Fractal

Fractal Design ION+ 660P

Serial Number 1918FD19410101502

Lab ID FD66001535

Certification ID 251535

Test Result Report ID:

Certificate Issue Date: May 21, 2020

Scheme: ETA-EMI PSU

115V



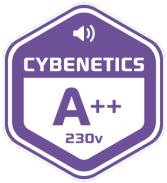
230V



115V



230V



Scheme: LAMBDA PSU



Aristeidis Bitziopoulos, Certification Body General Manager

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	Fractal Design
Model	ION+ 660P
OEM/ODM	High Power
Serial Number	1918FD19410101502
Product Specifications	
Manufacturer-Provided Information	
Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10-5
Rated Frequency (Hz)	50-60

Rated Power (W)	660
Operating Temperature (Continuous Full Load) (°C)	
Type	ATX12V
Cable Design	Fully Modular
Warranty	-
Cybenetics Measurements	
Dimensions (W x H x D)	
Weight	
Cooling	140mm Fluid Dynamic Bearing Fan (DYNAMIC X2 GP-14)
Semi-Passive Operation	✓ (selectable)
Cybenetics Testing Information	
Lab ID	FD66001535
Date of receipt	Jul 11, 2019
Testing Date	May 20, 2020
Report Issued Date	May 21, 2020
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 (700mm)	1	1	16AWG	No
6+2 pin PCIe (550mm+120mm)	2	4	16-18AWG	No
SATA (650mm+120mm)	1	2	18AWG	No
SATA (400mm+120mm+120mm+120mm)	2	8	18AWG	No
4 pin Molex (400mm+120mm+120mm+120mm)	1	4	18AWG	No
AC Power Cord (1400mm) - C13 coupler	1	1	16AWG	-

Power Specifications

Rail		3.3V	5V	12V	5VSB	-12V
Max. Power	Amps	20	20	55	15	0.3
	Watts	110		660	15	3.6
Total Max. Power (W)		660				

Parts Description

General Data	
Manufacturer (OEM)	High Power
PCB Type	Double Sided
Primary Side	
Transient Filter	4x Y caps, 2x X caps, 3x CM chokes, 1x MOV,1x Discharge IC
Inrush Protection	NTC Thermistor & Relay
Bridge Rectifier(s)	2x GBU1506 (600V, 15A @ 100°C)
APFC MOSFETS	2x Infineon IPA60R120P7 (650V, 16A @ 100°C, 0.120Ohm)
APFC Boost Diode	1x Infineon IDH06G65C5 (650V, 6A @ 145°C)
Hold-up Cap(s)	2x Rubycon (400V, 390uF each or 780uF combined, 2,000h @ 105°C, MXH)
Main Switchers	2x Infineon IPA60R120P7 (650V, 16A @ 100°C, 0.120Ohm)
APFC Controller	Infineon ICE3PCS01G
Resonant Controllers	Champion CM6901X
Topology	Primary side: Half-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	
+12V MOSFETS	6x Infineon BSC027N04LS (40V, 88A @ 100°C, 2.7mOhm)
5V & 3.3V	DC-DC Converters:8x Infineon BSC0906NS (30V, 40A @ 100°C, 4.5mOhm) PWM Controllers: ANPEC APW7159C
Filtering Capacitors	Electrolytics: 4x Nippon Chemi-Con (4-10,000h @ 105°C, KY), 5x Rubycon (3-6,000h @ 105°C, YXG), 1x Rubycon (6-10,000h @ 105°C, ZLH) Polymers: 31x FPCAP, 6x NIC
Supervisor IC	SITI PS224 (OCP, OVP, UVP, SCP, PG)
Micro Controller	STC 15W408AS
Fan Model	Fractal Design DYNAMIC X2 GP-14 (140mm, 3-12V, 0.30A, 1400rpm, Fluid Dynamic Bearing Fan)

Fan Power Transistor	STi 2SD882 (NPN)
5VSB Circuit	
Rectifier	1x PFC P10V45SP SBR (45V, 10A) & 2x Infineon BSC0906NS FET (30V, 40A @ 100°C, 4.5mΩ)
Standby PWM Controller	Excelliance MOS Corp EM8569
-12V Circuit	
Rectifier	KEC KIA7912PI (-12V, 1A)

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	

Performance Summary

115V

Accredited	
Average Efficiency (>1450 load combinations)	89.759%
Average Noise Output (>1450 Load Combinations)	13.74dBA
Average PF (>1450 Load Combinations)	0.993
Efficiency With 10W (≤500W) or 2% (>500W) Load	42.959%
Standby Power Consumption	0.1025W
Non-Accredited	
12V Ripple (Full Load)	16.30mV
5V Ripple (Full Load)	8.66mV
3.3V Ripple (Full Load)	15.47mV
5VSB Ripple (Full Load)	11.00mV
12V Load Regulation	1.04%
5V Load Regulation	0.79%
3.3V Load Regulation	1.18%

5VSB Load Regulation	2.60%
Inrush Current	20.797A

230V

Accredited		
Average Efficiency (>1450 load combinations)		91.473%
Average Noise Output (>1450 Load Combinations)		12.45dBA
Average PF (>1450 Load Combinations)		0.958
Efficiency With 10W (≤500W) or 2% (>500W) Load		-
Standby Power Consumption		0.1347W
Non-Accredited		
12V Ripple (Full Load)		15.47mV
5V Ripple (Full Load)		8.40mV
3.3V Ripple (Full Load)		16.04mV
5VSB Ripple (Full Load)		10.84mV
12V Load Regulation		1.03%
5V Load Regulation		0.79%
3.3V Load Regulation		1.09%
5VSB Load Regulation		2.51%
Inrush Current		41.593A
Hold-Up Time & PWR_OK Signal		19.90ms
AC Loss to PWR_OK Hold Up Time		15.60ms
PWR_OK Inactive to DC Loss Delay		4.30ms
OPP (0.00°C / 0.00°C)	131.27%	-

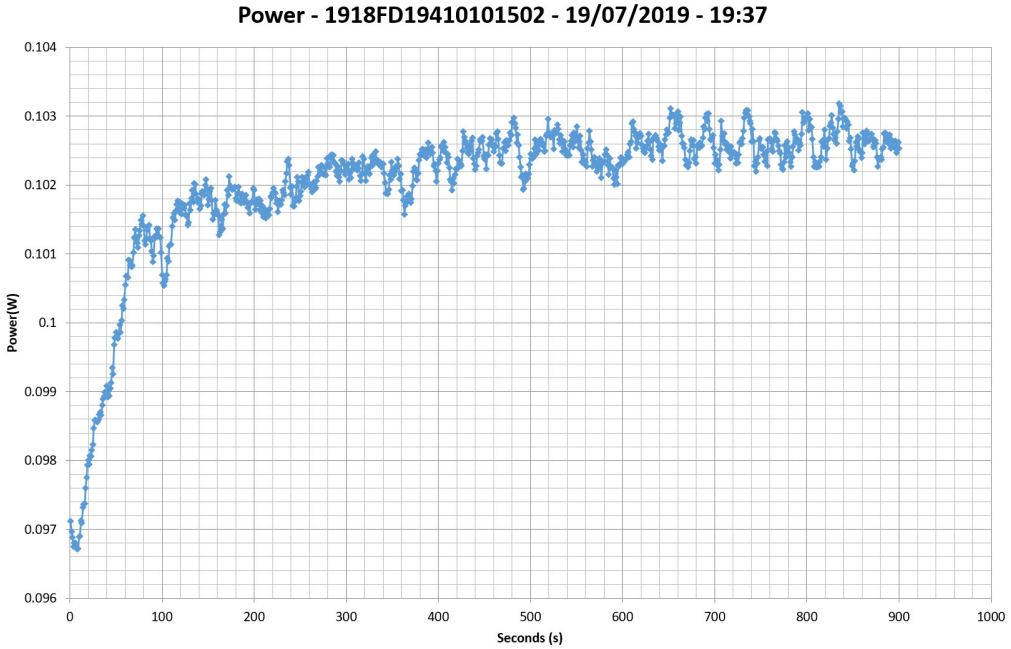
Hold-Up Time & PWR_OK Signal

Hold-Up Time (ms)	19.9
AC Loss to PWR_OK Hold Up Time (ms)	15.6
PWR_OK Inactive to DC Loss Delay (ms)	4.3

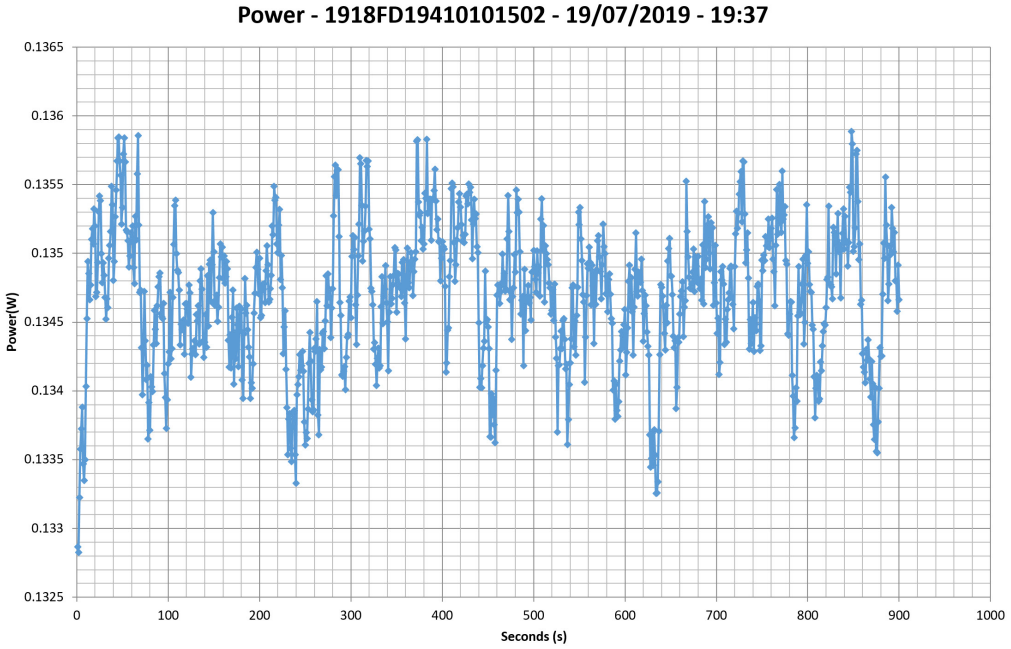
Vampire Power

Graphs

115V

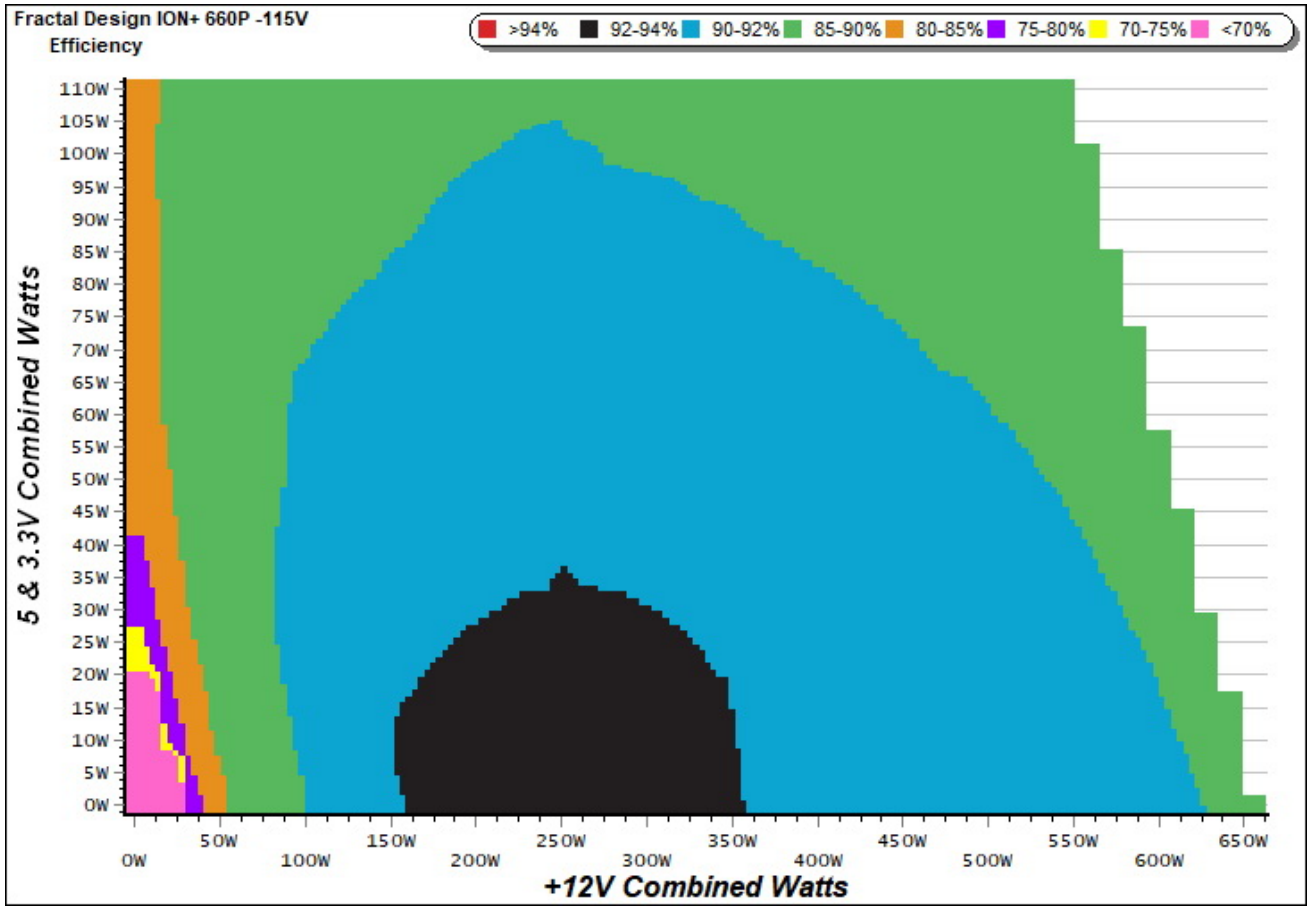


230V



Efficiency Graph

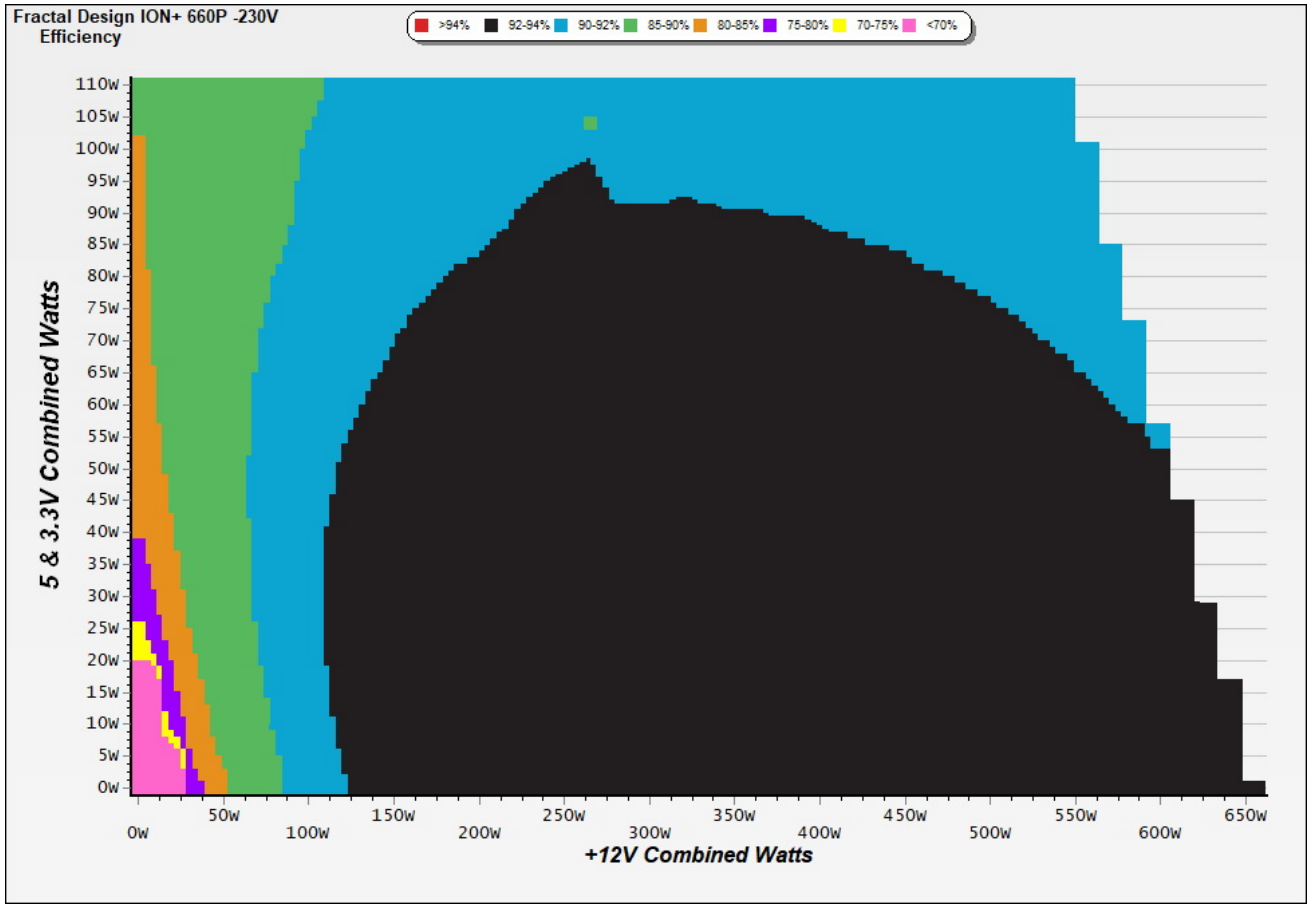
115V



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

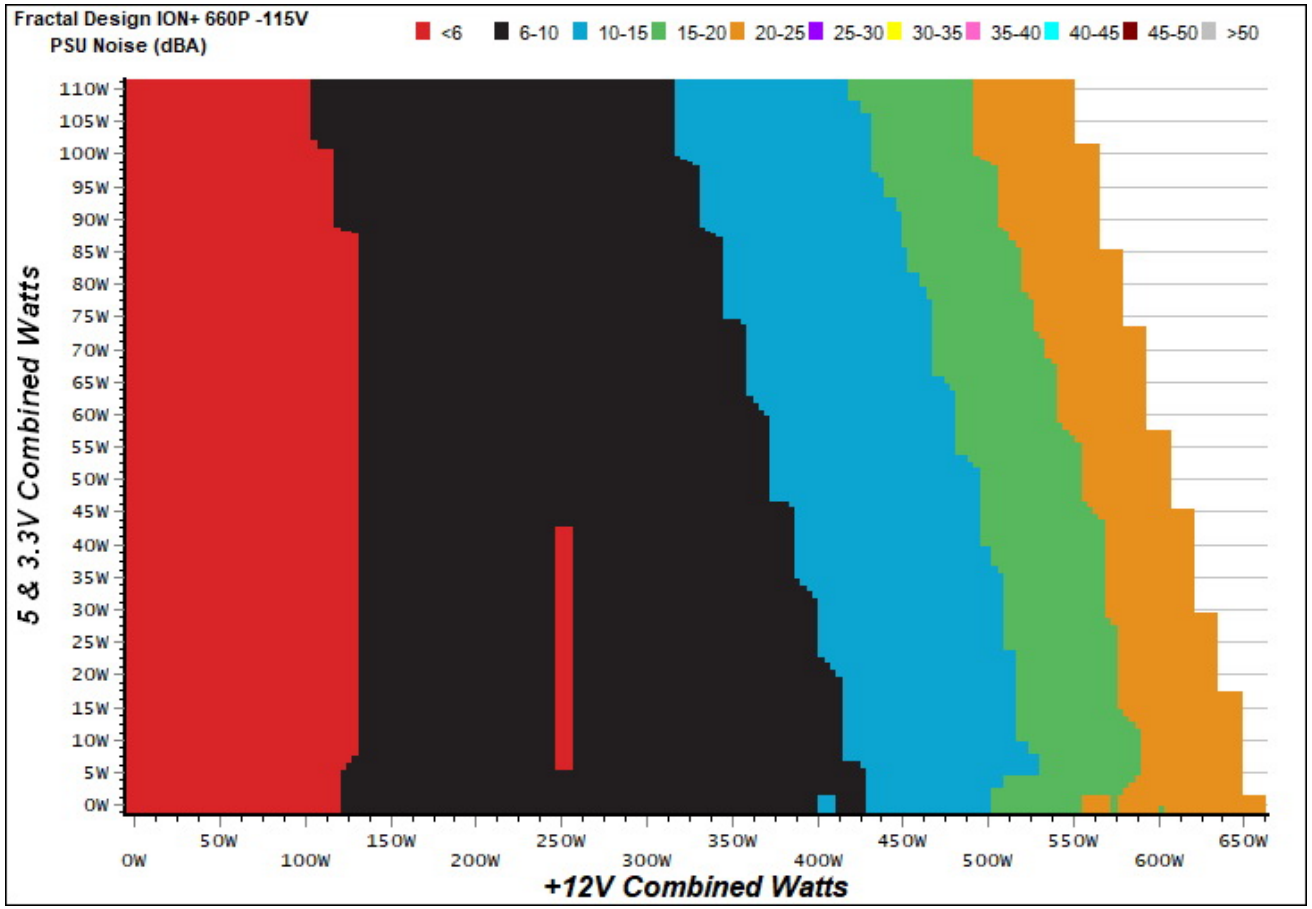


INFO

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

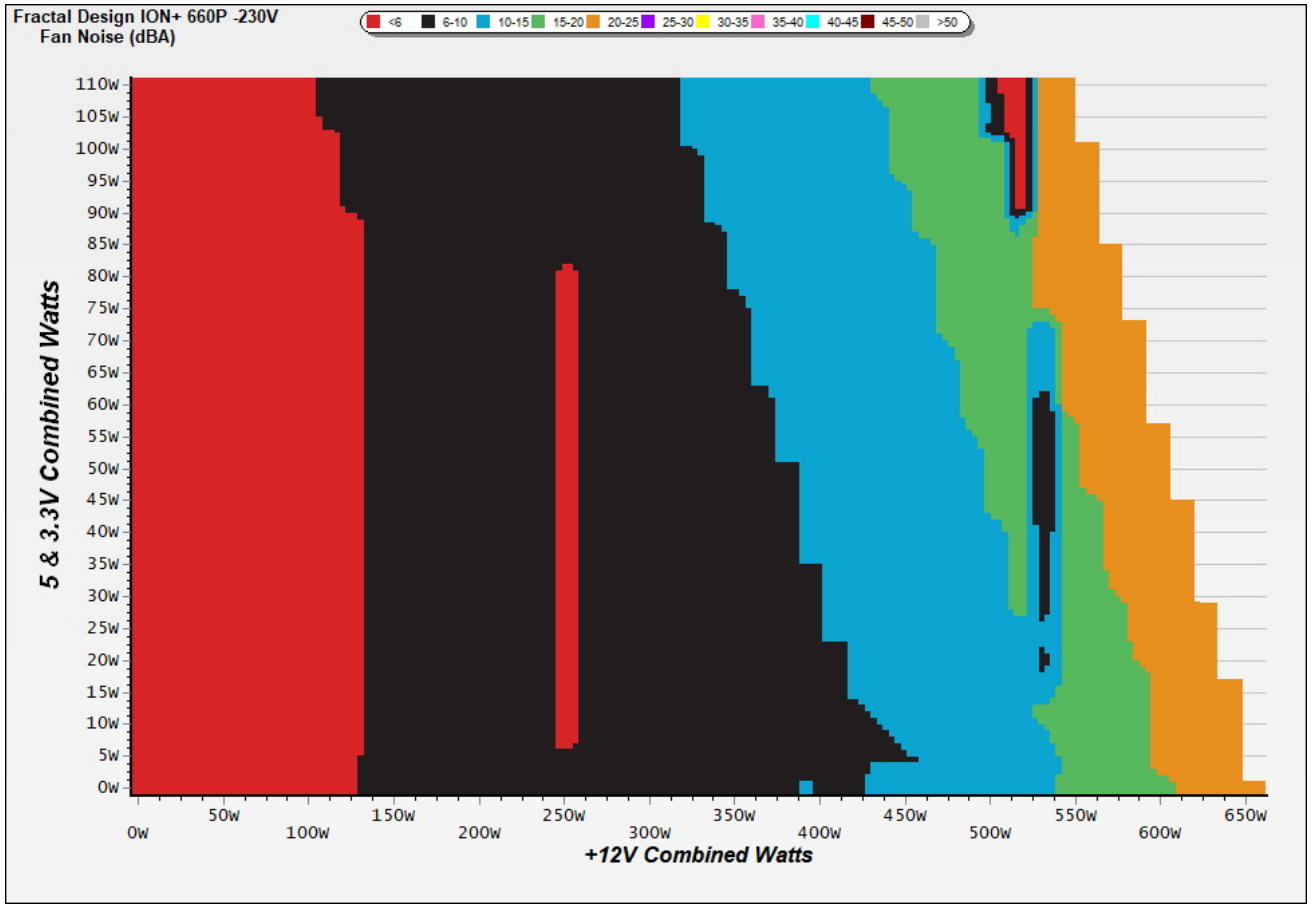
115V



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

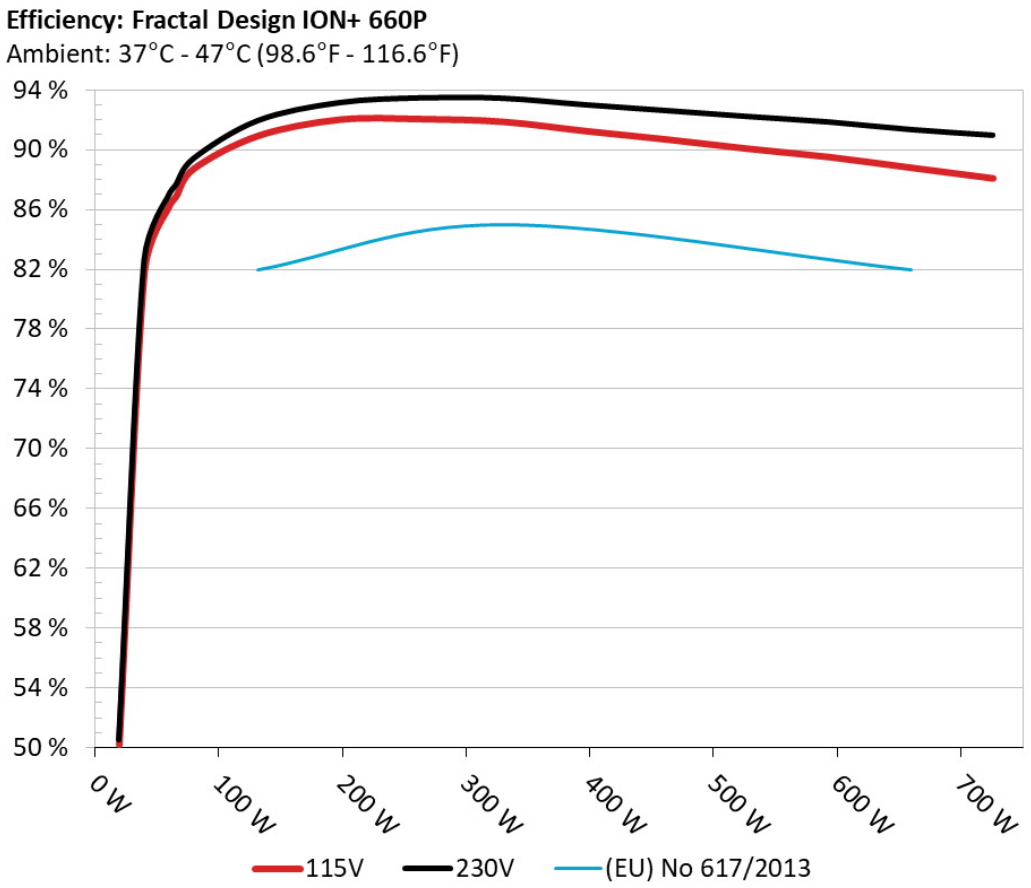


INFO

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

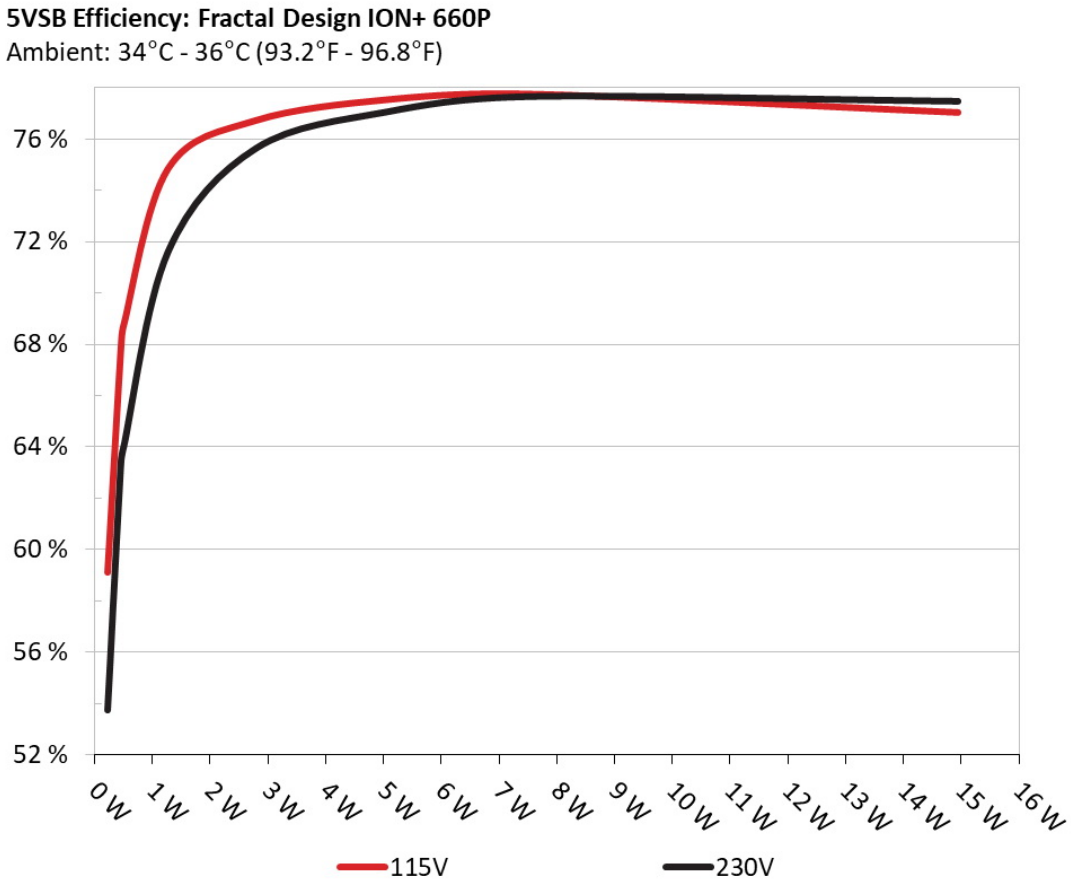
Efficiency under high ambient temperature



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	0.230	59.126%	0.056
	5.115V	0.389		115.13V
2	0.090A	0.460	67.847%	0.095
	5.113V	0.678		115.13V
3	0.550A	2.801	76.719%	0.319
	5.093V	3.651		115.13V
4	1.000A	5.074	77.525%	0.392
	5.073V	6.545		115.13V
5	1.500A	7.578	77.739%	0.431
	5.051V	9.748		115.13V
6	3.000A	14.940	77.026%	0.482
	4.980V	19.396		115.13V

230V

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.230	53.738%	0.019
	5.115V	0.428		230.30V
2	0.090A	0.460	63.361%	0.032
	5.113V	0.726		230.30V
3	0.550A	2.801	75.641%	0.146
	5.092V	3.703		230.30V
4	1.000A	5.073	77.062%	0.223
	5.073V	6.583		230.30V
5	1.500A	7.577	77.657%	0.280
	5.051V	9.757		230.30V
6	3.000A	14.948	77.471%	0.365
	4.982V	19.295		230.30V

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
1	3.675A	1.990A	1.991A	1.000A	65.746	86.875%	0	<6.0	44.25°C	0.963
	12.011V	5.029V	3.314V	5.001V	75.679				39.45°C	115.16V
2	8.414A	2.983A	2.993A	1.201A	131.860	90.910%	0	<6.0	46.03°C	0.987
	11.998V	5.032V	3.306V	4.999V	145.044				40.61°C	115.22V
3	13.498A	3.485A	3.481A	1.403A	197.787	91.994%	0	<6.0	47.79°C	0.994
	11.985V	5.027V	3.302V	4.989V	215.001				41.56°C	115.17V
4	18.587A	3.983A	4.001A	1.608A	263.788	92.030%	384	6.8	41.84°C	0.994
	11.975V	5.024V	3.298V	4.977V	286.634				48.41°C	115.15V
5	23.356A	4.985A	4.995A	1.813A	329.912	91.850%	387	6.9	42.17°C	0.996
	11.963V	5.017V	3.302V	4.965V	359.186				49.62°C	115.16V
6	28.140A	5.989A	6.010A	2.020A	396.029	91.233%	425	7.4	42.54°C	0.997
	11.948V	5.011V	3.294V	4.953V	434.087				50.40°C	115.14V
7	32.934A	6.998A	7.030A	2.228A	462.153	90.666%	722	18.4	43.07°C	0.998
	11.934V	5.003V	3.286V	4.940V	509.732				51.21°C	115.15V
8	37.746A	7.995A	8.030A	2.431A	528.277	90.044%	822	21.4	43.74°C	0.998
	11.918V	5.005V	3.288V	4.937V	586.689				52.66°C	115.15V
9	42.963A	8.503A	8.527A	2.433A	593.996	89.485%	977	26.7	44.40°C	0.998
	11.905V	5.000V	3.284V	4.934V	663.796				53.77°C	115.16V
10	47.963A	9.017A	9.064A	3.061A	660.013	88.773%	1119	30.8	45.80°C	0.998
	11.890V	4.993V	3.277V	4.903V	743.487				55.59°C	115.15V
11	53.581A	9.022A	9.070A	3.063A	726.058	88.066%	1122	31.0	46.62°C	0.998
	11.876V	4.990V	3.275V	4.899V	824.451				57.46°C	115.16V
CL1	0.154A	13.002A	13.000A	0.000A	109.741	84.213%	0	<6.0	49.74°C	0.984
	11.973V	5.016V	3.283V	5.058V	130.313				42.25°C	115.21V

CL2	55.038A	1.003A	1.000A	1.000A	668.412	89.434%	1118	30.8	45.38°C	0.998
	11.903V	5.005V	3.300V	4.975V	747.378				55.12°C	115.20V

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
1	3.673A	1.989A	1.991A	1.000A	65.715	87.681%	0	<6.0	44.45°C	0.787
	12.010V	5.030V	3.313V	5.000V	74.948				39.51°C	230.36V
2	8.411A	2.982A	2.995A	1.201A	131.816	91.977%	0	<6.0	45.62°C	0.909
	11.997V	5.033V	3.305V	4.998V	143.314				40.24°C	230.36V
3	13.496A	3.481A	3.484A	1.404A	197.742	93.182%	0	<6.0	46.95°C	0.953
	11.984V	5.029V	3.300V	4.988V	212.211				41.02°C	230.36V
4	18.583A	3.982A	3.992A	1.608A	263.736	93.501%	386	6.9	41.82°C	0.969
	11.975V	5.023V	3.307V	4.976V	282.067				48.57°C	230.39V
5	23.353A	4.987A	4.998A	1.814A	329.862	93.476%	388	7.0	42.38°C	0.978
	11.962V	5.016V	3.300V	4.964V	352.883				50.01°C	230.42V
6	28.136A	5.990A	6.013A	2.020A	395.977	93.045%	425	7.4	42.64°C	0.985
	11.948V	5.009V	3.293V	4.952V	425.575				50.88°C	230.38V
7	32.929A	7.002A	7.030A	2.228A	462.097	92.650%	543	10.5	43.24°C	0.987
	11.934V	5.002V	3.285V	4.939V	498.758				51.81°C	230.39V
8	37.738A	7.996A	8.032A	2.432A	528.217	92.253%	670	15.2	43.77°C	0.991
	11.919V	5.004V	3.287V	4.936V	572.576				53.11°C	230.43V
9	42.959A	8.503A	8.530A	2.434A	593.944	91.885%	850	22.4	44.08°C	0.994
	11.905V	4.999V	3.283V	4.933V	646.402				53.82°C	230.38V
10	47.952A	9.015A	9.064A	3.061A	659.968	91.381%	1123	31.0	45.53°C	0.995
	11.892V	4.993V	3.277V	4.903V	722.216				55.58°C	230.38V
11	53.572A	9.020A	9.069A	3.063A	725.983	91.003%	1125	31.0	46.63°C	0.995
	11.877V	4.990V	3.274V	4.899V	797.758				57.42°C	230.39V
CL1	0.152A	13.001A	13.000A	0.000A	109.725	85.003%	0	<6.0	50.60°C	0.894
	11.978V	5.016V	3.284V	5.056V	129.084				42.34°C	230.42V

CL2	55.022A	1.003A	1.000A	1.000A	668.393	92.151%	1116	30.8	45.60°C	0.995
	11.906V	5.009V	3.300V	4.977V	725.320				55.12°C	230.40V

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])	PF/AC Volts
1	1.205A	0.498A	0.482A	0.199A	19.649	50.174%	0	<6.0	0.906
	12.068V	5.036V	3.312V	5.034V	39.162				115.16V
2	2.475A	0.996A	0.994A	0.399A	40.043	81.859%	0	<6.0	0.934
	12.014V	5.029V	3.316V	5.021V	48.917				115.16V
3	3.673A	1.491A	1.478A	0.598A	59.526	86.109%	0	<6.0	0.959
	12.015V	5.033V	3.308V	5.019V	69.129				115.16V
4	4.942A	1.990A	1.992A	0.799A	79.951	88.710%	0	<6.0	0.972
	12.009V	5.027V	3.312V	5.006V	90.126				115.16V

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])	PF/AC Volts
1	1.205A	0.498A	0.482A	0.199A	19.640	50.544%	0	<6.0	0.607
	12.066V	5.029V	3.312V	5.025V	38.857				230.36V
2	2.474A	0.995A	0.996A	0.399A	40.024	82.595%	0	<6.0	0.671
	12.015V	5.026V	3.310V	5.016V	48.458				230.36V
3	3.671A	1.490A	1.482A	0.598A	59.502	86.925%	0	<6.0	0.768
	12.013V	5.034V	3.307V	5.018V	68.452				230.36V
4	4.940A	1.989A	1.992A	0.799A	79.921	89.439%	0	<6.0	0.829
	12.009V	5.028V	3.311V	5.006V	89.358				230.36V

The results above are not used in the certification process

Ripple Measurements

115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	12.70mV	3.90mV	10.90mV	6.80mV	Pass
20% Load	8.00mV	4.10mV	10.70mV	6.90mV	Pass
30% Load	7.90mV	6.00mV	14.70mV	10.00mV	Pass
40% Load	8.30mV	5.30mV	11.80mV	7.70mV	Pass
50% Load	8.50mV	5.70mV	11.70mV	7.70mV	Pass
60% Load	8.80mV	6.70mV	13.10mV	8.70mV	Pass
70% Load	9.40mV	6.20mV	13.20mV	8.70mV	Pass
80% Load	10.20mV	7.10mV	15.20mV	9.40mV	Pass
90% Load	10.80mV	7.40mV	14.80mV	10.20mV	Pass
100% Load	16.30mV	8.70mV	15.50mV	11.00mV	Pass
110% Load	17.80mV	8.90mV	15.30mV	10.80mV	Pass
Crossload1	11.00mV	5.20mV	16.00mV	7.40mV	Pass
Crossload2	16.20mV	7.50mV	12.40mV	10.00mV	Pass

The results above are not used in the certification process

230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	11.40mV	3.80mV	10.80mV	6.70mV	Pass
20% Load	7.90mV	4.60mV	11.10mV	7.00mV	Pass
30% Load	7.30mV	5.00mV	11.00mV	7.80mV	Pass
40% Load	7.60mV	5.10mV	11.00mV	7.50mV	Pass
50% Load	8.00mV	5.50mV	11.90mV	7.90mV	Pass
60% Load	8.20mV	6.30mV	12.30mV	9.30mV	Pass
70% Load	8.60mV	6.20mV	12.90mV	9.10mV	Pass
80% Load	9.00mV	6.90mV	14.60mV	9.40mV	Pass

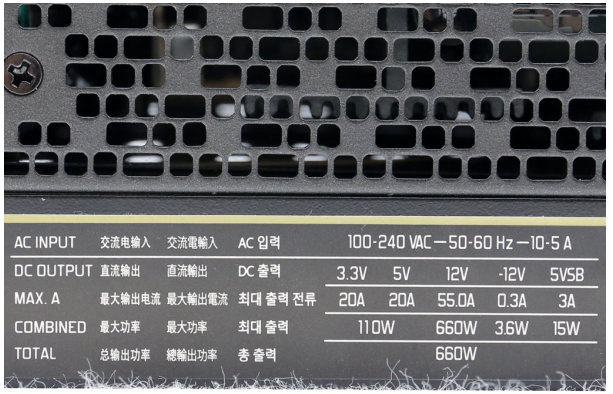
Test	12V	5V	3.3V	5VSB	Pass/Fail
90% Load	10.10mV	7.50mV	15.10mV	9.40mV	Pass
100% Load	15.50mV	8.40mV	16.00mV	10.80mV	Pass
110% Load	16.60mV	8.60mV	16.10mV	11.20mV	Pass
Crossload1	10.60mV	5.20mV	15.80mV	7.20mV	Pass
Crossload2	15.60mV	7.80mV	12.40mV	10.40mV	Pass

The results above are not used in the certification process

Fractal Design ION+ 660P



Top side



Power specifications label

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

Cybenetics runs voluntary certification programs for power supplies - ETA for efficiency, LAMBDA for noise and SAFE for safety and correct operation - and for cooling products, with DELTA for chassis soundproofing and PHI for fan airflow and static pressure. THETA rates cooler performance on AMD AM5 and Intel LGA1851 outside ISO 17065 and accreditation scope

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