Seasonic Focus Plus Gold 650W (#3)

Serial Number R1708AA174160086

Lab ID 236

Certification ID 25236

Test Result Report ID:

Certificate Issue Date: Jun 12, 2018

Scheme: ETA-EMI PSU

115V 230V

Scheme: LAMBDA PSU

115V 230V

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	Seasonic
Model	Focus Plus Gold 650W (#3)
OEM/ODM	Seasonic
Serial Number	R1708AA174160086
Product Specifications	
Manufacturer-Provided Information	
Rated Voltage (Vrms)	100-240
Rated Current (Arms)	9-4.5
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 (HA1225H12F-Z)
Semi-Passive Operation	✓ (selectable)
Cybenetics Testing Information	
Lab ID	236
Date of receipt	Jun 4, 2018
Testing Date	Jun 10, 2018
Report Issued Date	Jun 12, 2018
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 (610mm)	1	1	18-22AWG	Yes
4+4 pin EPS12V (655mm)	1	1	18AWG	No
6+2 pin PCIe (680mm+80mm)	2	4	18AWG	No
SATA (455mm+115mm+115mm+115mm)	2	8	18AWG	No
4 pin Molex (460mm+125mm+125mm)	1	3	18AWG	No
FDD Adapter (+110mm)	1	1	22AWG	No
AC Power Cord (1400mm) - C13 coupler	1	1	18AWG	No

Power Specifications

Rail		3.3V	5V	12V	5VSB	-12V
Max. Power	Amps	20	20	54	3	0.3
	Watts	100		648	15	3.6
Total Max. Power (W)		650				

Parts Description

General Data	
Manufacturer (OEM)	Seasonic
Platform Model	FX
Primary Side	
Transient Filter	4x Y caps, 2x X caps, 2x CM chokes, 1x MOV
Inrush Protection	NTC Thermistor & Diode
Bridge Rectifier(s)	2x GBU1006 (600V, 10A @ 100°C)
APFC MOSFETS	2x UTC GPT18N50DG (500V, 18A @ 100°C, 0.265Ohm)
APFC Boost Diode	1x BYC8-600 (600V, 8A @ 109°C)
Hold-up Cap(s)	1x Nippon Chemi-Con (400V, 450uF, 2000h @ 105°C, CE)
Main Switchers	4x UTC GBT10N50ADG (500V, 10A @ 25°C, 0.61Ohm)
APFC Controller	Champion CM6500UNX
Resonant Controller	Champion CM6901T6X
Topology	Primary side: Full-Bridge & LLC Resonant Controller Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	
+12V MOSFETS	2x Nexperia PSMN1R8-40YLC (40V, 100A @ 25°C, 1.8mOhm)
5V & 3.3V	DC-DC Converters: 6x Infineon BSC0906NS (30V, 40A @ 100°C, 4.5mOhm) PWM Controller: APW7159
Filtering Capacitors	Electrolytics: Chemi-Con (1-5,000 @ 105°C, KZE), Chemi-Con (4-10,000 @ 105°C, KY), Chemi-Con (105°C, W) Polymers: Chemi-Con
Supervisor IC	Weltrend WT7527V (OVP, UVP, OCP, SCP, PG)
Fan Model	Hong Hua HA1225H12F-Z (120mm, 12V, 0.58A, 2200 RPM, Fluid Dynamic Bearing)
5VSB Circuit	

Standby PWM Controller	Excelliance EM8569

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)	88.653%
Average Noise Output (>1450 Load Combinations)	25.17dBA
Average PF (>1450 Load Combinations)	0.983
Efficiency With 10W (≤500W) or 2% (>500W) Load	-
Standby Power Consumption	0.0458W
Non-Accredited	
12V Ripple (Full Load)	28.73mV
5V Ripple (Full Load)	13.85mV
3.3V Ripple (Full Load)	9.60mV
5VSB Ripple (Full Load)	11.32mV
12V Load Regulation	0.06%
5V Load Regulation	0.34%
3.3V Load Regulation	0.51%
5VSB Load Regulation	2.54%
Inrush Current	26.855A

230V		
Accredited		
Average Efficiency (>1450 load combinations)	90.679%	
Average Noise Output (>1450 Load Combinations)	25.40dBA	
Average PF (>1450 Load Combinations)	0.931	
Efficiency With 10W (≤500W) or 2% (>500W) Load	-	
Standby Power Consumption	0.0742W	
Non-Accredited		
12V Ripple (Full Load)	28.36mV	
5V Ripple (Full Load)	13.77mV	
3.3V Ripple (Full Load)	9.31mV	
5VSB Ripple (Full Load)	6.65mV	
12V Load Regulation	0.04%	
5V Load Regulation	0.36%	
3.3V Load Regulation	0.54%	
5VSB Load Regulation	2.46%	
Inrush Current	54.955A	
Hold-Up Time & PWR_OK Signal	17.00ms	
AC Loss to PWR_OK Hold Up Time	15.00ms	
PWR_OK Inactive to DC Loss Delay	2.00ms	
OPP (0.00°C / 0.00°C)	-	-

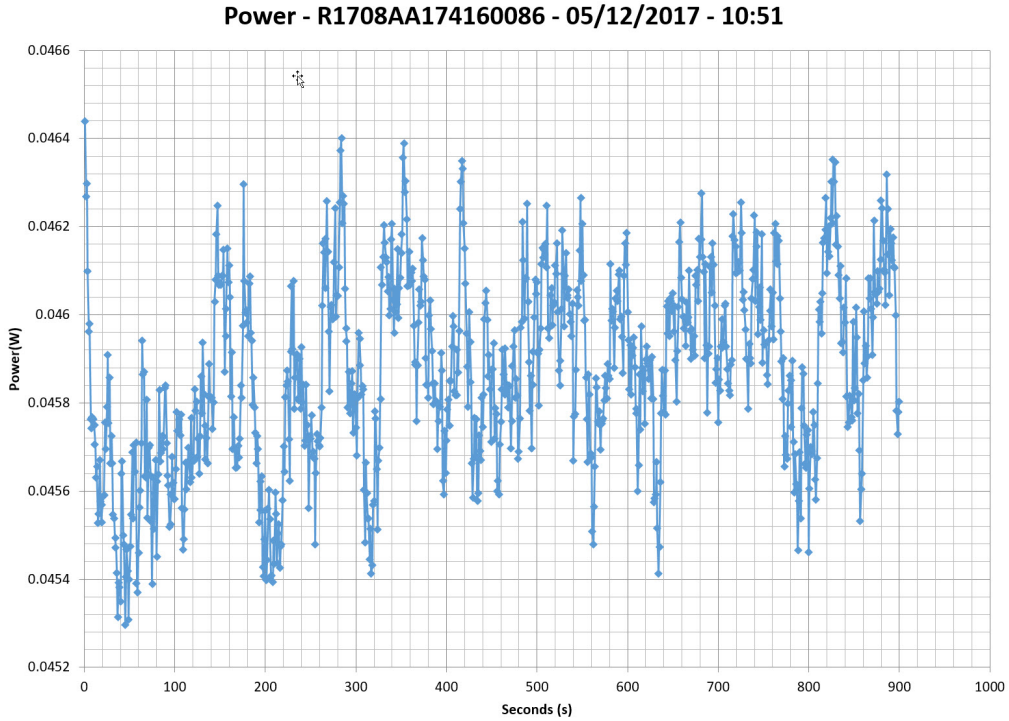
Hold-Up Time & PWR_OK Signal

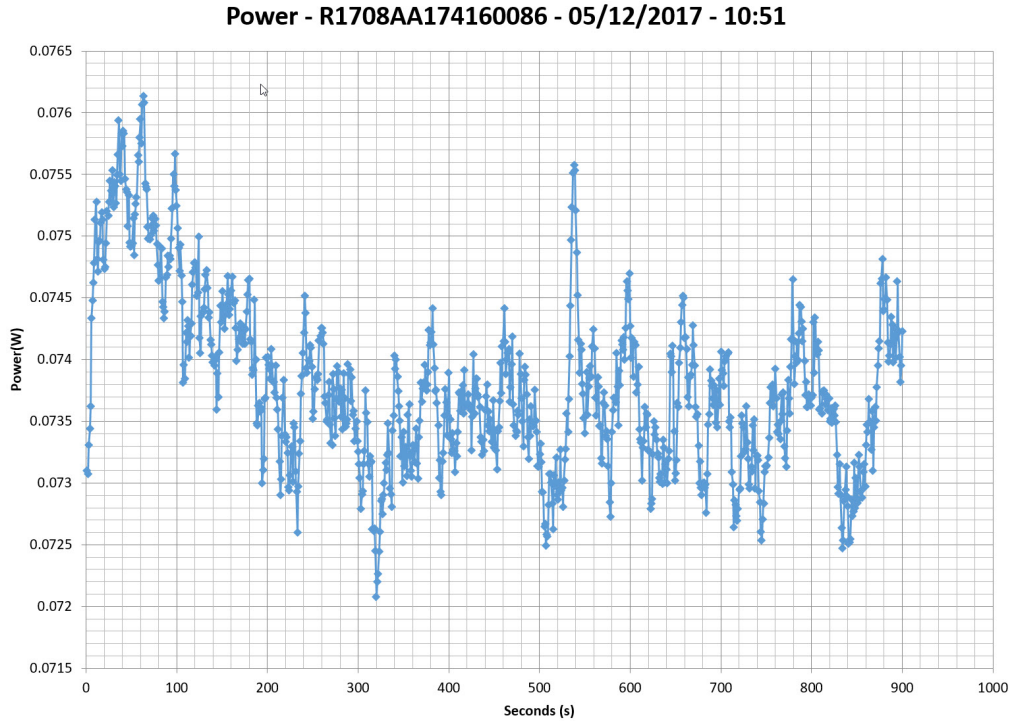
Hold-Up Time (ms)	17
AC Loss to PWR_OK Hold Up Time (ms)	15
PWR_OK Inactive to DC Loss Delay (ms)	2

Stromverbrauch im Ruhezustand

Graphs

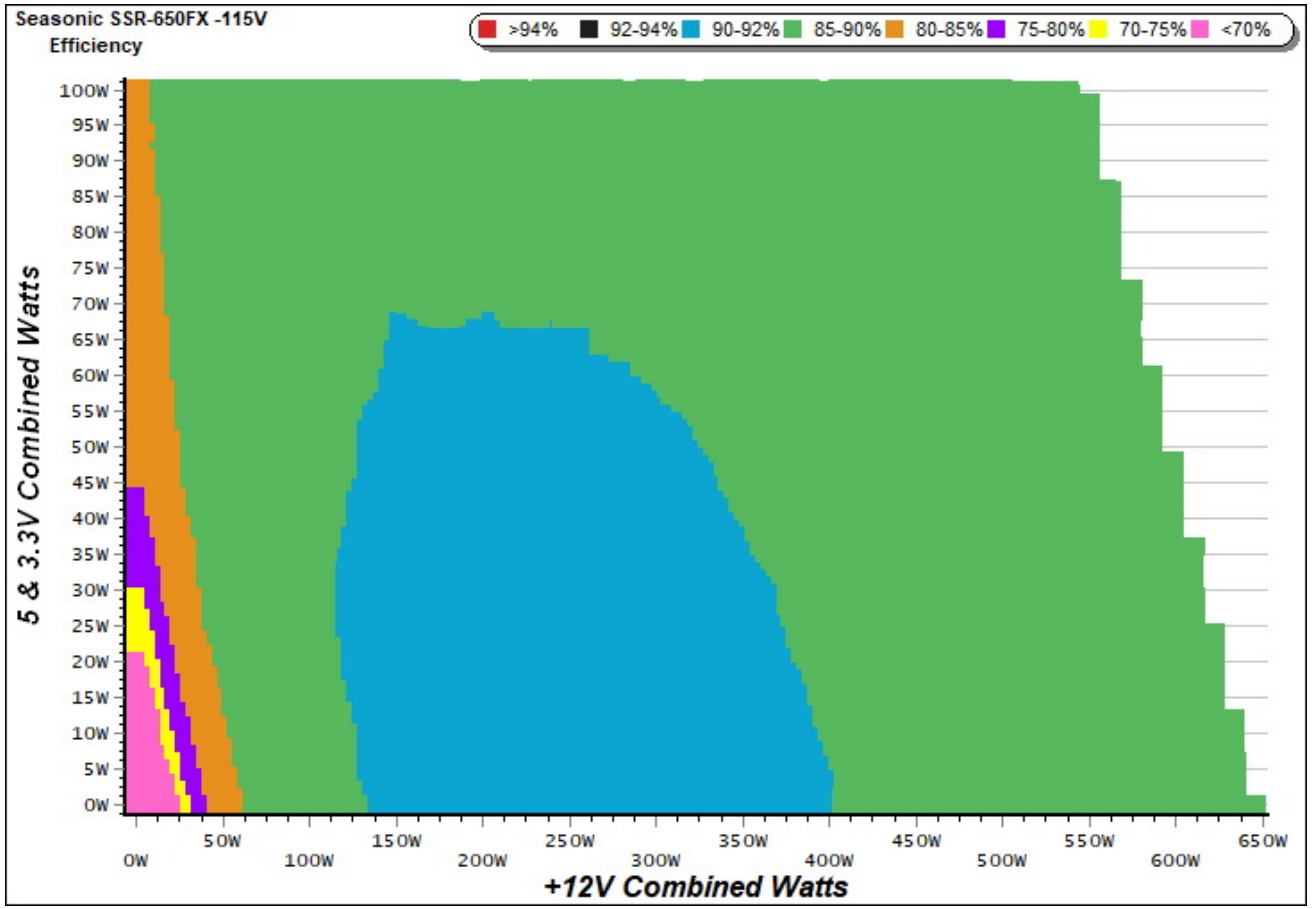
115V	230V





Efficiency Graph

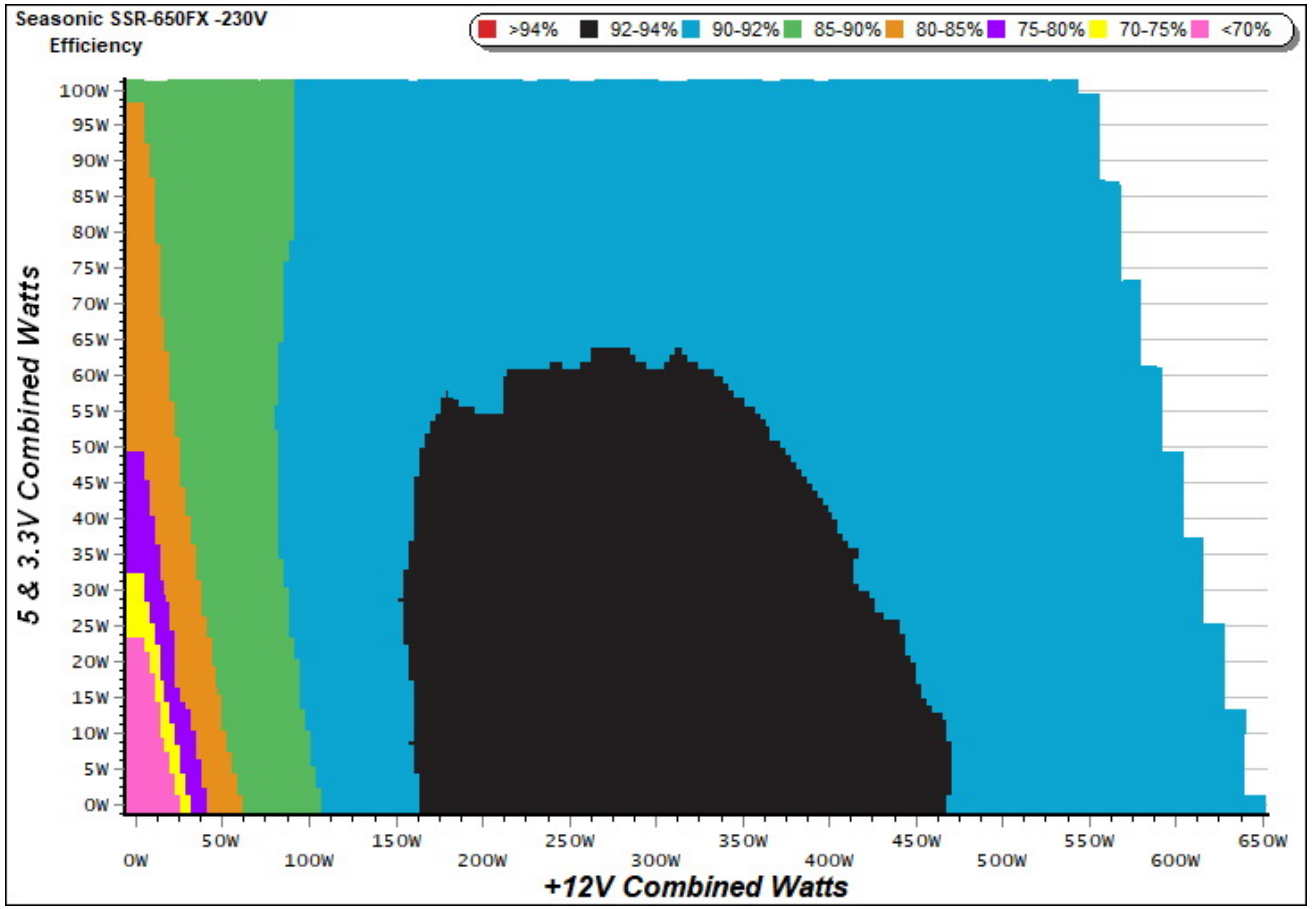
115V



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

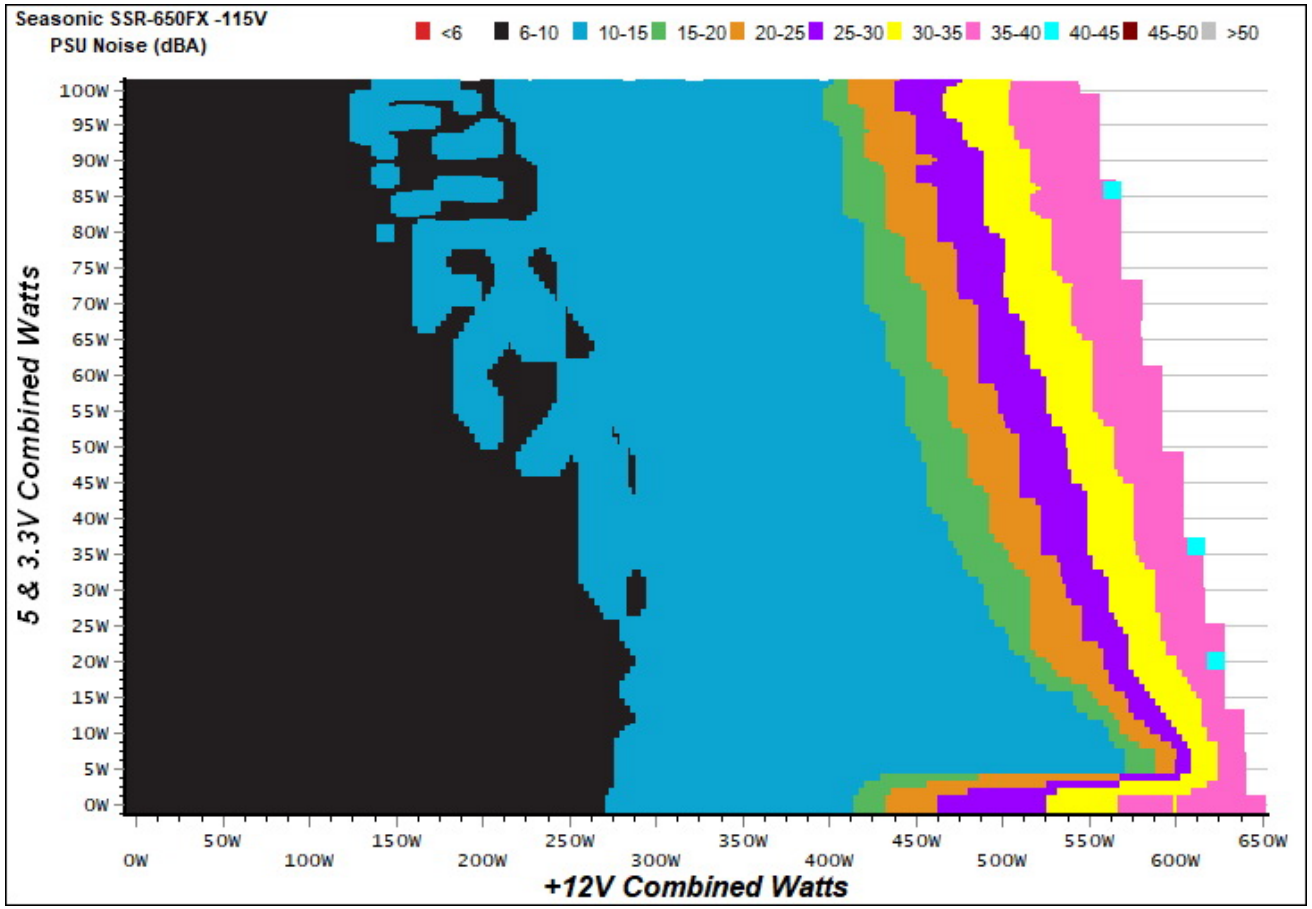


INFO

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

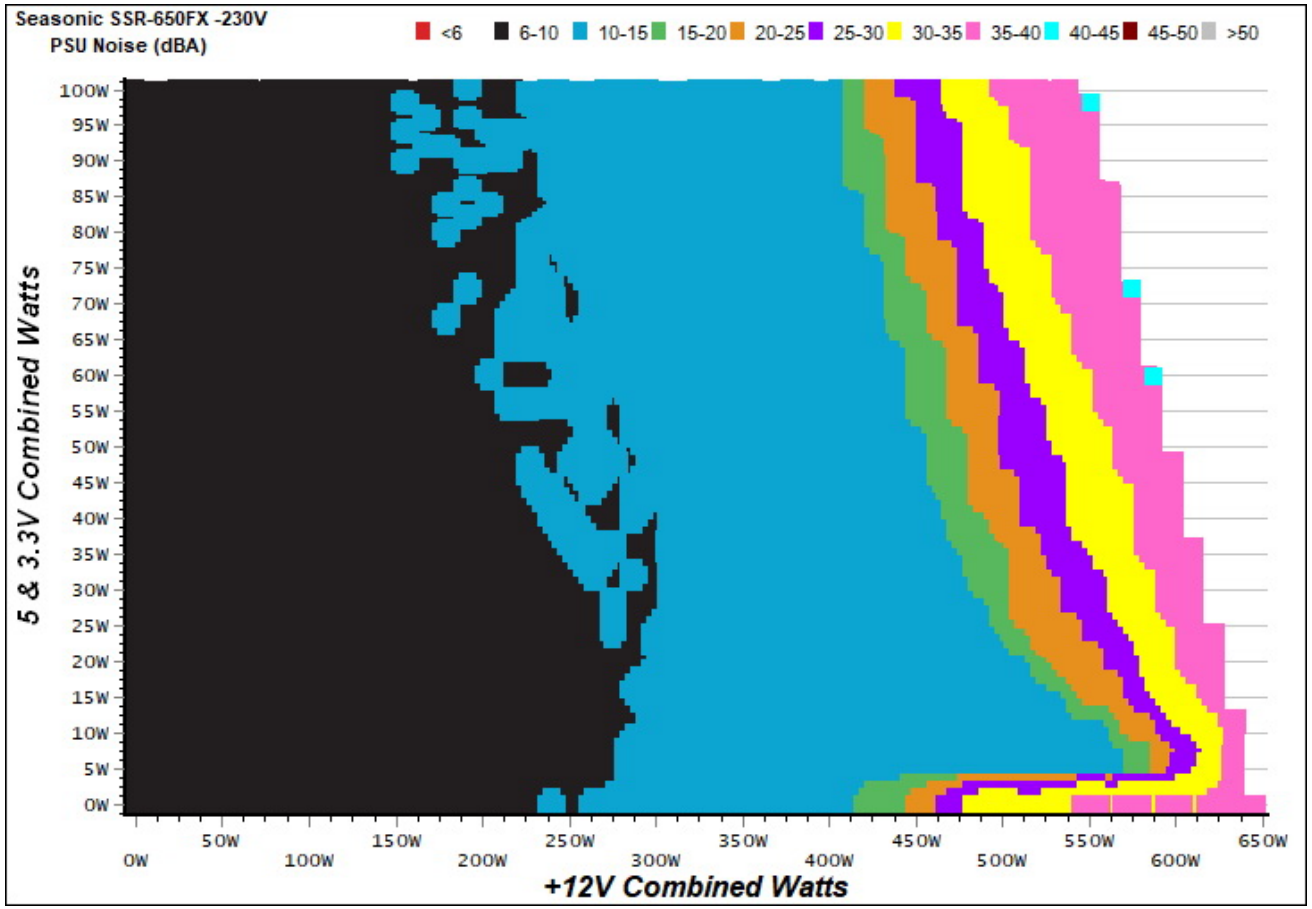
115V



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

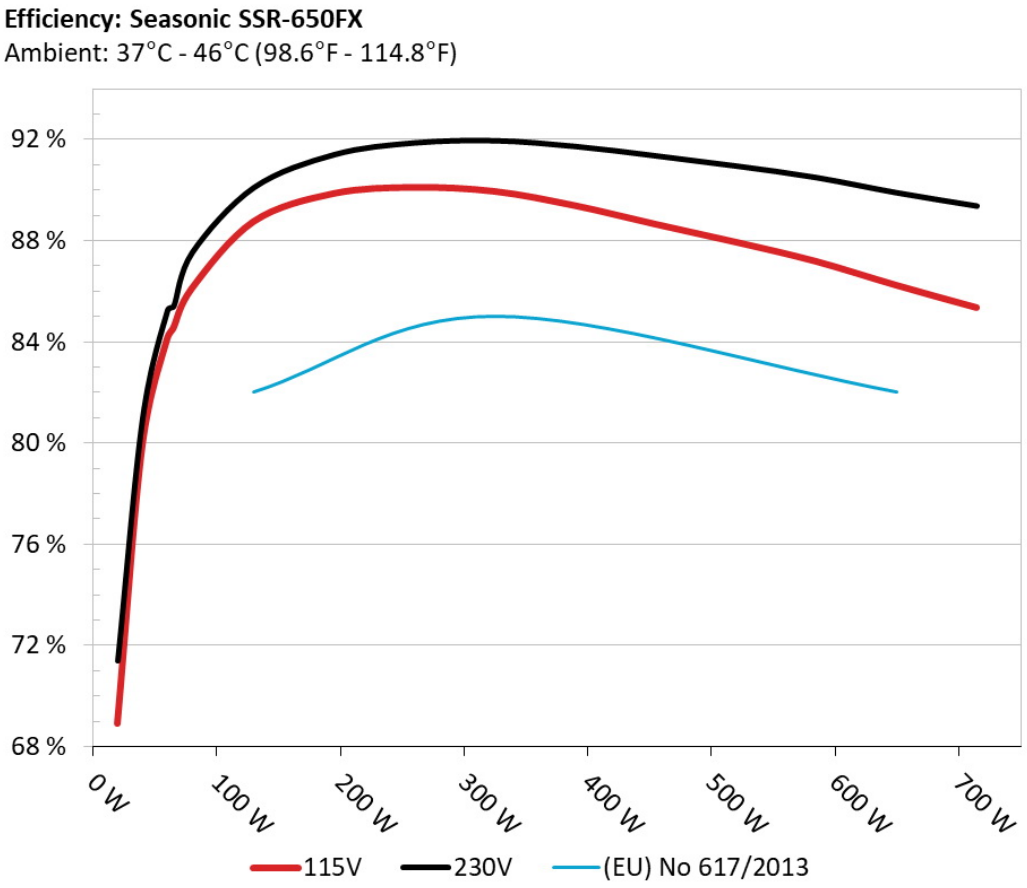


INFO

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

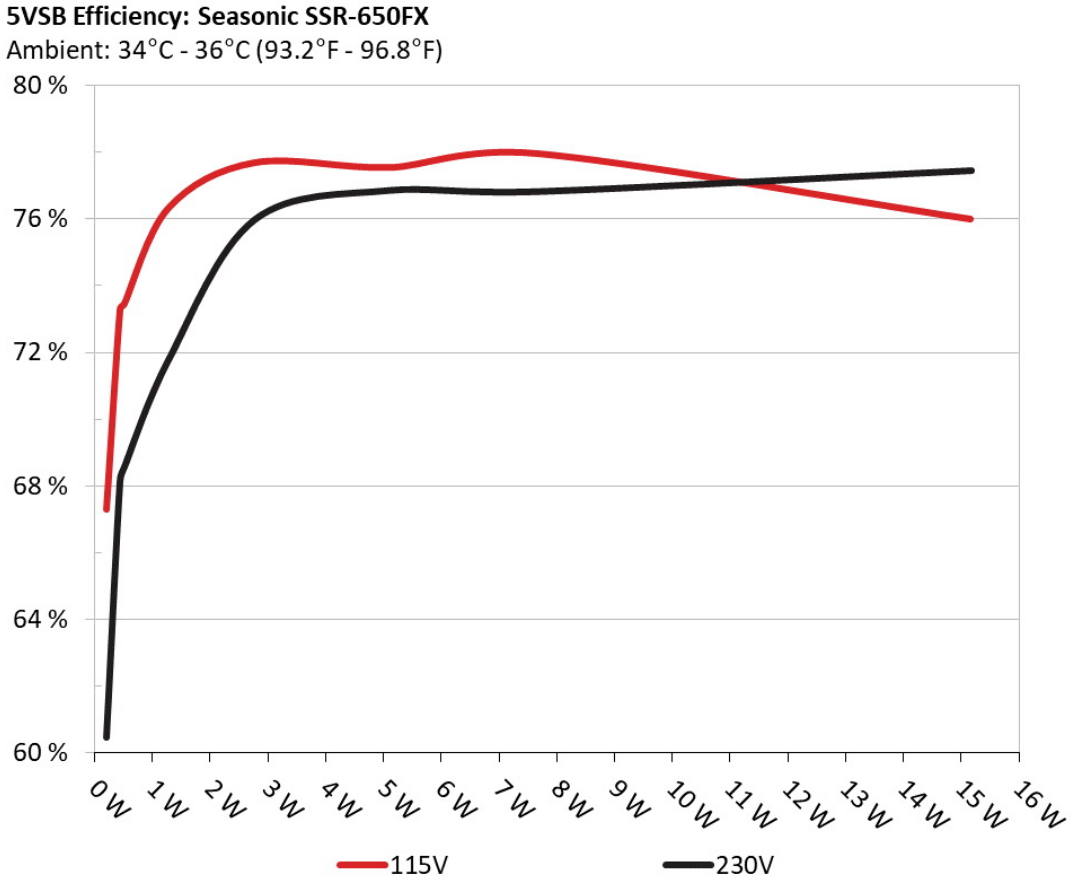
Efficiency under high ambient temperature



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	0.042A	0.214	67.296%	0.052
	5.126V	0.318		115.03V
2	0.087A	0.447	73.279%	0.097
	5.125V	0.610		115.04V
3	0.542A	2.774	77.681%	0.327
	5.115V	3.571		115.03V
4	1.002A	5.115	77.535%	0.397
	5.104V	6.597		115.03V
5	1.502A	7.649	77.956%	0.431
	5.093V	9.812		115.03V
6	3.001A	15.155	75.992%	0.478
	5.050V	19.943		115.03V

230V

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.042A	0.214	60.452%	0.018
	5.126V	0.354		230.15V
2	0.087A	0.447	68.140%	0.032
	5.125V	0.656		230.15V
3	0.542A	2.774	75.979%	0.157
	5.115V	3.651		230.14V
4	1.002A	5.116	76.863%	0.239
	5.104V	6.656		230.14V
5	1.502A	7.648	76.826%	0.293
	5.093V	9.955		230.15V
6	3.001A	15.182	77.455%	0.367
	5.059V	19.601		230.15V

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	3.567A	1.994A	1.980A	0.981A	64.823	84.546%	0	<6.0	48.07°C	0.944
	12.120V	5.015V	3.331V	5.093V	76.672				38.07°C	115.08V
2	8.162A	2.988A	2.968A	1.181A	129.797	88.769%	0	<6.0	49.17°C	0.974
	12.121V	5.014V	3.330V	5.081V	146.219				38.46°C	115.08V
3	13.101A	3.494A	3.482A	1.380A	194.914	89.877%	621	11.6	39.51°C	0.984
	12.122V	5.013V	3.329V	5.070V	216.868				50.93°C	115.08V
4	18.031A	3.994A	3.968A	1.580A	259.766	90.117%	550	10.4	39.76°C	0.988
	12.122V	5.010V	3.324V	5.060V	288.253				51.70°C	115.07V
5	22.626A	4.988A	4.962A	1.781A	324.734	89.959%	560	10.5	39.98°C	0.990
	12.122V	5.008V	3.323V	5.050V	360.981				52.34°C	115.07V
6	27.214A	5.992A	5.958A	1.981A	389.683	89.396%	560	10.5	40.21°C	0.990
	12.123V	5.007V	3.321V	5.038V	435.908				52.80°C	115.07V
7	31.799A	6.997A	6.956A	2.185A	454.631	88.664%	845	20.4	41.79°C	0.991
	12.124V	5.005V	3.320V	5.028V	512.760				54.64°C	115.07V
8	36.396A	7.996A	7.957A	2.390A	519.579	87.955%	1300	32.4	42.66°C	0.991
	12.122V	5.003V	3.317V	5.016V	590.736				56.01°C	115.06V
9	41.418A	8.500A	8.473A	2.395A	584.571	87.196%	1890	40.5	43.26°C	0.992
	12.120V	5.000V	3.315V	5.009V	670.407				57.12°C	115.06V
10	46.191A	9.010A	8.962A	3.005A	649.510	86.249%	2320	45.2	45.17°C	0.992
	12.119V	4.998V	3.314V	4.988V	753.061				59.34°C	115.06V
11	51.541A	9.011A	8.963A	3.008A	714.394	85.367%	2020	42.8	46.22°C	0.993
	12.120V	4.998V	3.313V	4.982V	836.853				60.47°C	115.05V
CL1	0.102A	12.011A	12.003A	0.004A	101.413	84.734%	510	6.0	42.36°C	0.969
	12.123V	5.013V	3.328V	5.103V	119.684				55.07°C	115.10V

CL2	53.969A	1.002A	1.002A	1.002A	667.605	86.542%	2320	45.2	45.22°C	0.992
	12.122V	5.002V	3.319V	5.045V	771.421				59.24°C	115.06V

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	3.564A	1.995A	1.981A	0.981A	64.809	85.390%	0	<6.0	49.82°C	0.733
	12.122V	5.017V	3.332V	5.093V	75.898				37.99°C	230.25V
2	8.159A	2.989A	2.969A	1.181A	129.795	90.092%	0	<6.0	50.93°C	0.871
	12.123V	5.016V	3.331V	5.081V	144.069				38.30°C	230.24V
3	13.099A	3.494A	3.483A	1.380A	194.908	91.395%	621	11.6	38.42°C	0.919
	12.123V	5.013V	3.329V	5.071V	213.258				52.21°C	230.24V
4	18.028A	3.995A	3.966A	1.580A	259.729	91.856%	459	9.9	38.88°C	0.942
	12.122V	5.010V	3.324V	5.060V	282.756				52.87°C	230.25V
5	22.622A	4.990A	4.965A	1.781A	324.704	91.941%	550	10.4	39.31°C	0.955
	12.122V	5.008V	3.323V	5.049V	353.166				53.82°C	230.25V
6	27.212A	5.994A	5.959A	1.982A	389.654	91.714%	560	10.5	40.17°C	0.963
	12.122V	5.007V	3.321V	5.039V	424.860				55.04°C	230.25V
7	31.796A	6.997A	6.957A	2.185A	454.598	91.345%	800	18.4	41.14°C	0.969
	12.124V	5.005V	3.320V	5.028V	497.674				56.61°C	230.24V
8	36.389A	7.997A	7.957A	2.391A	519.547	90.942%	1270	32.7	42.41°C	0.974
	12.123V	5.003V	3.318V	5.016V	571.292				58.58°C	230.25V
9	41.424A	8.500A	8.473A	2.395A	584.640	90.485%	1960	41.4	43.79°C	0.977
	12.120V	5.000V	3.315V	5.008V	646.118				60.22°C	230.25V
10	46.187A	9.011A	8.961A	3.006A	649.481	89.883%	2310	45.1	45.18°C	0.980
	12.119V	4.999V	3.314V	4.989V	722.584				62.02°C	230.25V
11	51.540A	9.011A	8.962A	3.008A	714.390	89.360%	2320	45.2	46.10°C	0.982
	12.120V	4.998V	3.314V	4.983V	799.454				63.83°C	230.25V
CL1	0.099A	12.013A	12.004A	0.004A	101.403	85.917%	510	6.0	43.42°C	0.838
	12.123V	5.013V	3.329V	5.103V	118.025				55.70°C	230.25V

CL2	53.969A	1.004A	1.003A	1.002A	667.617	90.310%	2320	45.2	45.61°C	0.980
	12.122V	5.001V	3.319V	5.045V	739.247				61.10°C	230.25V

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	1.209A	0.488A	0.478A	0.196A	19.694	68.932%	0	<6.0	0.764
	12.116V	5.019V	3.334V	5.118V	28.570				115.07V
2	2.435A	0.989A	0.990A	0.391A	39.758	79.904%	0	<6.0	0.895
	12.117V	5.014V	3.330V	5.111V	49.757				115.07V
3	3.667A	1.486A	1.499A	0.586A	59.872	84.131%	0	<6.0	0.937
	12.118V	5.015V	3.331V	5.102V	71.165				115.07V
4	4.886A	1.994A	1.979A	0.782A	79.788	86.118%	0	<6.0	0.956
	12.119V	5.014V	3.331V	5.096V	92.650				115.07V

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 1.206A0.491A 0.476A 0.196A 19.667 71.379% 0000 <6.0 0.486 12.122V 5.021V 3.336V 5.117V 27.553 230.23V 2 2.436A0.990A0.989A 0.391A 39.779 80.983% 0000 <6.0 0.605 12.122V 5.016V 3.332V 5.110V 49.120 230.26V 3 3.666A 1.486A 1.499A 0.586A 59.881 85.234% 0000 <6.0 0.710 12.122V 5.017V 3.332V 5.102V 70.255 230.25V 4 4.885A 1.995A 1.979A 0.783A 79.787 87.515% 0000 <6.0 0.782 12.122V 5.016V 3.331V 5.096V 91.170 230.25V
The results above are not used in the certification process

Ripple Measurements

115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	9.7 mV	6.3 mV	5.3 mV	4.7 mV	Pass

Test	12V	5V	3.3V	5VSB	Pass/Fail
20% Load	13.4 mV	7.1 mV	5.7 mV	4.7 mV	Pass
30% Load	16.4 mV	7.8 mV	6.5 mV	4.8 mV	Pass
40% Load	18.9 mV	8.9 mV	7.0 mV	4.9 mV	Pass
50% Load	20.6 mV	9.5 mV	6.9 mV	5.4 mV	Pass
60% Load	22.0 mV	10.0 mV	7.8 mV	6.2 mV	Pass
70% Load	23.5 mV	11.3 mV	8.0 mV	6.9 mV	Pass
80% Load	24.8 mV	11.6 mV	7.9 mV	7.9 mV	Pass
90% Load	26.5 mV	12.4 mV	8.9 mV	8.5 mV	Pass
100% Load	28.7 mV	13.9 mV	9.6 mV	11.3 mV	Pass
110% Load	30.0 mV	14.1 mV	10.1 mV	10.4 mV	Pass
Crossload 1	12.5 mV	11.4 mV	7.1 mV	6.4 mV	Pass
Crossload 2	28.3 mV	9.3 mV	9.1 mV	8.3 mV	Pass

The results above are not used in the certification process

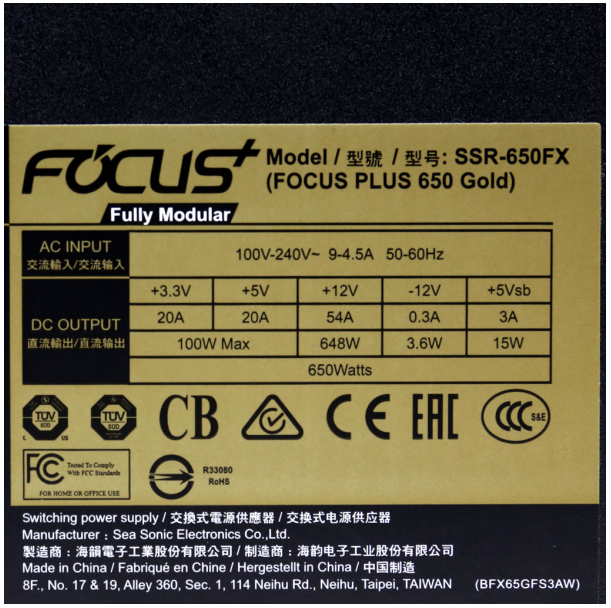
230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	8.5 mV	5.9 mV	5.2 mV	4.4 mV	Pass
20% Load	13.1 mV	7.1 mV	5.5 mV	4.6 mV	Pass
30% Load	16.1 mV	8.2 mV	5.9 mV	4.6 mV	Pass
40% Load	18.9 mV	8.9 mV	6.9 mV	4.8 mV	Pass
50% Load	20.4 mV	9.2 mV	6.7 mV	5.1 mV	Pass
60% Load	21.9 mV	10.0 mV	7.2 mV	5.6 mV	Pass
70% Load	23.3 mV	11.0 mV	8.1 mV	5.8 mV	Pass
80% Load	24.8 mV	11.3 mV	8.1 mV	6.1 mV	Pass
90% Load	26.3 mV	12.4 mV	9.0 mV	6.0 mV	Pass
100% Load	28.4 mV	13.8 mV	9.3 mV	6.7 mV	Pass
110% Load	30.2 mV	14.1 mV	9.6 mV	6.6 mV	Pass
Crossload 1	11.7 mV	11.4 mV	7.1 mV	6.4 mV	Pass
Crossload 2	28.3 mV	9.6 mV	8.6 mV	5.9 mV	Pass

The results above are not used in the certification process

Seasonic Focus Plus Gold 650W (#3)

Top side



Power specifications label

Cybenetics bietet freiwillige Zertifizierungsprogramme für Netzteile – ETA für Effizienz, LAMBDA für Lautstärke und SAFE für Sicherheit und korrekten Betrieb – sowie für Kühlprodukte mit DELTA für die Schalldämmung von Gehäusen und PHI für Luftstrom und statischen Druck von Lüftern

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