C	229.93V

The results above are not used in the certification process

Ripple Measurements

115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	9.11mV	10.56mV	10.03mV	4.44mV	Pass
20% Load	12.42mV	11.03mV	10.24mV	4.75mV	Pass
30% Load	13.51mV	10.72mV	11.22mV	5.01mV	Pass
40% Load	15.83mV	11.64mV	11.27mV	5.47mV	Pass
50% Load	19.95mV	12.78mV	13.44mV	5.83mV	Pass
60% Load	20.62mV	12.88mV	14.01mV	6.45mV	Pass
70% Load	22.84mV	14.48mV	15.93mV	7.33mV	Pass
80% Load	26.91mV	16.33mV	17.53mV	8.62mV	Pass
90% Load	31.09mV	15.61mV	18.15mV	8.72mV	Pass
100% Load	39.48mV	16.37mV	20.11mV	11.02mV	Pass
110% Load	41.84mV	17.63mV	21.31mV	11.78mV	Pass
Crossload1	23.45mV	15.22mV	16.49mV	7.80mV	Pass
Crossload2	17.32mV	16.33mV	19.55mV	7.43mV	Pass

Test	12V	5V	3.3V	5VSB	Pass/Fail
Crossload3	15.00mV	13.96mV	12.05mV	7.38mV	Pass
Crossload4	33.95mV	14.42mV	16.14mV	12.02mV	Pass

The results above are not used in the certification process

230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	8.80mV	10.67mV	9.20mV	4.34mV	Pass
20% Load	11.55mV	11.18mV	10.29mV	4.80mV	Pass
30% Load	13.87mV	11.33mV	10.96mV	5.06mV	Pass
40% Load	15.47mV	11.85mV	11.69mV	5.73mV	Pass
50% Load	18.77mV	12.52mV	12.26mV	6.30mV	Pass
60% Load	20.57mV	12.52mV	14.01mV	6.87mV	Pass
70% Load	23.10mV	14.32mV	15.51mV	7.85mV	Pass
80% Load	25.93mV	15.40mV	17.79mV	8.51mV	Pass
90% Load	29.23mV	16.49mV	18.72mV	8.83mV	Pass
100% Load	38.10mV	16.14mV	19.93mV	11.19mV	Pass
110% Load	40.38mV	17.22mV	20.77mV	12.23mV	Pass
Crossload1	23.45mV	15.49mV	16.44mV	7.84mV	Pass
Crossload2	16.14mV	14.42mV	18.56mV	7.28mV	Pass
Crossload3	13.82mV	13.81mV	12.26mV	7.33mV	Pass
Crossload4	33.66mV	14.78mV	15.70mV	11.62mV	Pass

The results above are not used in the certification process

Thermaltake Toughpower GF A3 650W (HKC)

Top side

Power specifications label

Cybenetics [redacted] ETA[redacted] LAMBDA[redacted] SAFE[redacted] DELTA[redacted] PHI[redacted]

CYBENETICS LTD Syrou 6, Latsia, 2231, Nicosia Cyprus

www.cybenetics.com - info@cybenetics.com