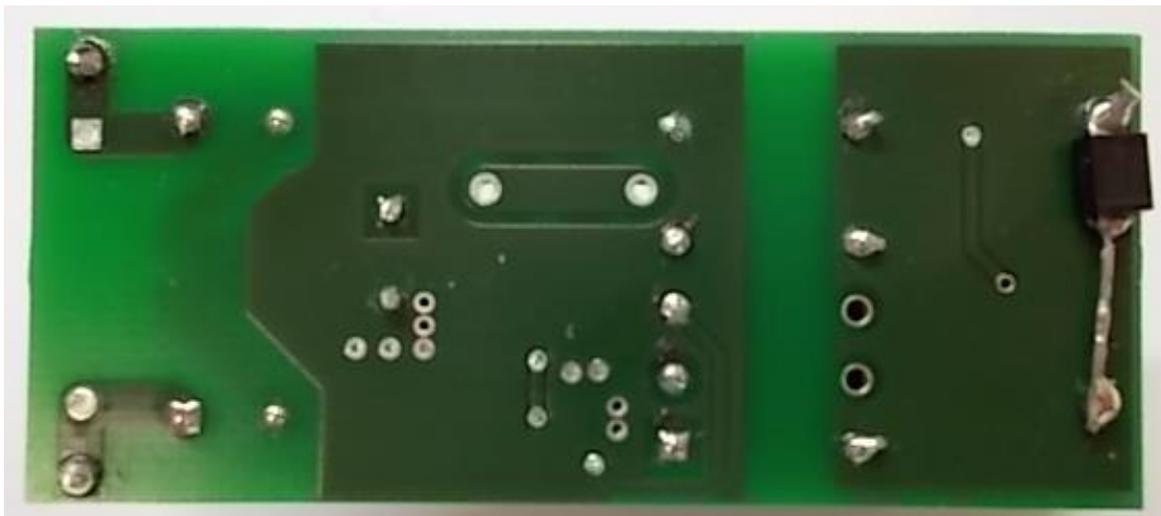
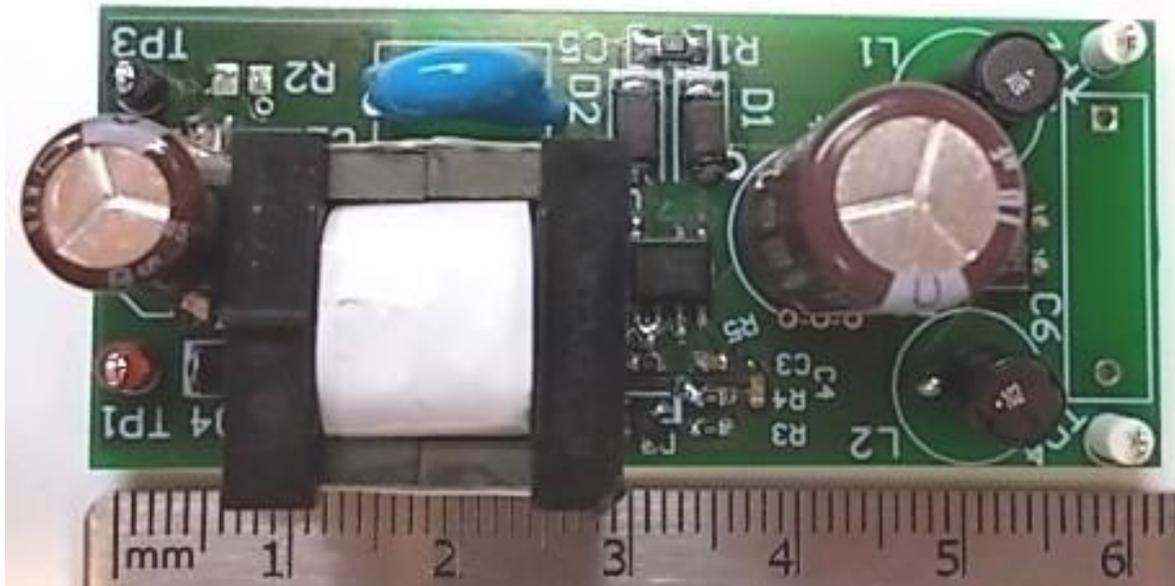


1 Photo of the prototype:

The reference design PMP30313 Rev_B has been built on PMP30313 Rev_A PCB



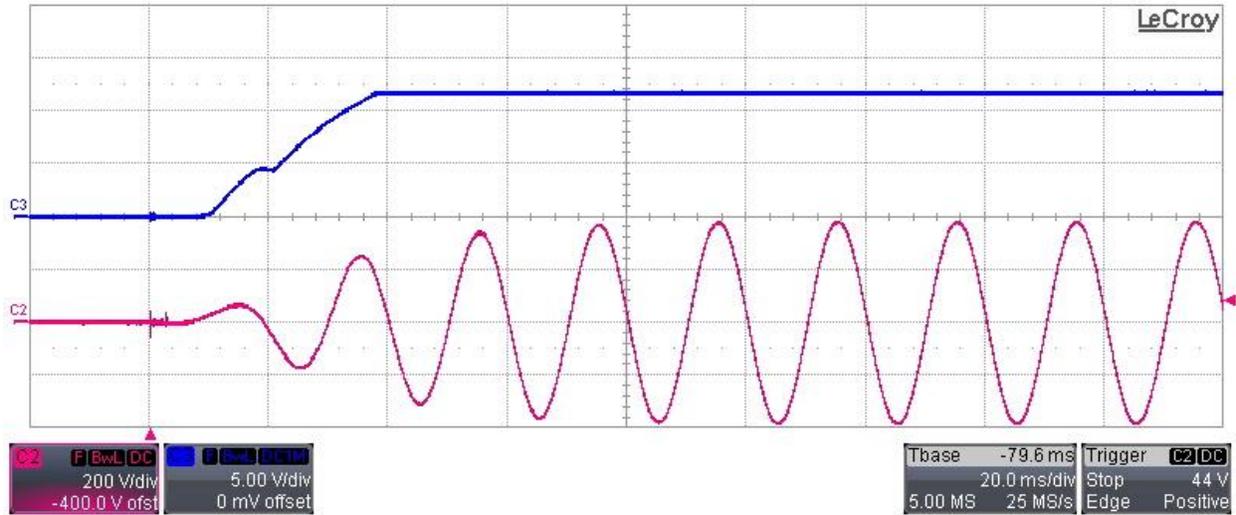
2 Startup

The output voltage behavior versus load and input AC voltage is shown in the images below. The input voltage was set respectively to 264VAC and 85VAC.

Ch.2: Input voltage (200V/div, 20ms/div, 20MHz BWL)

Ch.3: Output voltage (5V/div, 20MHz BWL)

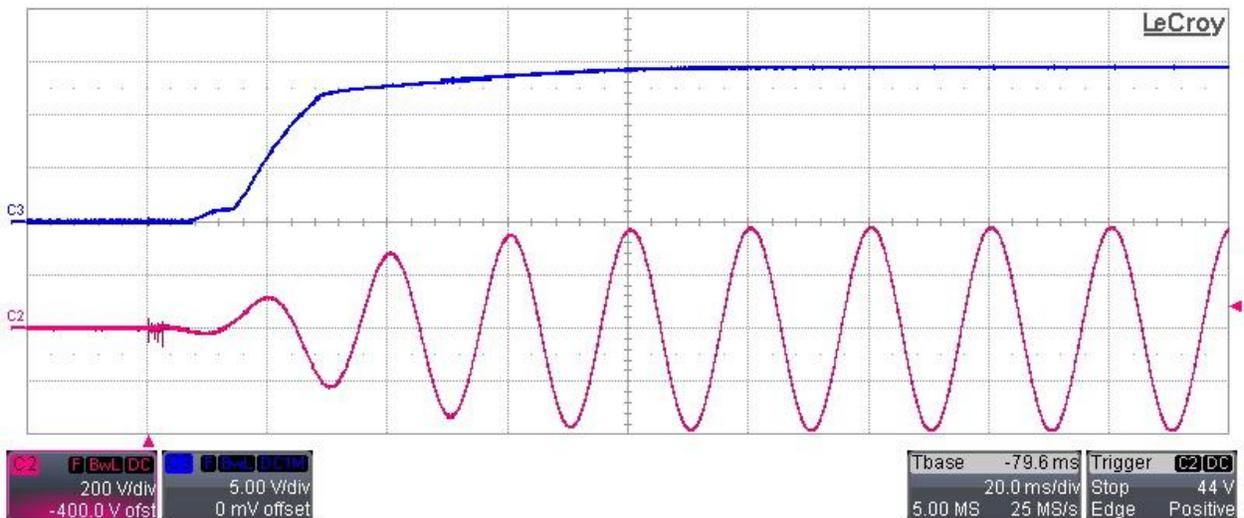
Full load, $V_{in} = 264VAC, 50Hz$:



Ch.2: Input voltage (200V/div, 20ms/div, 20MHz BWL)

Ch.3: Output voltage (5V/div, 20MHz BWL)

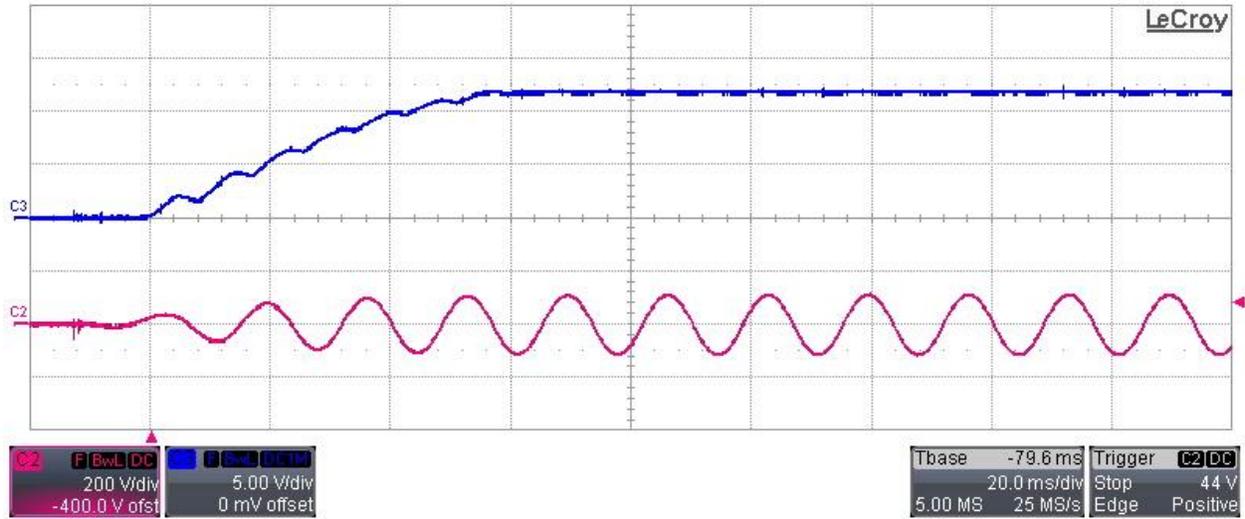
Zero load, $V_{in} = 264VAC, 50Hz$:



Ch.2: Input voltage (200V/div, 20ms/div, 20MHz BWL)

Ch.3: Output voltage (5V/div, 20MHz BWL)

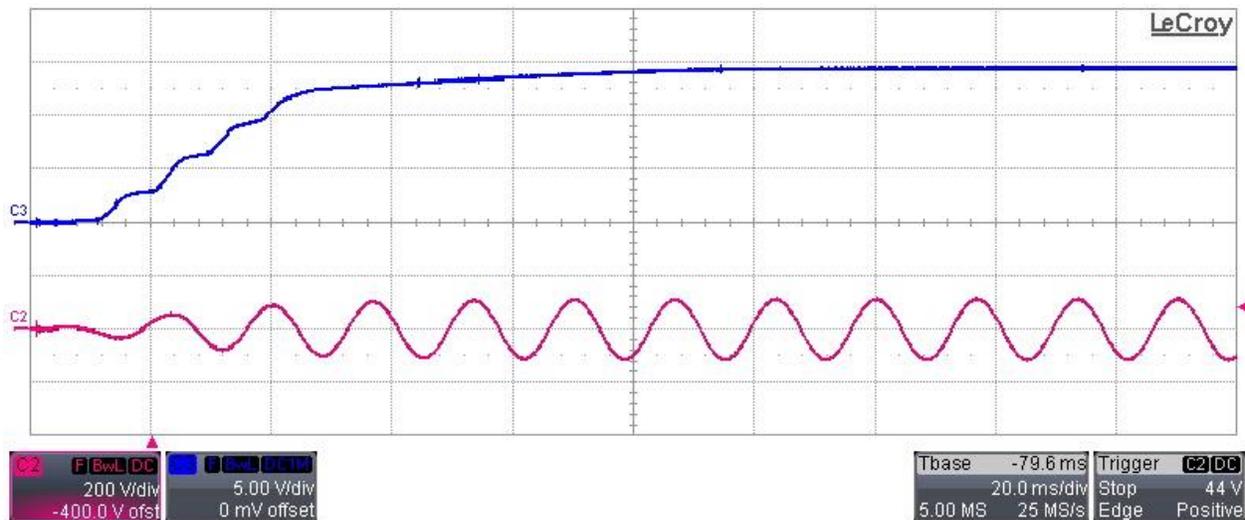
Full load, $V_{in} = 85VAC, 60Hz$:



Ch.2: Input voltage (200V/div, 20ms/div, 20MHz BWL)

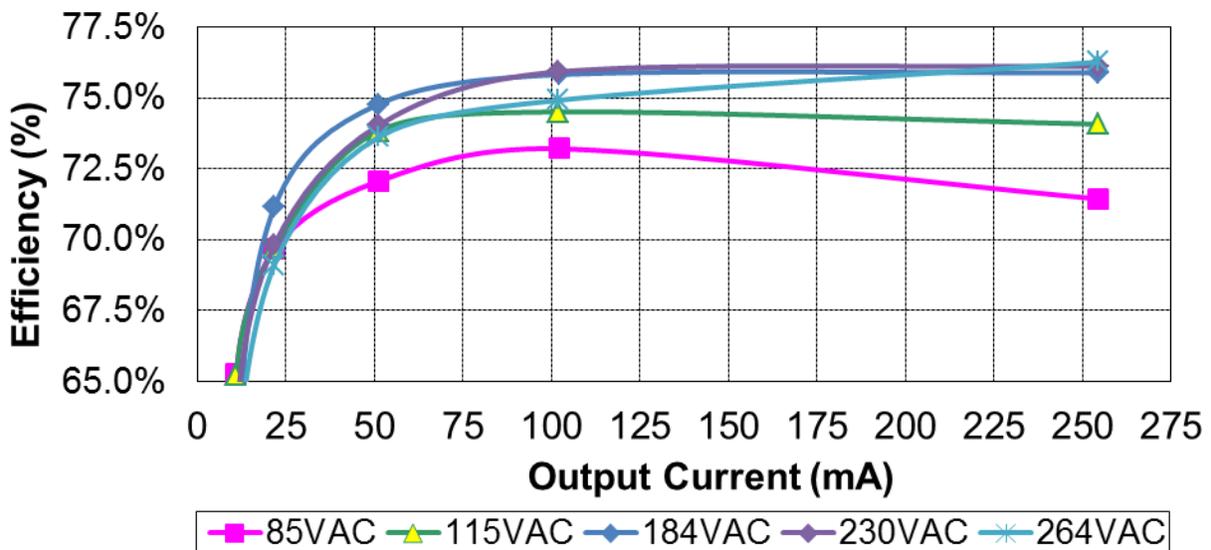
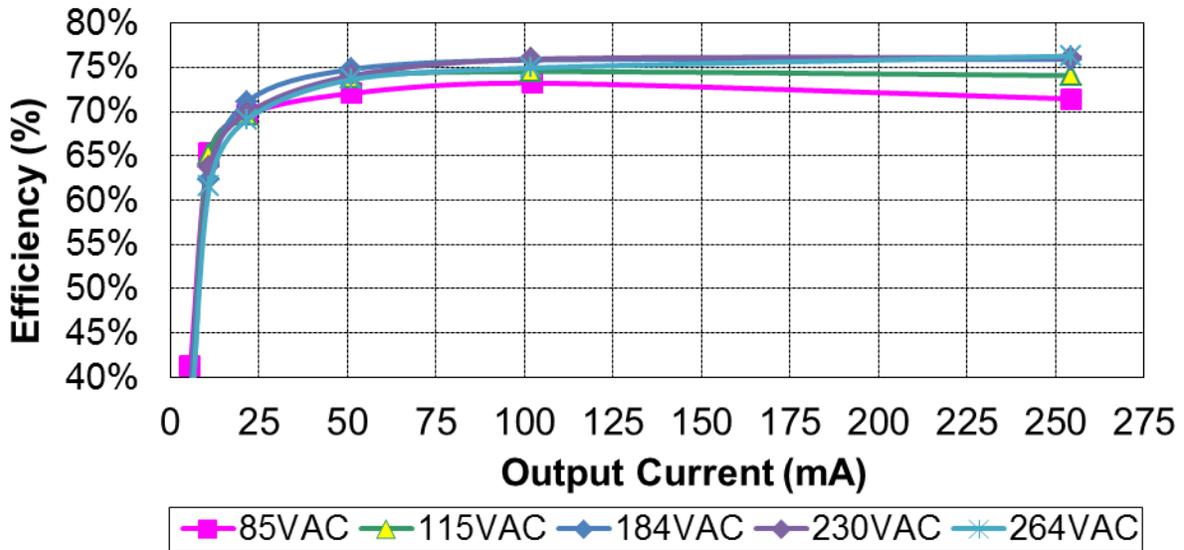
Ch.3: Output voltage (5V/div, 20MHz BWL)

Zero load, $V_{in} = 85VAC, 60Hz$:



3 Efficiency

The efficiency data, versus V_{in} and load, are shown in the tables and graph below. The input voltage has been set respectively to 85VAC (60Hz), 115VAC (60Hz), 184VAC (50Hz), 230VAC (50Hz) and 264VAC (50Hz). The second graph shows the same data but with expanded efficiency axis.



VAC (Vrms)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
85	0.185	14.32	0	0	0.0%
85	0.196	14.22	5.7	0.081	41.4%
85	0.234	13.76	11.1	0.153	65.3%
85	0.403	12.88	21.8	0.281	69.7%
85	0.869	12.23	51.2	0.626	72.1%
85	1.668	11.96	102.1	1.221	73.2%
85	4.170	11.71	254.4	2.979	71.4%

VAC (Vrms)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
115	0.203	14.33	0	0	0.0%
115	0.211	14.24	5.6	0.080	37.8%
115	0.237	13.93	11.1	0.155	65.2%
115	0.405	12.95	21.8	0.282	69.7%
115	0.846	12.20	51.2	0.625	73.8%
115	1.625	11.87	102.0	1.211	74.5%
115	4.008	11.67	254.4	2.969	74.1%

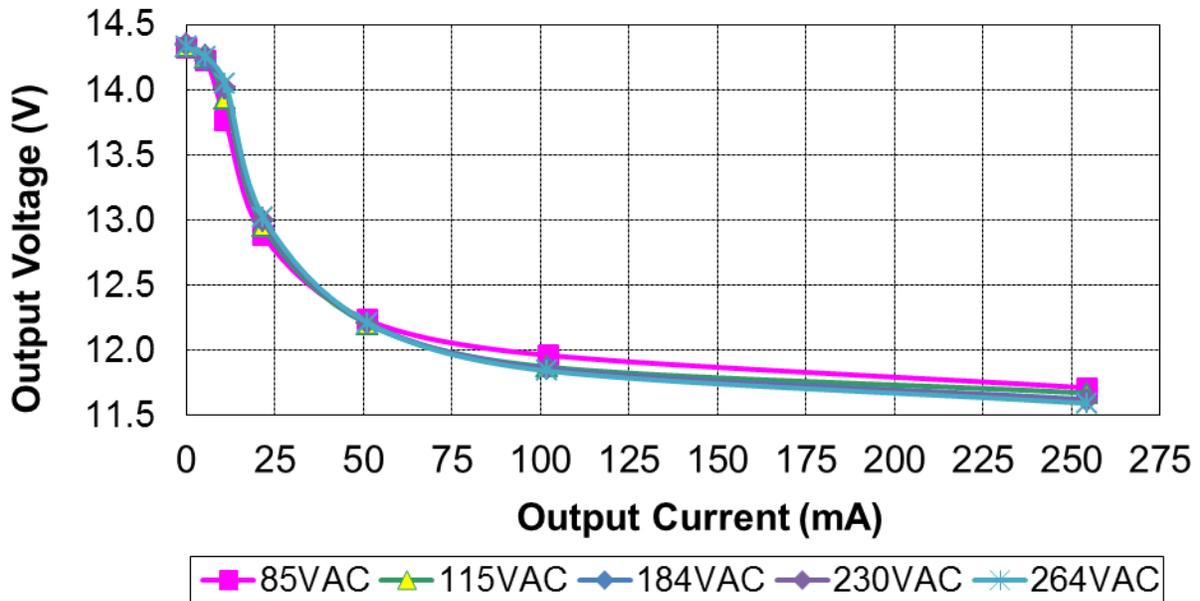
VAC (Vrms)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
184	0.209	14.34	0	0	0.0%
184	0.216	14.22	5.7	0.081	37.5%
184	0.250	14.01	11.1	0.156	62.3%
184	0.398	12.99	21.8	0.283	71.2%
184	0.836	12.21	51.2	0.625	74.8%
184	1.597	11.86	102.1	1.211	75.8%
184	3.895	11.62	254.4	2.956	75.9%

VAC (Vrms)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
230	0.221	14.35	0	0	0.0%
230	0.240	14.26	5.7	0.081	33.9%
230	0.244	14.02	11.1	0.156	63.7%
230	0.406	13.00	21.8	0.283	69.8%
230	0.844	12.21	51.2	0.625	74.0%
230	1.592	11.85	102.0	1.209	75.9%
230	3.880	11.61	254.4	2.954	76.1%

VAC (Vrms)	Pin (W)	Vout (V)	Iout(mA)	Pout (W)	Efficiency (%)
264	0.227	14.33	0	0	0.0%
264	0.237	14.25	5.7	0.081	34.2%
264	0.253	14.05	11.1	0.156	61.5%
264	0.411	13.02	21.8	0.284	69.1%
264	0.849	12.21	51.2	0.625	73.6%
264	1.612	11.84	102.0	1.208	74.9%
264	3.866	11.59	254.4	2.948	76.3%

4 Output Voltage Regulation versus Load Current

The output voltage variation versus load current, for different input voltages, is plotted below.

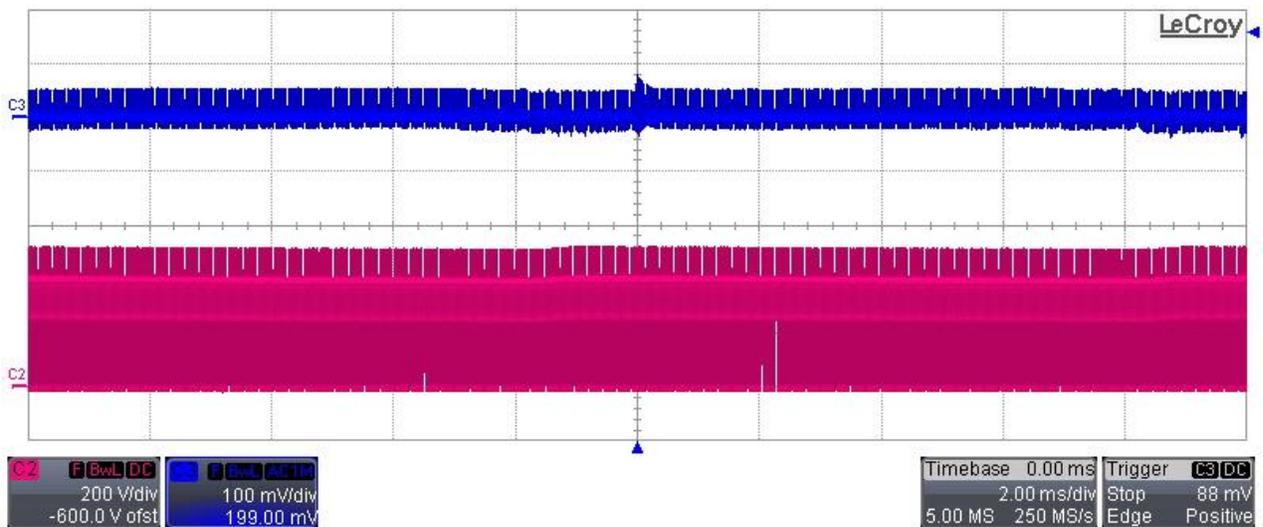


5 Output Ripple and Switch-Node Voltages

The output ripple voltage has been measured by supplying the converter at 230VAC in full load condition. (All screenshots have been taken with 20MHz bandwidth, Vout in AC coupling).

Ch.2: Switch-node (pin 8 of U1) (200V/div, 2msec/div)

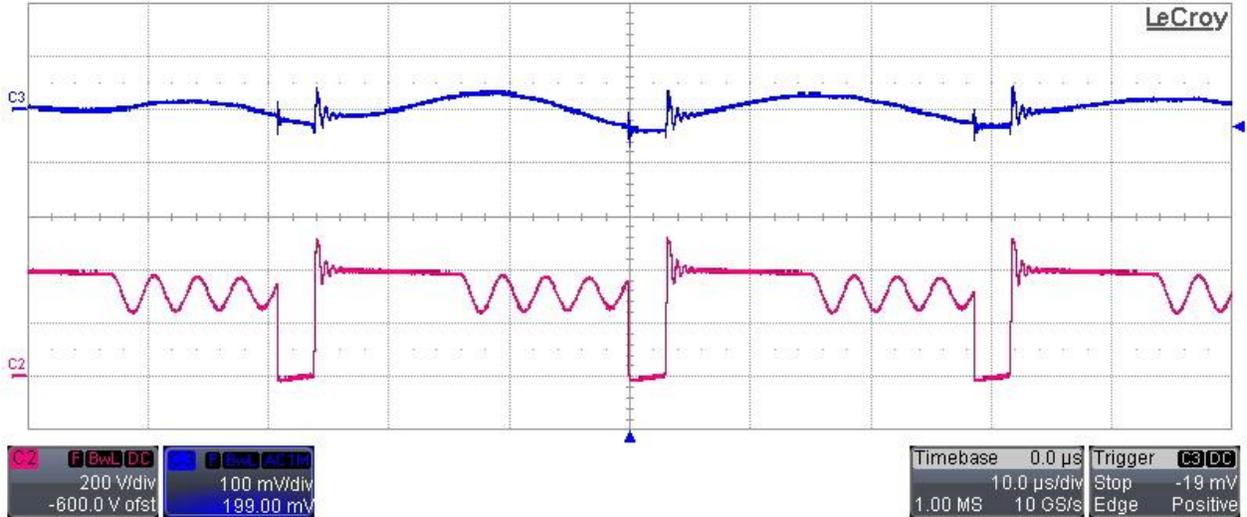
Ch.3: Output voltage (100mV/div, AC coupling)



Ch.2: Switch-node (pin 8 of U1) (200V/div, 10usec/div)

Ch.3: Output voltage (100mV/div, AC coupling)

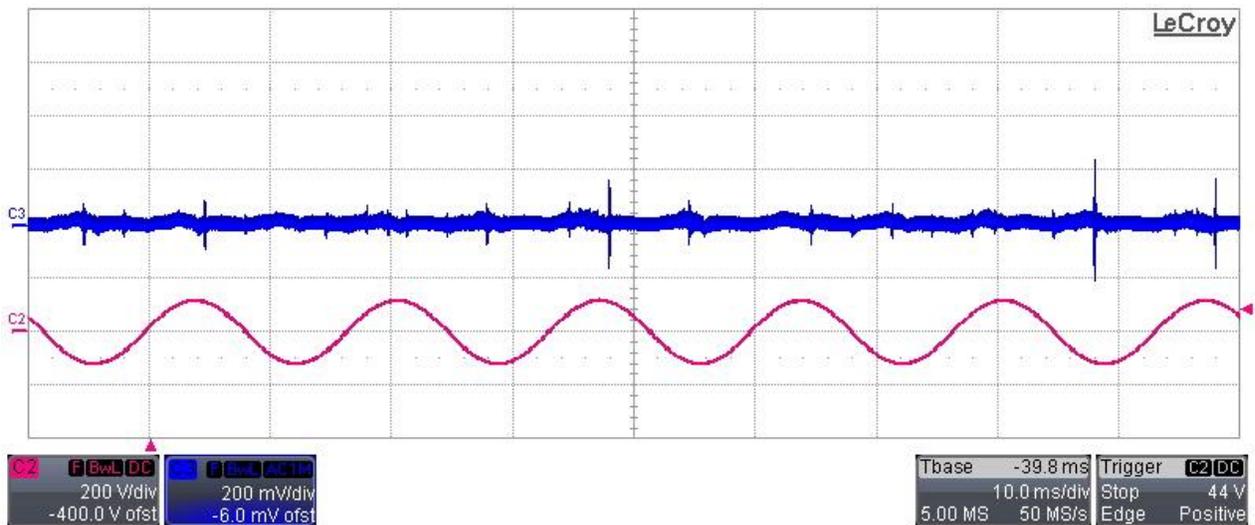
Same graph as above, but with smaller time division.



Ch.2: Input voltage (200V/div, 10msec/div)

Ch.3: Output voltage (200mV/div, AC coupling)

Effect of 120Hz ripple on C1, full load, 85Vac, 60Hz



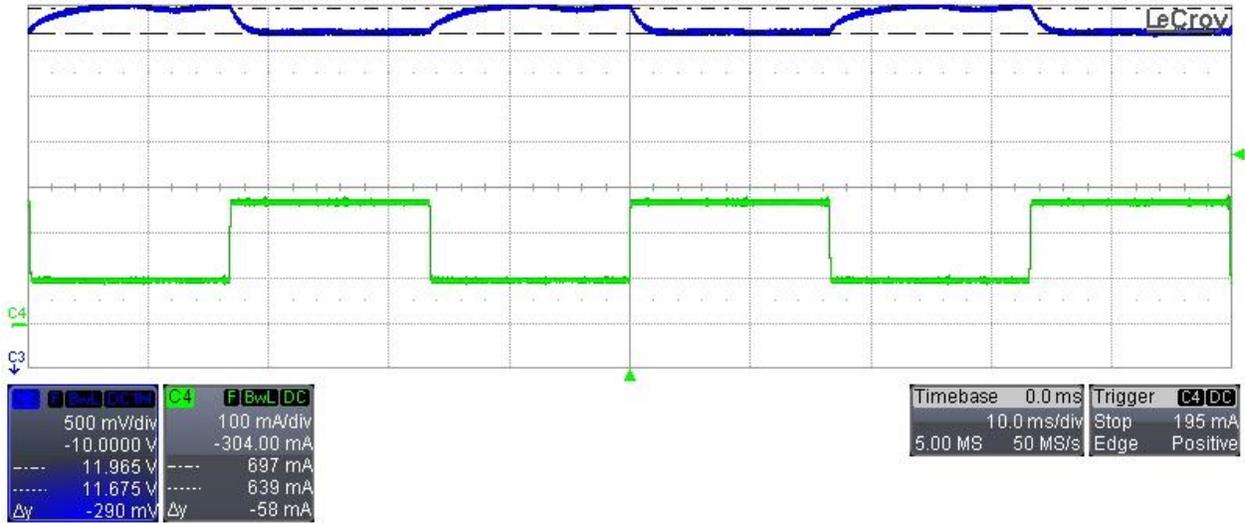
6 Transient Response

The images below show the transient response on output voltage in different load transient range and Vin conditions.

Vin = 85VAC, 60Hz; Iout = 100mA → 280mA

Ch.4: Output current (100mA/div, 10ms/div, DC coupling, 20MHz BWL)

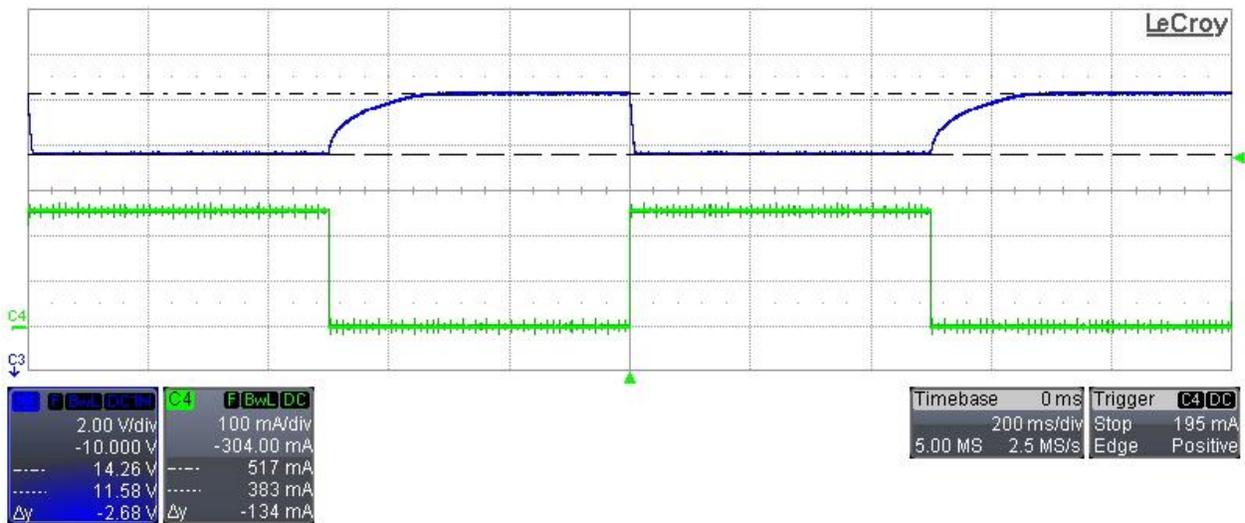
Ch.3: Output voltage (500mV/div, DC coupling, -10V offset, 20MHz BWL)



Vin = 230VAC, 50Hz; Iout = 0mA → 250mA

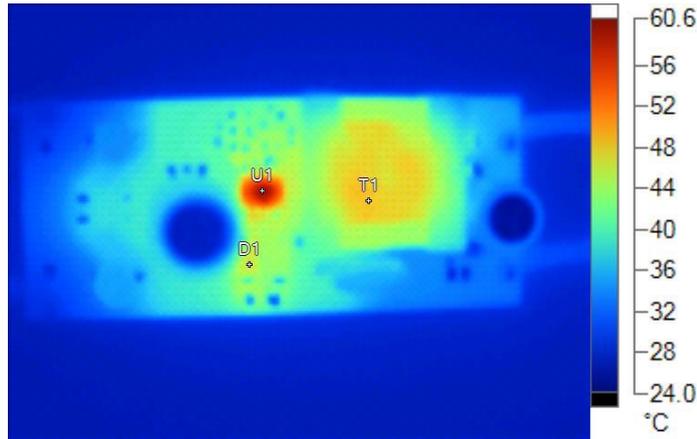
Ch.4: Output current (100mA/div, 200ms/div, DC coupling, 20MHz BWL)

Ch.3: Output voltage (2V/div, DC coupling, -10V offset, 20MHz BWL)



7 Thermal Analysis

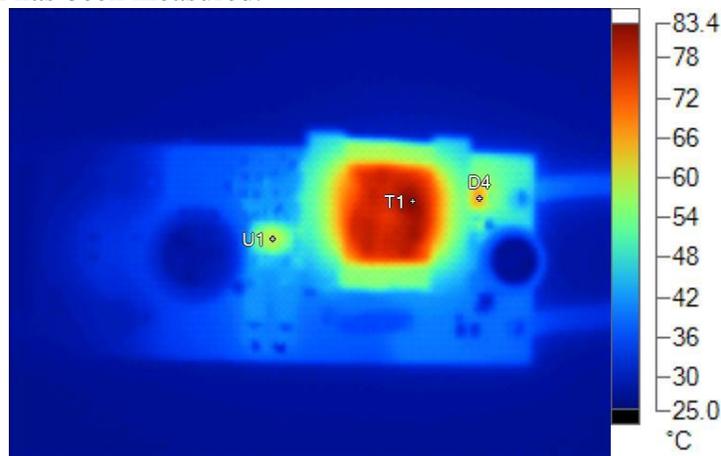
During the thermal analysis, the converter has been placed horizontally on the bench in still air conditions, while fully loaded and supplied @ 230Vrms, 50Hz.



Main Image Markers (230VAC, 50Hz, full load)

Name	Temperature	Emissivity	Background
U1	58.9°C	0.95	24.0°C
T1	48.1°C	0.95	24.0°C
D1	46.1°C	0.95	24.0°C

The following thermal image shows the scan of the converter, taken at the same VAC input voltage while the output terminals were shorted (picture taken after 5 minutes). A short-circuits output current ~ 1A has been measured.



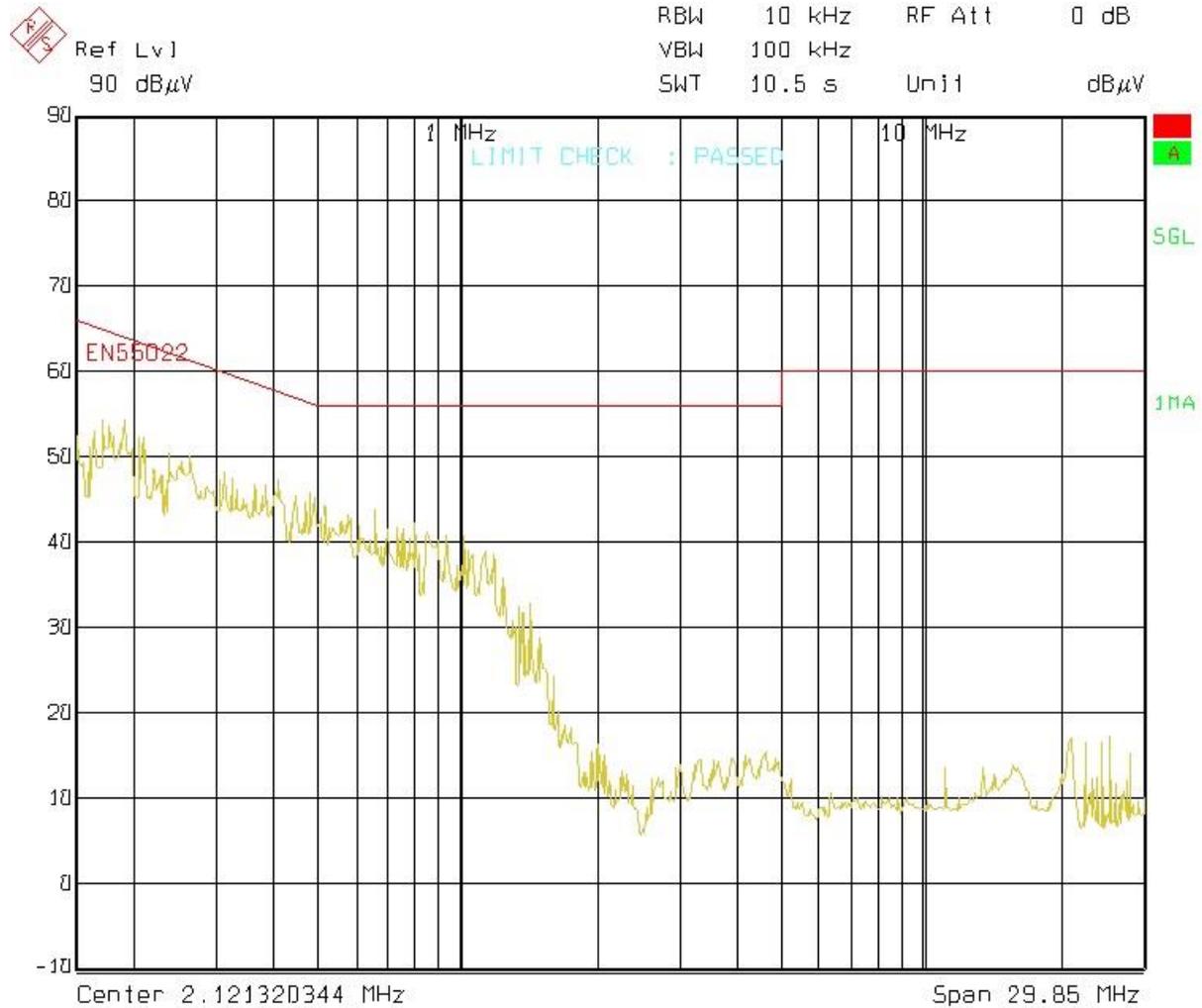
Main Image Markers (230VAC, 50Hz, short circuit on output terminals)

Name	Temperature	Emissivity	Background
U1	59.6°C	0.95	24.0°C
T1	83.0°C	0.95	24.0°C
D4	65.3°C	0.95	24.0°C

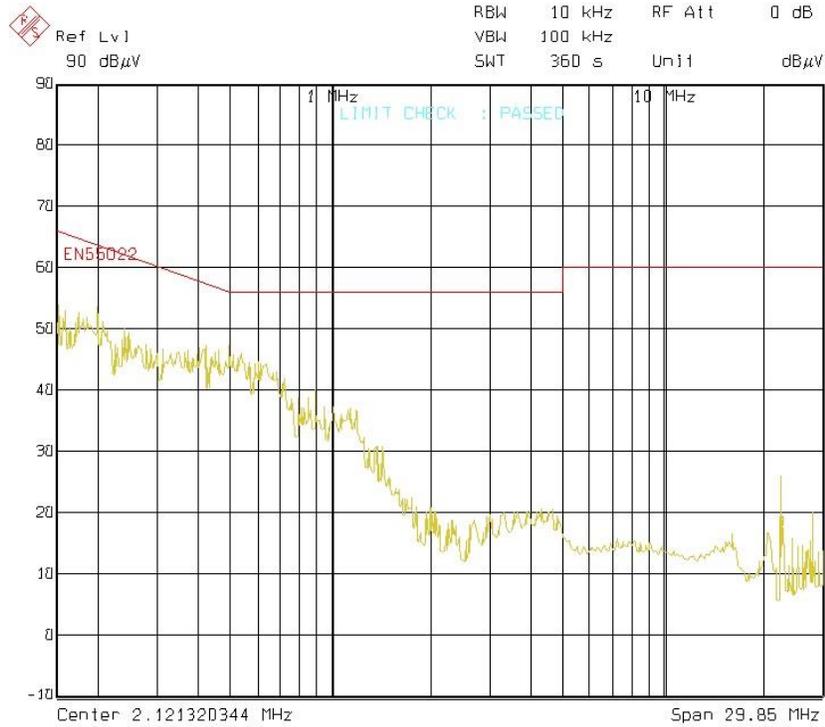
8 EMI measurement

The graphs below show the EMI measurements of the converter connected to an isolation transformer by means of a Hameg HM6050-2 LISN. The supply voltage was 230VAC. The converter has been loaded with a power resistor adjusted to deliver 3W and 1W. The output negative terminal of the converter has been connected to the ground of the LISN. The detector of the receiver was set to “quasi-peak” and the limit is the equivalent EN55022 grade B.

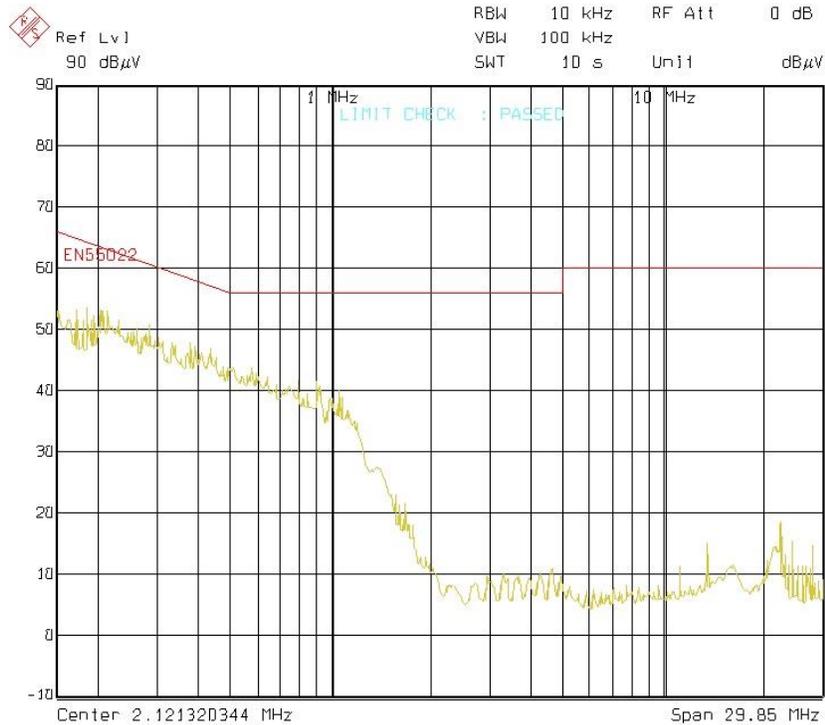
Load = **3W**, Line



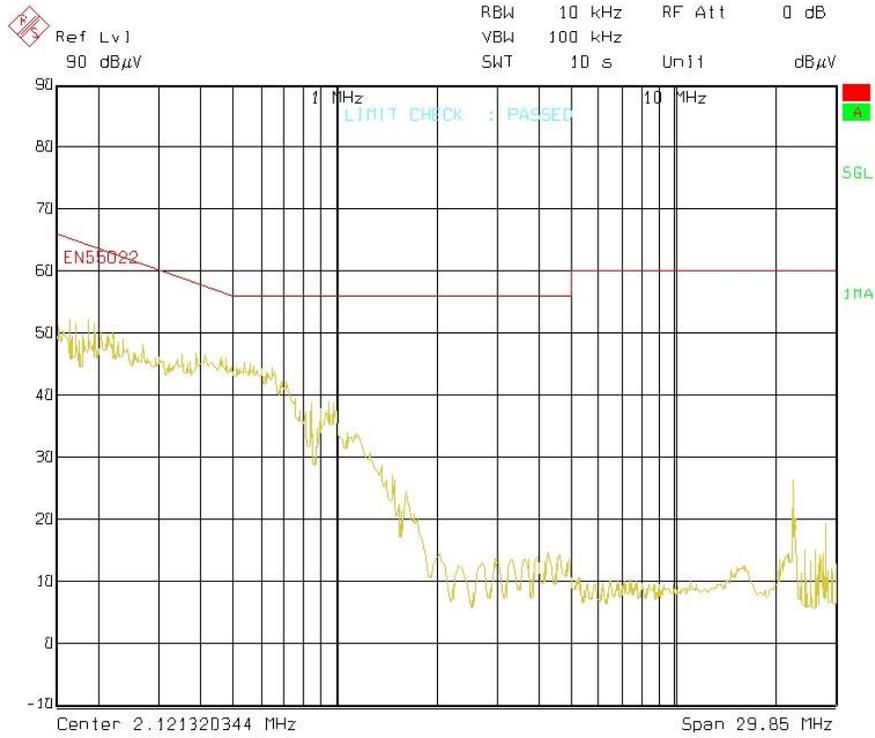
Load = 3W, Neutral



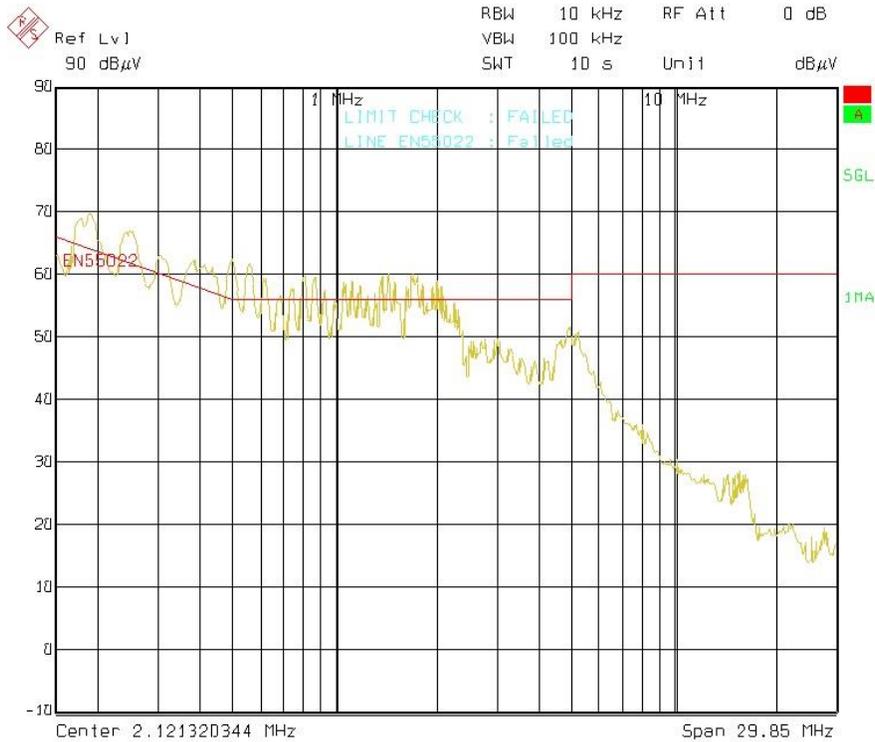
Load = 1W, Line



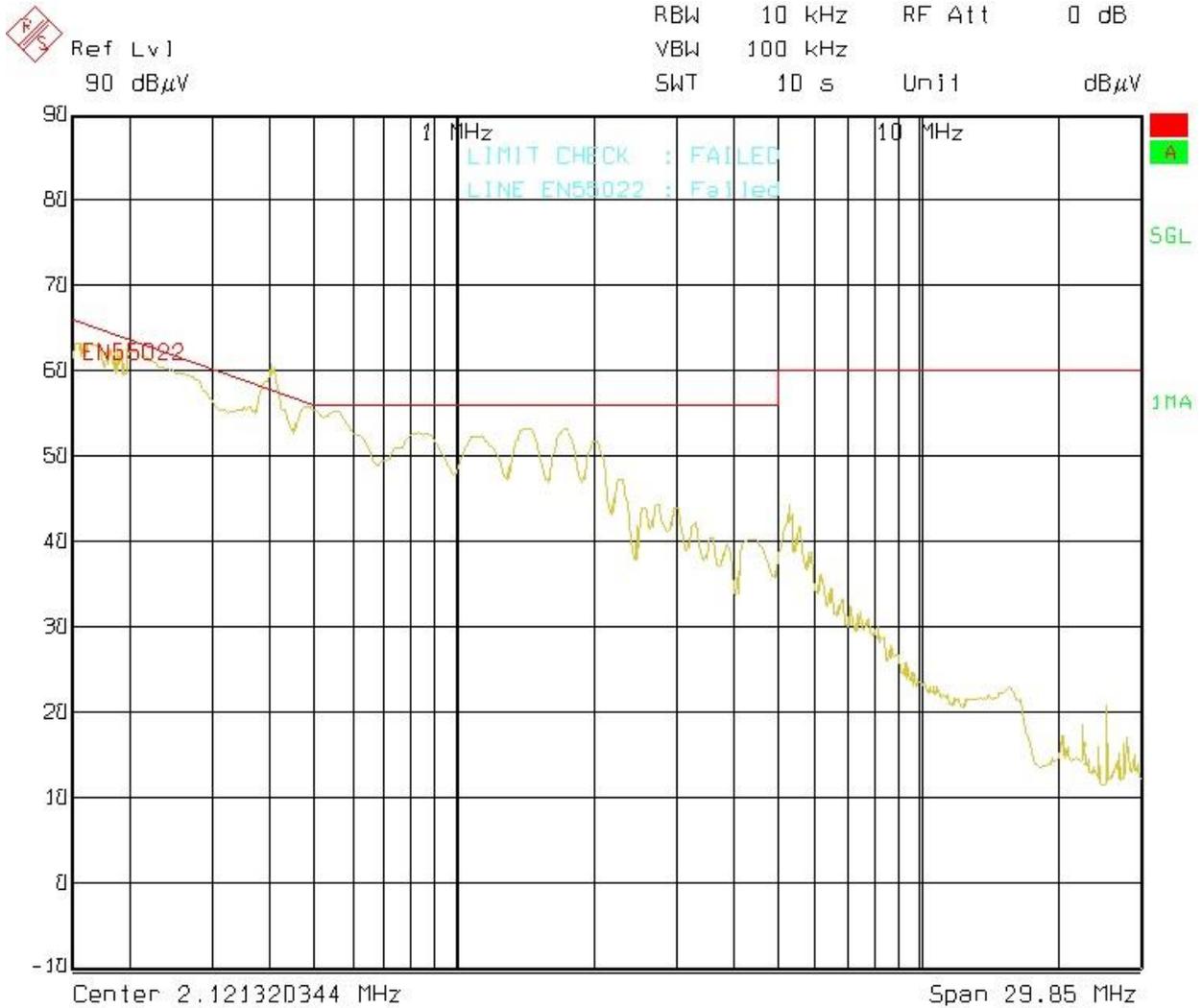
Load = 1W, Neutral



Load = 3W, Line, with L1 and L2 shorted + 10 Ohm fused resistor in series to AC



Load = 1W, Line, with L1 and L2 shorted + 10 Ohm fused resistor in series to AC



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