

***TDK-Lambda***

**TPS3000-48**

**Evaluation Data**

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## TERMINOLOGY USED

- $V_{out}$  = Output Voltage
- $I_{out}$  = Output Current
- $V_{in}$  = Input Voltage
- $I_{in}$  = Input Current
- $I_{lim}$  = Current Limit
- $T_a$  = Ambient Temperature
- OVP = Over-voltage protection
- OCP – Over-current protection

### Load/Line Regulation

Vout = 48Vdc, 100% load = 63A, Ta = 25°C

Vout measured across output bus bars. Remote sense connected to bus bars.

Iout\Vin	350VAC	400VAC	480VAC	528VAC	Line Regulation	
0% Load	48.014	48.058	48.005	48.021	0.053	0.1104%
25% Load	48.022	48.021	48.022	48.022	0.001	0.0021%
50% Load	48.018	48.021	48.02	48.021	0.003	0.0063%
75% Load	48.019	48.018	48.018	48.018	0.001	0.0021%
100% Load	48.016	48.017	48.018	48.018	0.002	0.0042%
Load Regulation	0.008	0.041	0.017	0.004		
	0.0167%	0.0854%	0.0354%	0.0083%		

### Temperature Drift

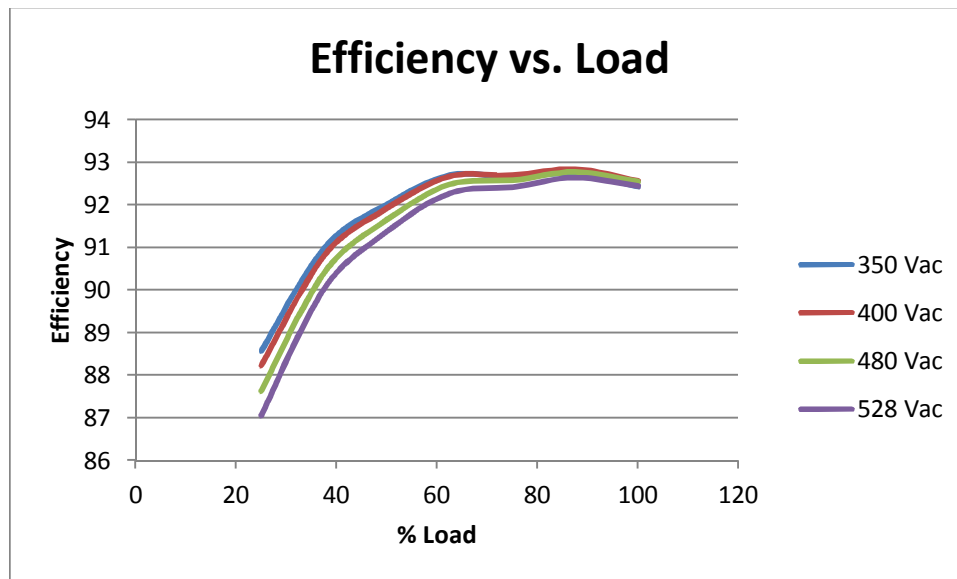
Vout =48Vdc, 100% load = 63A

Vin	Iout	Vout @ -10°C	Vout @ 25°C	Vout @ 50°C	Vout Delta	Overall Temperature Coefficient (ppm)
400	100%	48.103284	48.040767	47.946174	0.15711	54.55208333
480	100%	48.044362	47.969154	47.951919	0.092443	32.09826389
400	0%	48.110689	47.987433	47.983386	0.127303	44.20243056
480	0%	48.110819	47.987433	47.988217	0.122602	42.57013889

## Efficiency vs Output Current

Vout = 48Vdc, 100% Load = 63A, Ta = 25°C

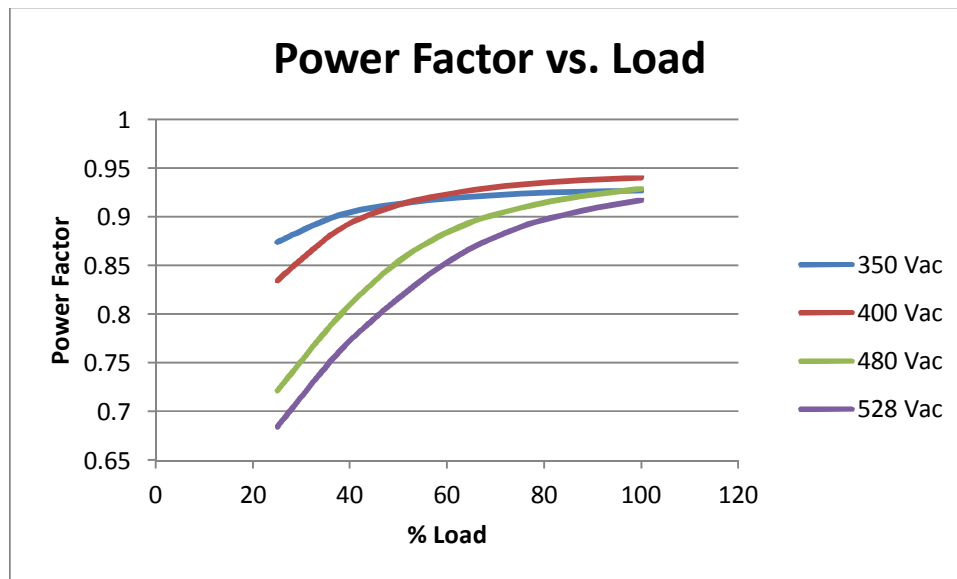
Iout(%) / Vin	350 Vac	400 Vac	480 Vac	528 Vac
25	88.57	88.2326	87.629	87.0545
50	92.0202	91.9246	91.6554	91.3768
75	92.6495	92.6994	92.5769	92.4185
100	92.4355	92.5674	92.5466	92.4445



## Power Factor vs Output Current

Vout = 48Vdc, 100% Load = 63A, Ta = 25°C

Iout(%)/Vin	350 Vac	400 Vac	480 Vac	528 Vac
25	0.8745	0.834931	0.721532	0.684546
50	0.91383	0.912696	0.854738	0.817152
75	0.92423	0.933292	0.909453	0.889817
100	0.92695	0.94088	0.929282	0.917533



## Inrush Characteristics

Inrush Current <15A peak per phase @ 400-480VAC input (excluding initial spike charging capacitors lasting < 2ms)

Vout =48Vdc, Ta=25°C, %100 Load = 63A

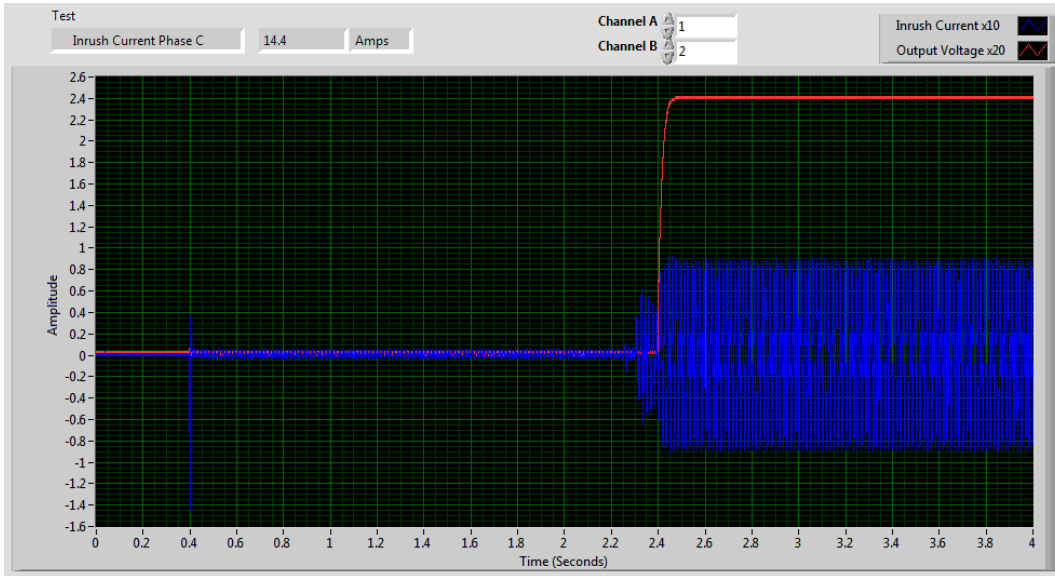


Figure 1: Inrush @ 400VAC, 100% Load

CH1 (Blue) – Inrush Current, 2A/DIV

CH2 (Red) – Vout, 4V/DIV

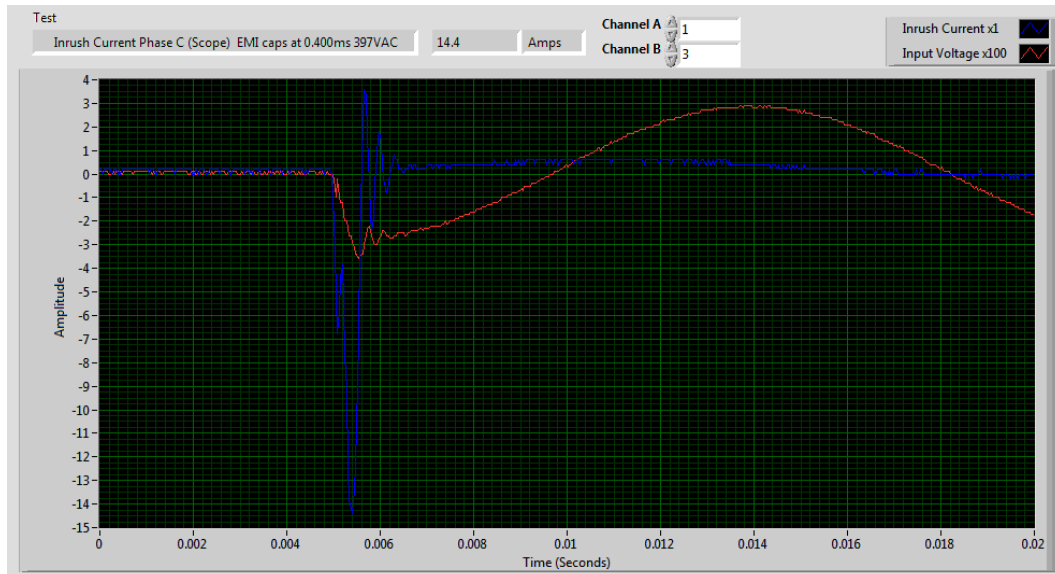


Figure 2: Inrush @ 400VAC, 100% Load. Initial spike charging capacitors

CH1 (Blue) – Inrush Current, 1A/DIV

CH2 (Red) – Vin, 100V/DIV

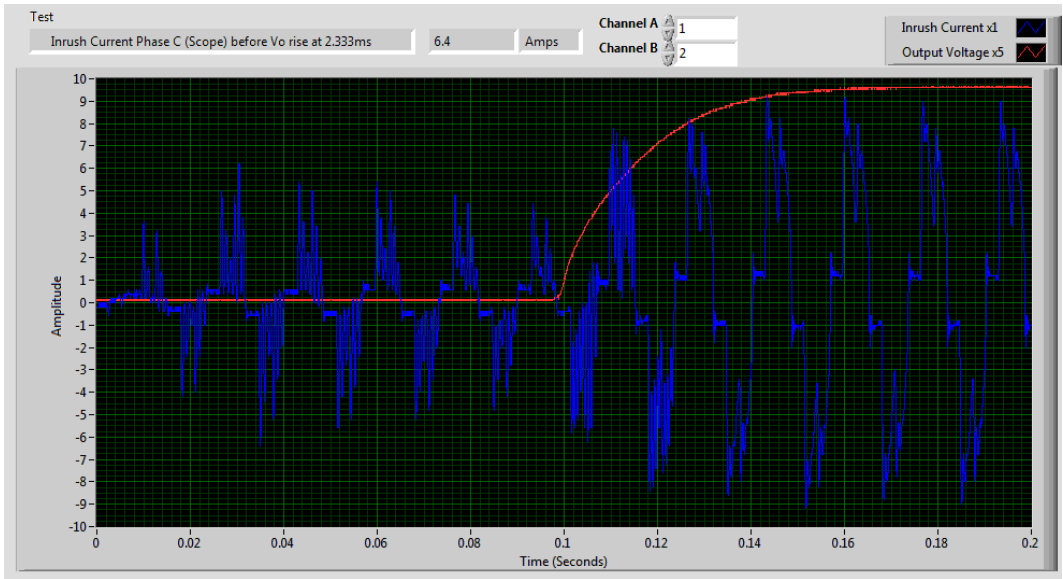


Figure 3: Inrush @ 400VAC, 100% Load.

CH1 (Blue) – Inrush Current, 1A/DIV

CH2 (Red) – Vout, 5V/DIV

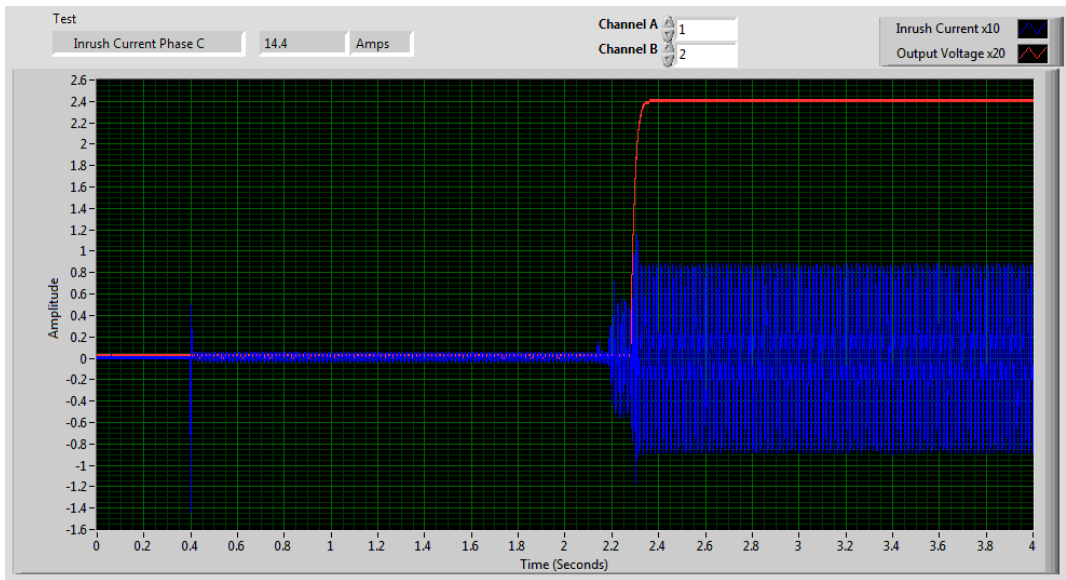


Figure 4: Inrush @ 480VAC, 100% Load

CH1 (Blue) – Inrush Current, 2A/DIV

CH2 (Red) – Vout, 4V/DIV

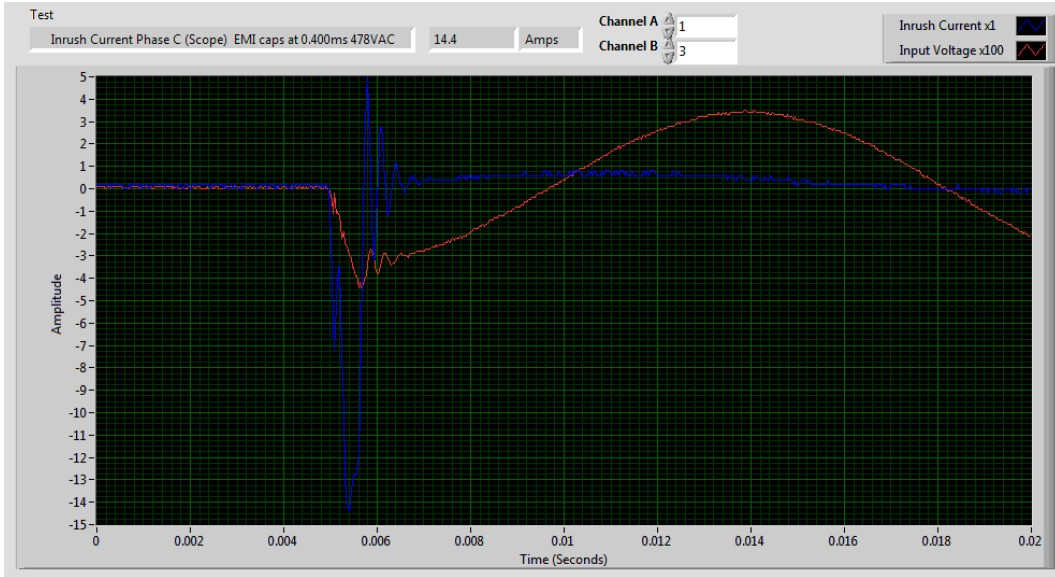


Figure 5: Inrush @ 480VAC, 100% Load. Initial spike charging capacitors

CH1 (Blue) – Inrush Current, 1A/DIV

CH2 (Red) – Vin, 100V/DIV

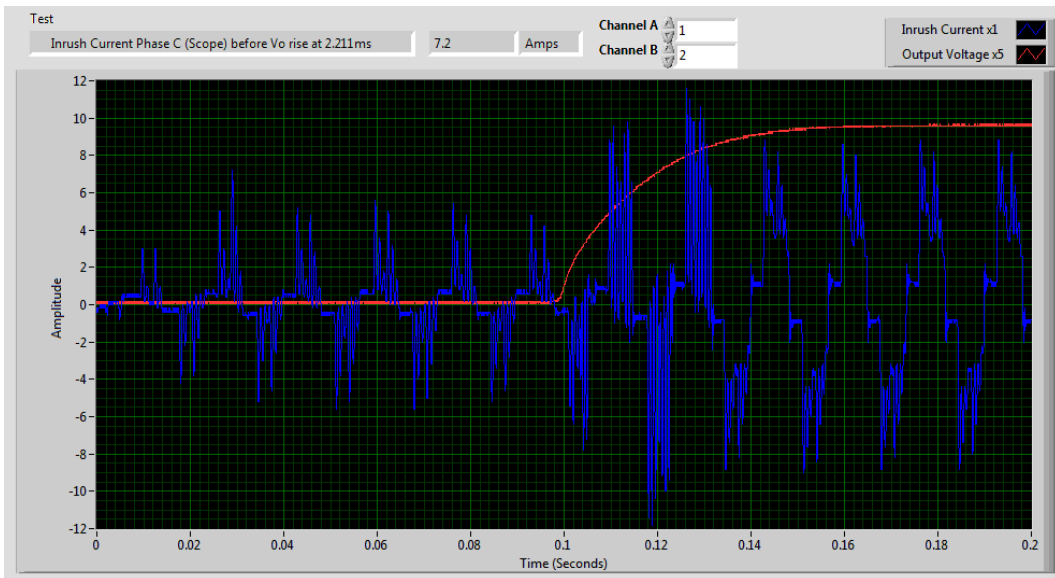


Figure 6: Inrush @ 480VAC, 100% Load.

CH1 (Blue) – Inrush Current, 2A/DIV

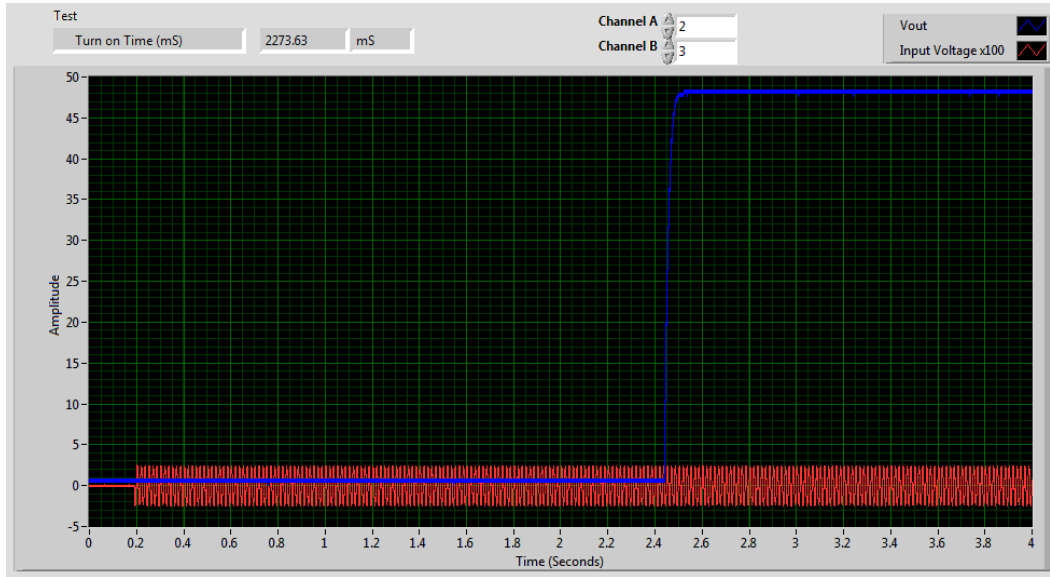
CH2 (Red) – Vout, 10V/DIV



## Output Rise Characteristics

$V_{out} = 48V_{dc}$ ,  $T_a = 25^{\circ}C$ ,  $I_{out} = 63A$

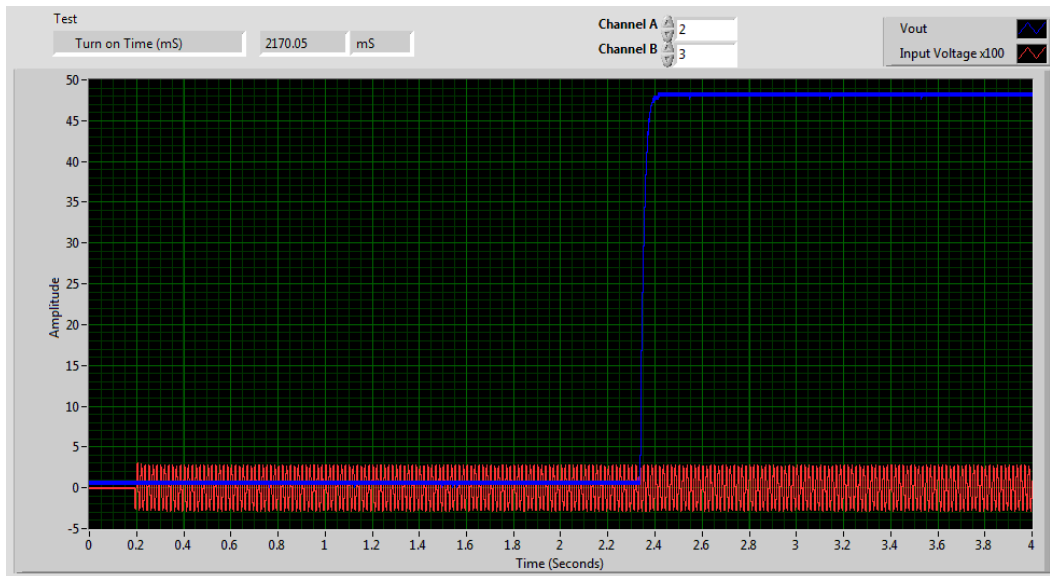
**AC ON Control** - Output Rise time from application of input voltage



**Figure 7: Turn ON Time from  $V_{in} = 346V_{AC}$**

CH1 (Blue) –  $V_{out}$ , 5V/DIV

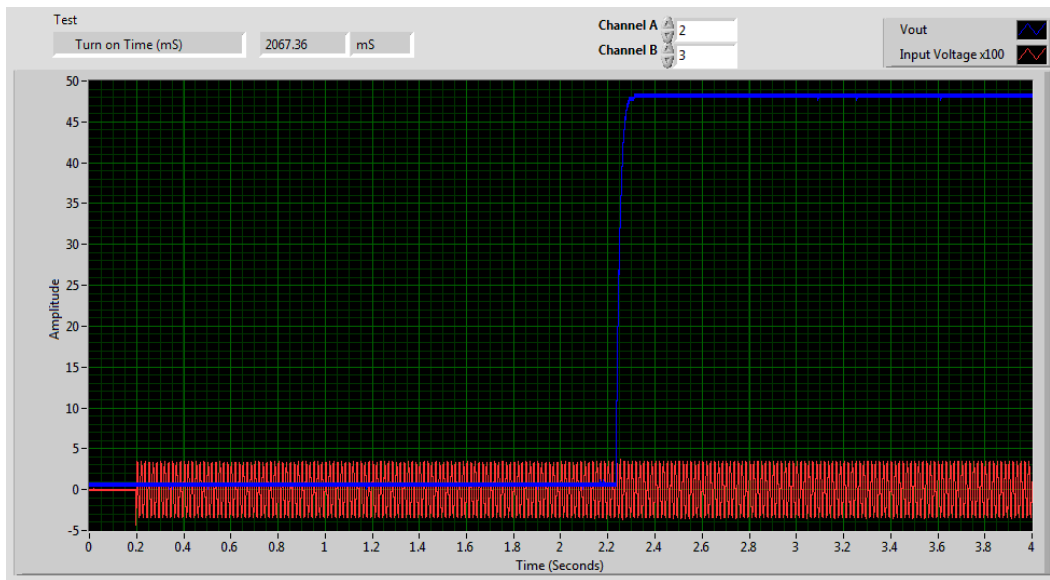
CH2 (Red) –  $V_{in}$ , 500V/DIV



**Figure 8: Turn ON Time from  $V_{in} = 400V_{AC}$**

CH1 (Blue) –  $V_{out}$ , 5V/DIV

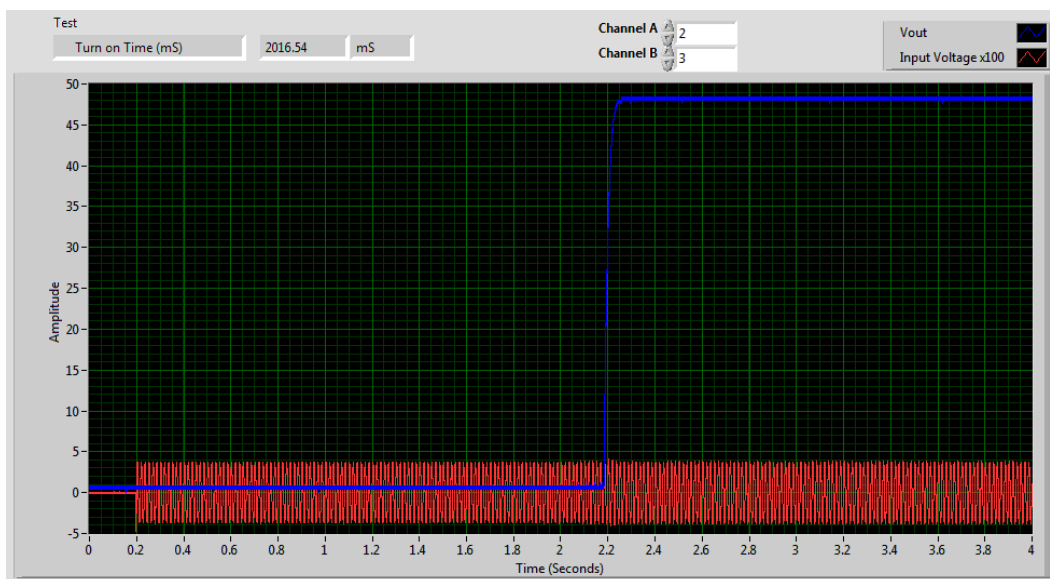
CH2 (Red) –  $V_{in}$ , 500V/DIV



**Figure 9: Turn ON Time from  $V_{in} = 480VAC$**

CH1 (Blue) – Vout, 5V/DIV

CH2 (Red) – Vin, 500V/DIV

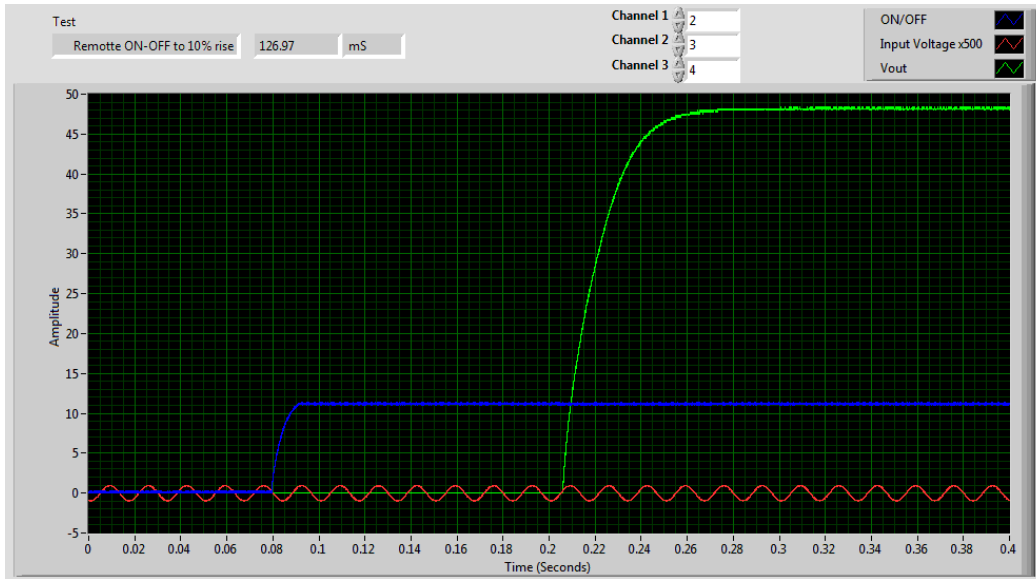


**Figure 10: Turn ON Time from  $V_{in} = 528VAC$**

CH1 (Blue) – Vout, 5V/DIV

CH2 (Red) – Vin, 500V/DIV

**Remote On/Off Control** – TTL voltage level compatible signal connected between pins 14 and 18 of the Signal Connector. With the Output Enable switch in the ON position, a Logic High or Open will enable the output. A Logic Low or Short will disable the output.

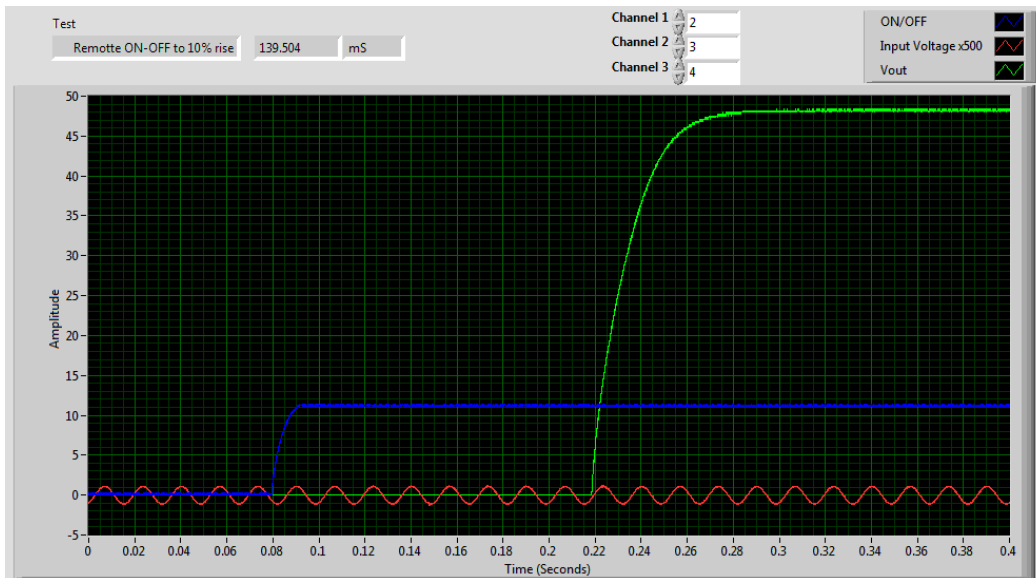


**Figure 11: Rise Time from Remote On-Off 346VAC 100% load**

CH1 (Blue) – Enable Signal, 5V/DIV

CH2 (Red) – Vin, 2500V/DIV

CH3 (Green) – Vout, 5V/DIV

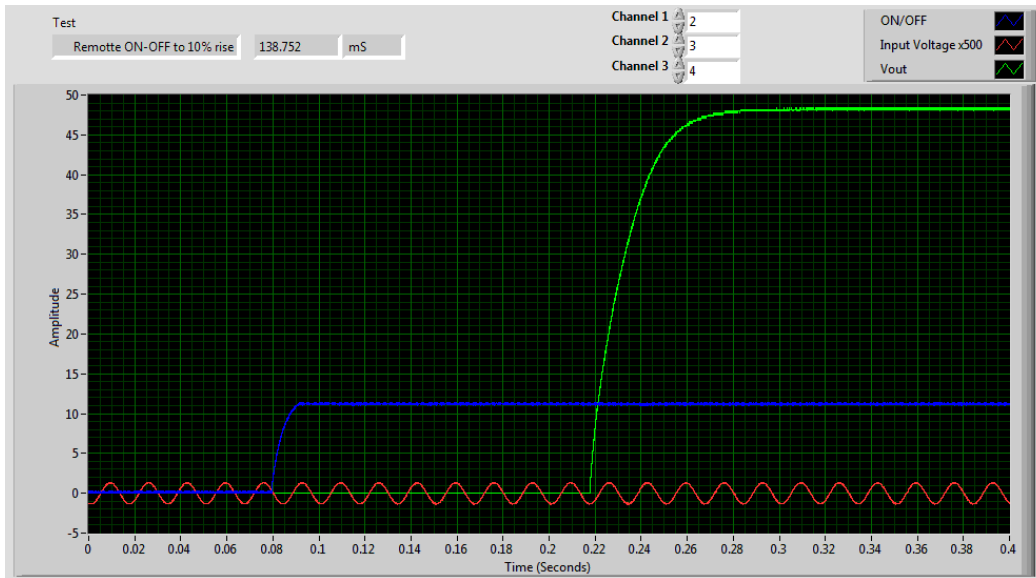


**Figure 12: Rise Time from Remote On-Off 400VAC 100% load**

CH1 (Blue) – Enable Signal, 5V/DIV

CH2 (Red) – Vin, 2500V/DIV

CH3 (Green) – Vout, 5V/DIV

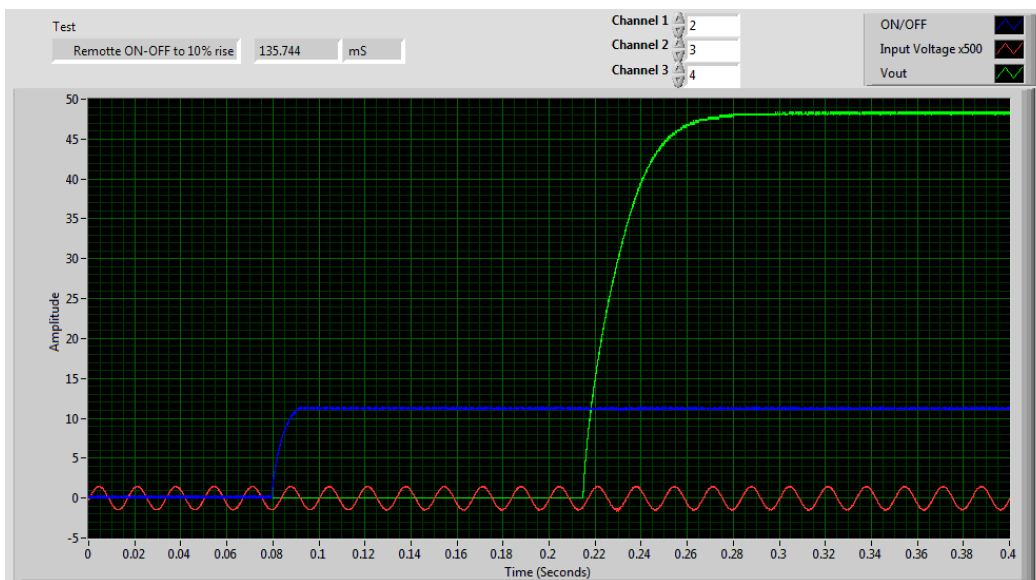


**Figure 13: Rise Time from Remote On-Off 480VAC 100% load**

CH1 (Blue) – Enable Signal, 5V/DIV

CH2 (Red) – Vin, 2500V/DIV

CH3 (Green) – Vout, 5V/DIV



**Figure 14: Rise Time from Remote On-Off 528VAC 100% load**

CH1 (Blue) – Enable Signal, 5V/DIV

CH2 (Red) – Vin, 2500V/DIV

CH3 (Green) – Vout, 5V/DIV

### Rise Time & Overshoot

Vout = 48Vdc, 100% Load = 63A, Ta = 25°C

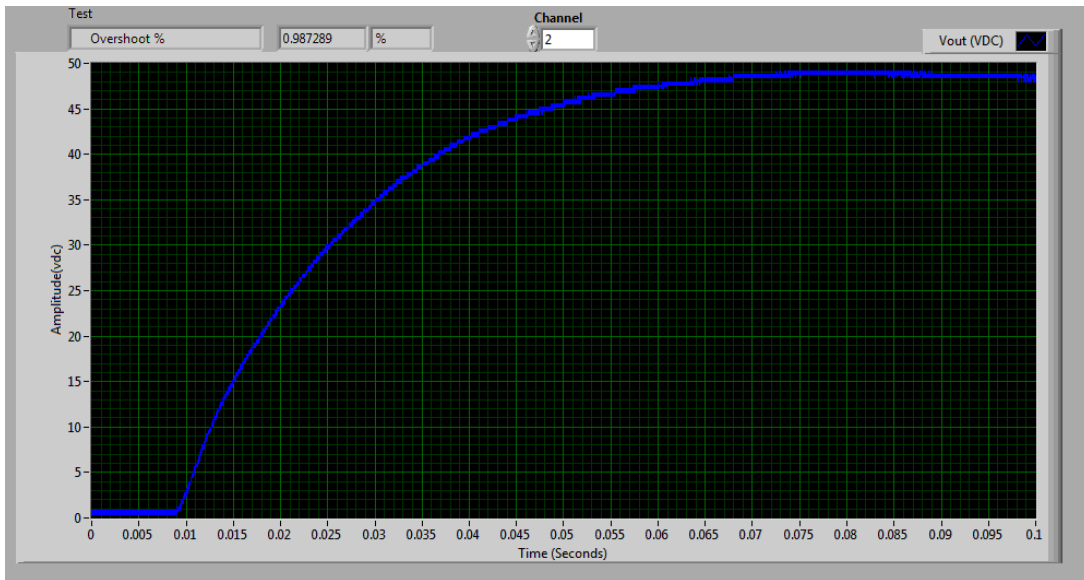


Figure 15: Rise Characteristics at Turn On 346VAC 0% load

CH1 (Blue) – Enable Signal, 5V/DIV

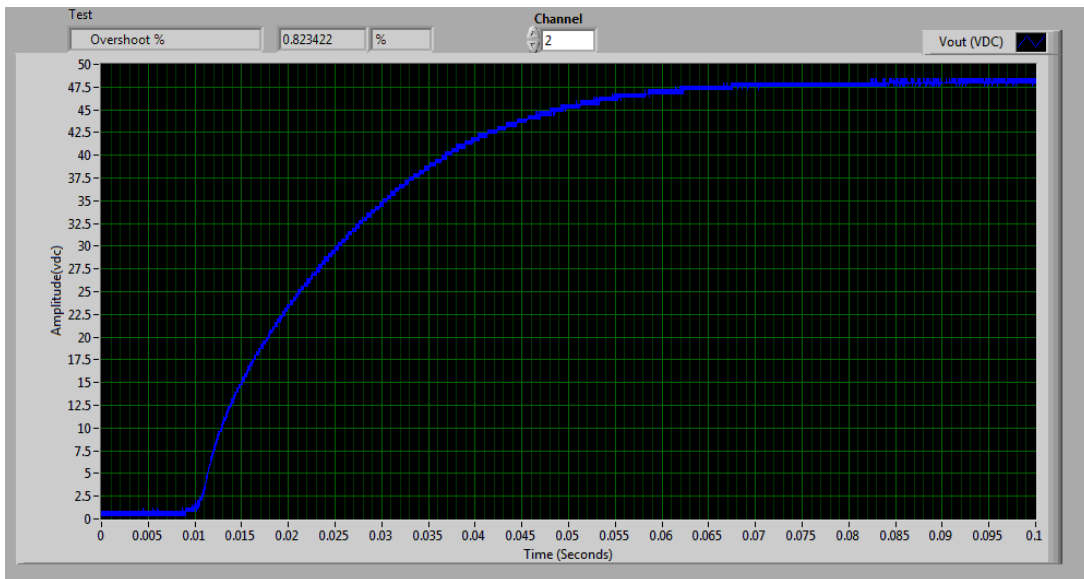


Figure 16: Rise Characteristics at Turn On 346VAC 100% load

CH1 (Blue) – Enable Signal, 2.5V/DIV

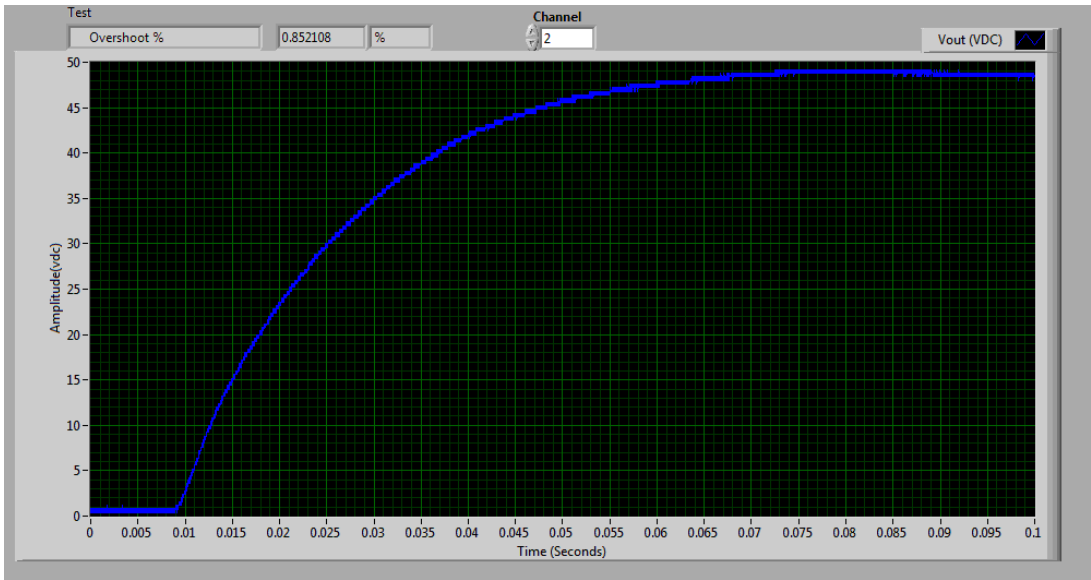


Figure 17: Rise Characteristics at Turn On 400VAC 0% load

CH1 (Blue) – Enable Signal, 5V/DIV

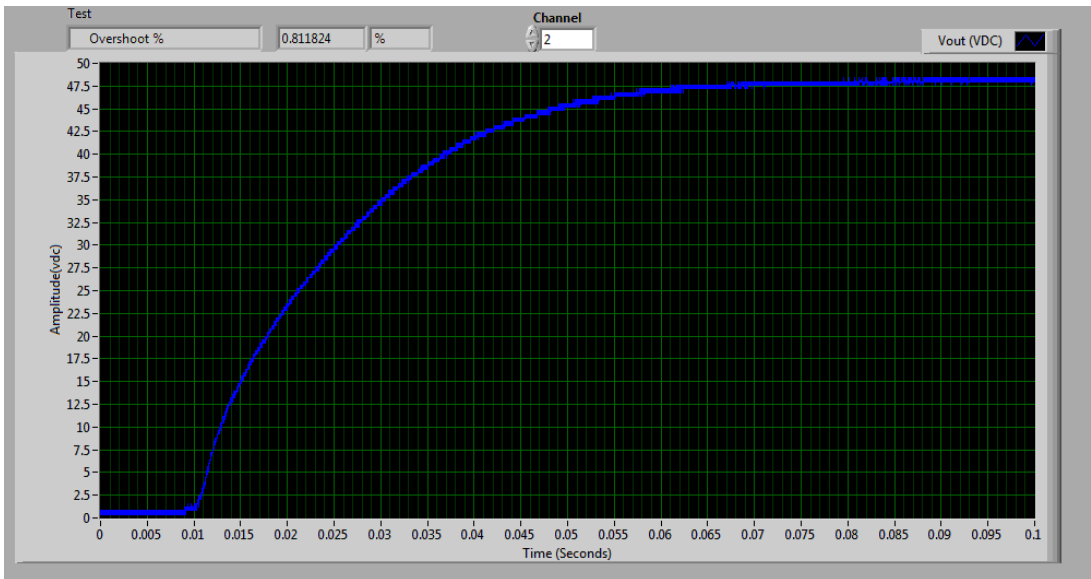


Figure 18: Rise Characteristics at Turn On 400VAC 100% load

CH1 (Blue) – Enable Signal, 2.5V/DIV

## Hold-Up Time Characteristics

Vout =48Vdc, Ta=25°C, 100% Load = 63A

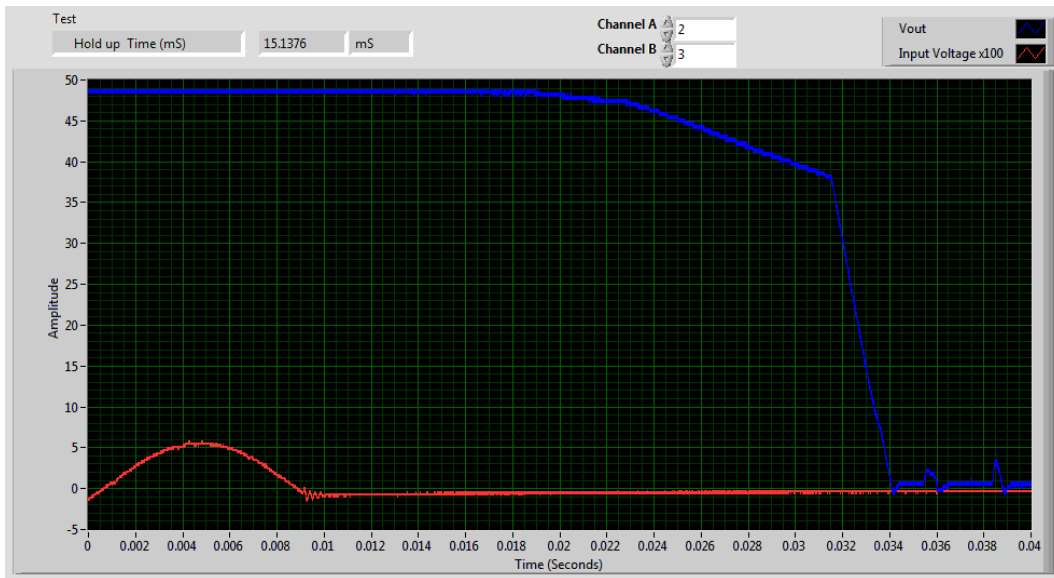


Figure 19: HOLD-UP TIME 400VAC 80% Load

CH1 (Blue) – Vout, 5V/DIV

CH2 (Red) – Vin, 500V/DIV

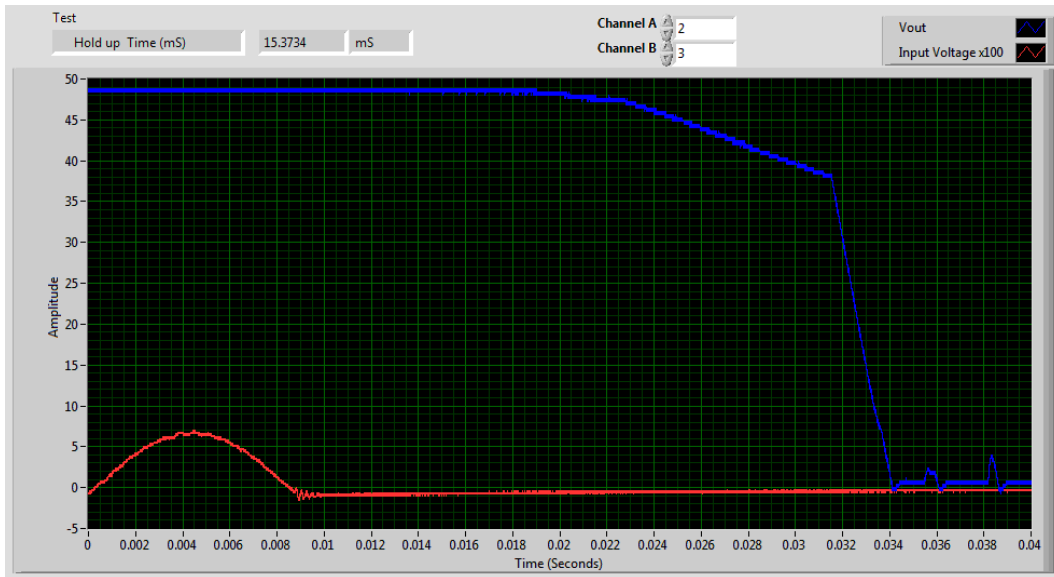


Figure 20: HOLD-UP TIME 480VAC 80% Load

CH1 (Blue) – Vout, 5V/DIV

CH2 (Red) – Vin, 500V/DIV

## Ripple Characteristics

Ripple and Noise: 480mV pk-pk max, 100MHz bandwidth. Jeita RC-9131C Procedure.  
Vout =48Vdc, Ta=25°C, 100% Load = 63A

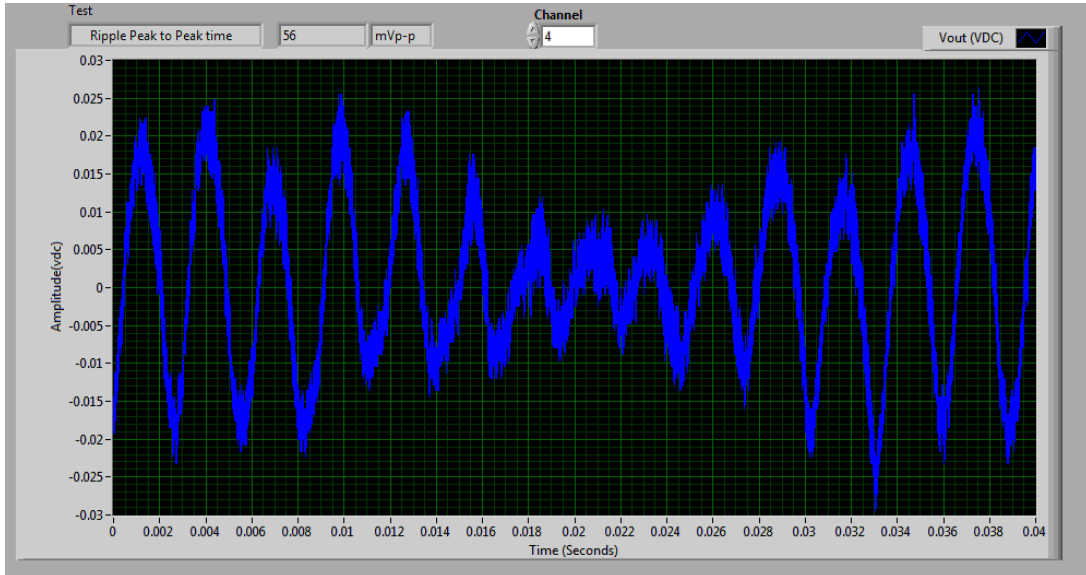


Figure 21: Ripple at 100% Load @ 346VAC. Timebase = 2mS/Div

CH1 (Blue) – Vout Ripple, 5mV/DIV

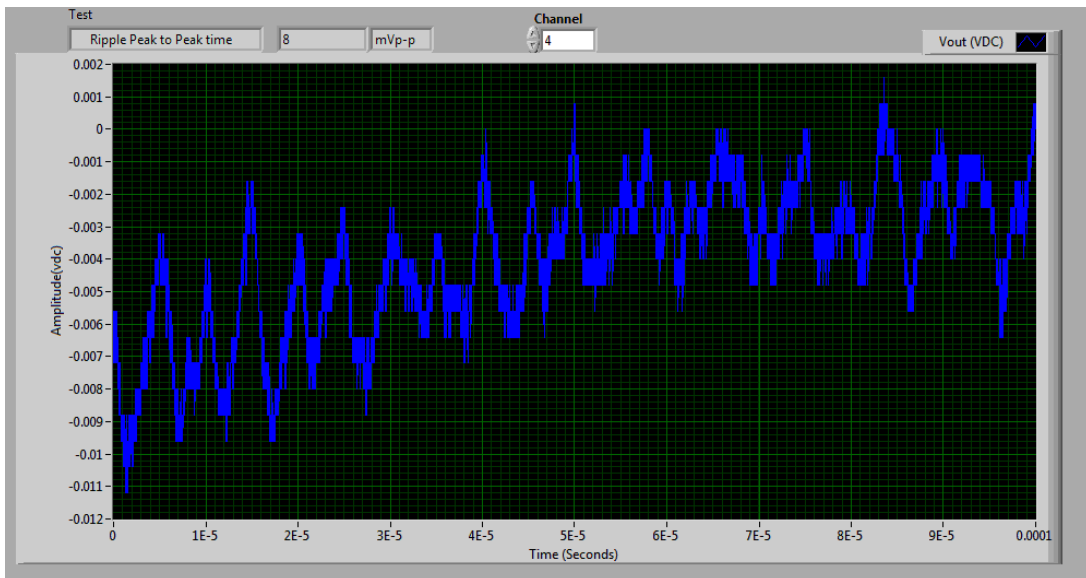


Figure 22: Ripple at 100% Load @ 346VAC. Timebase = 10uS/Div

CH1 (Blue) – Vout Ripple, 1mV/DIV



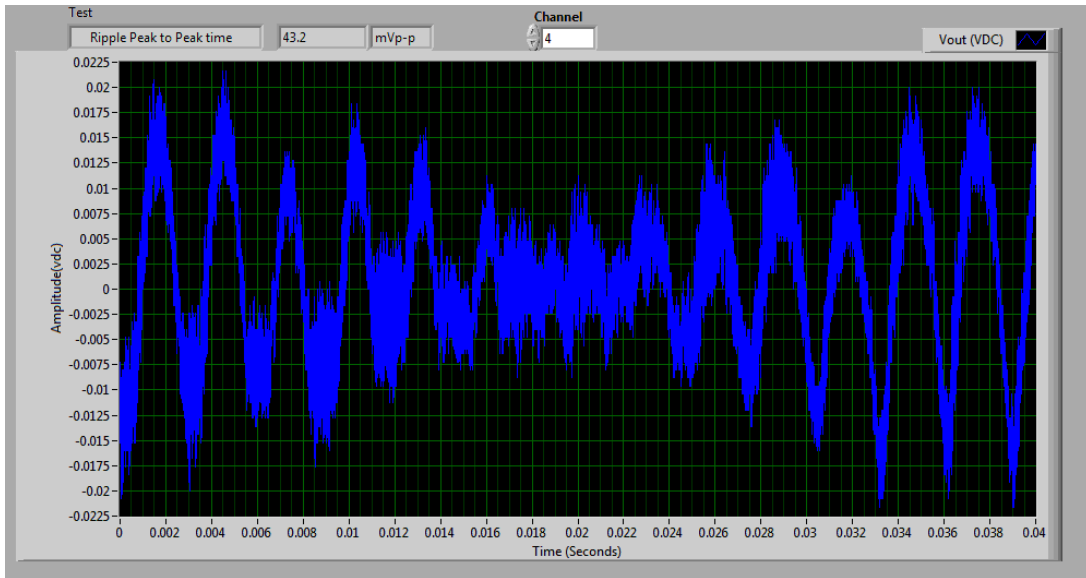


Figure 23: Ripple at 100% Load @ 400VAC. Timebase = 2mS/Div

CH1 (Blue) – Vout Ripple, 2.5mV/DIV

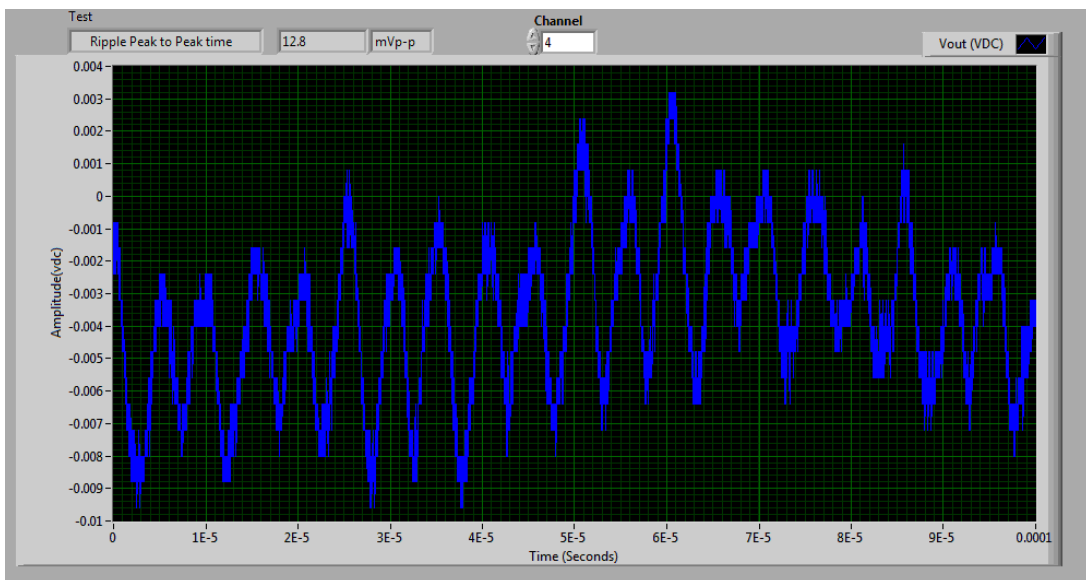


Figure 24: Ripple at 100% Load @ 346VAC. Timebase = 10uS/Div

CH1 (Blue) – Vout Ripple, 1mV/DIV

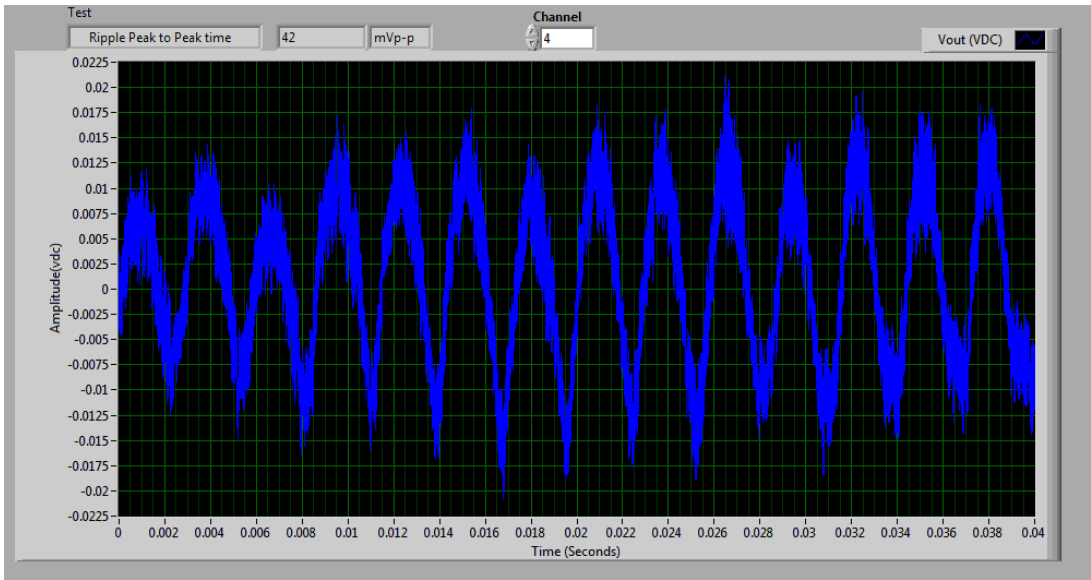


Figure 25: Ripple at 100% Load @ 480VAC. Timebase = 2mS/Div

CH1 (Blue) – Vout Ripple, 2.5mV/DIV

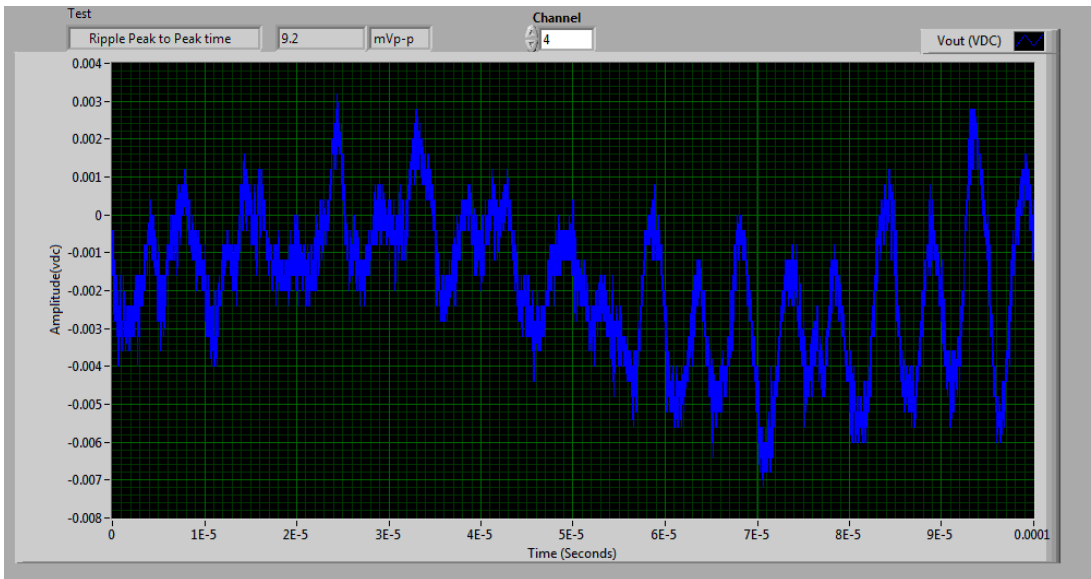


Figure 26: Ripple at 100% Load @ 480VAC. Timebase = 1uS/Div

CH1 (Blue) – Vout Ripple, 1mV/DIV

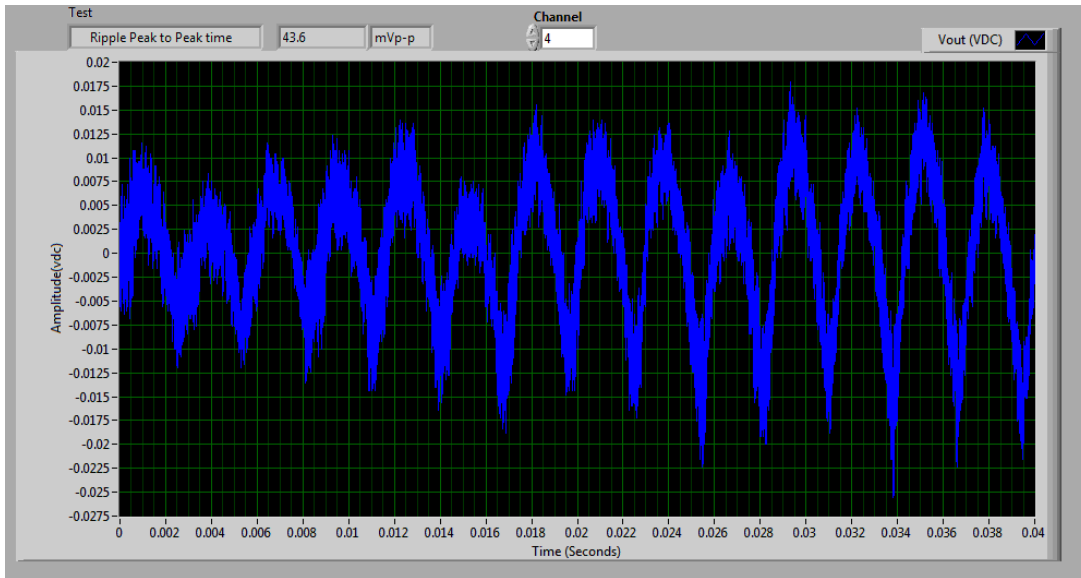


Figure 27: Ripple at 100% Load @ 528VAC. Timebase = 2mS/Div

CH1 (Blue) – Vout Ripple, 2.5mV/DIV

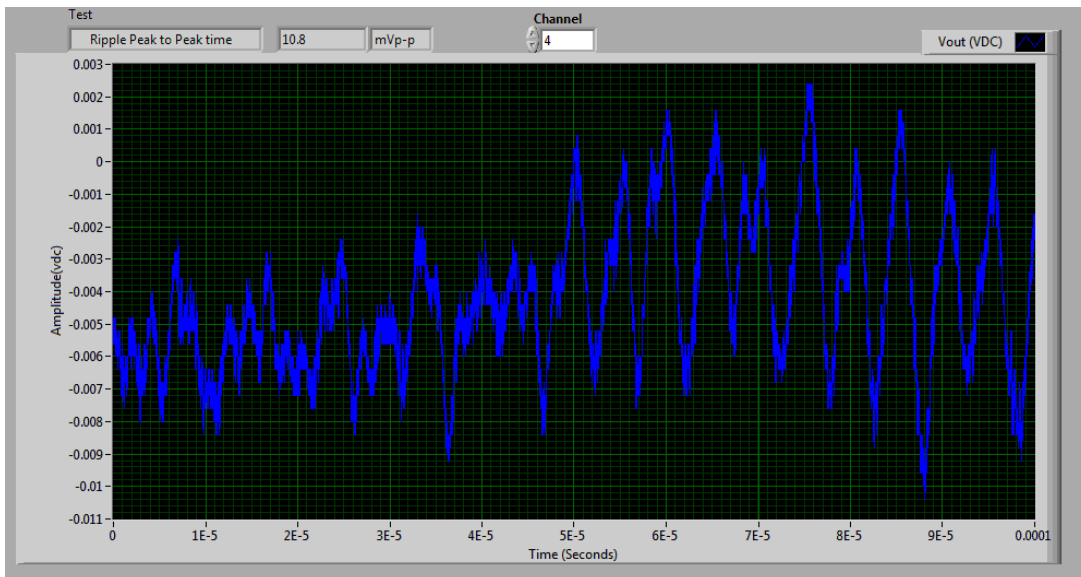


Figure 28: Ripple at 100% Load @ 528VAC. Timebase = 1uS/Div

CH1 (Blue) – Vout Ripple, 1mV/DIV

## OCP Characteristics

Vout =48Vdc, Ta=25°C

### Local Mode

In local mode, the current setpoint is adjustable via either the Ilimit Adjust trim pot or by applying a 0-5V signal to terminals 10 and 18 of the signal connector. See User manual for details.

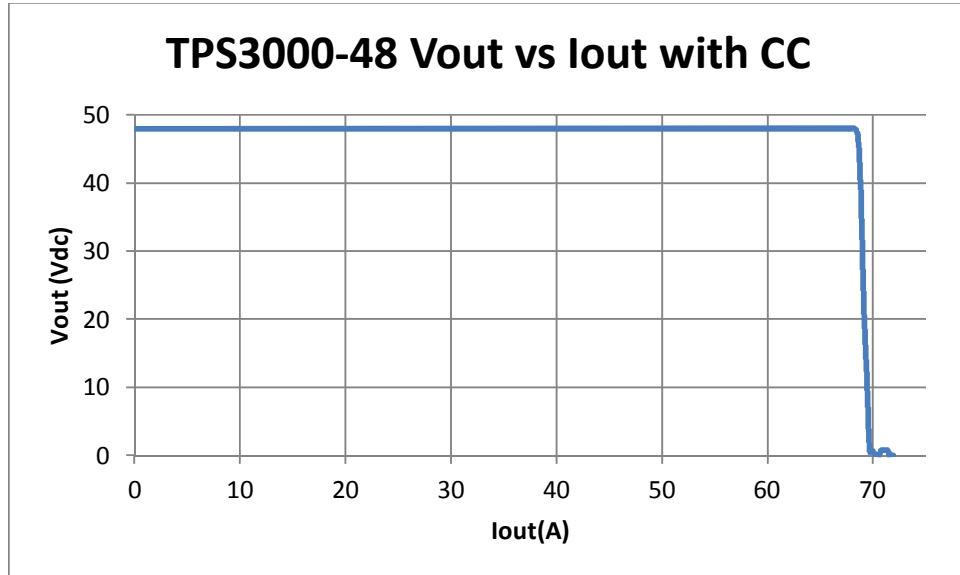


Figure 29: OCP Dropout Curve. Ilim setpoint= 68.5A. Local Mode

### Remote Mode

In remote mode, the current limit setpoint is programmable via the I2C.

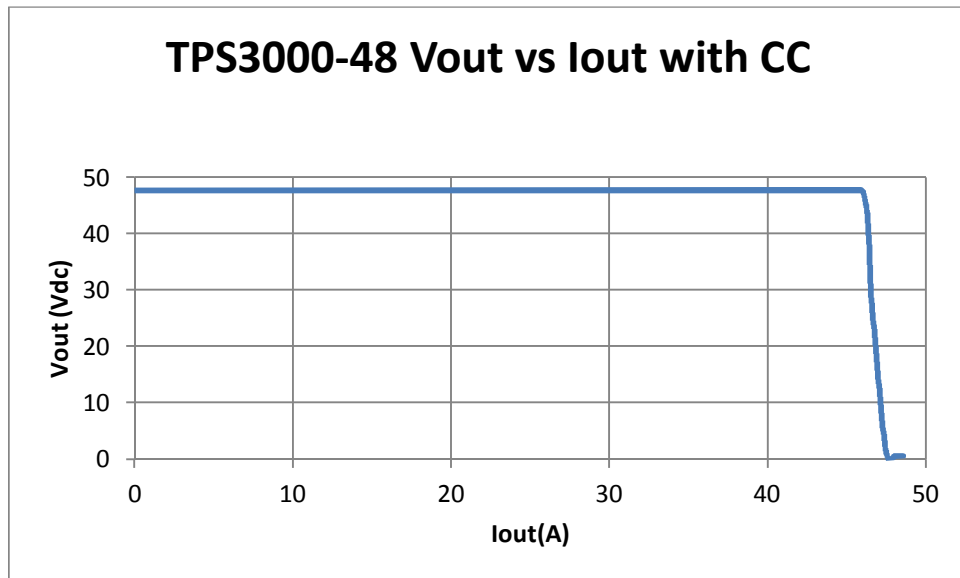


Figure 30: Dropout Curve. Ilim setpoint = 44A. Remote Mode

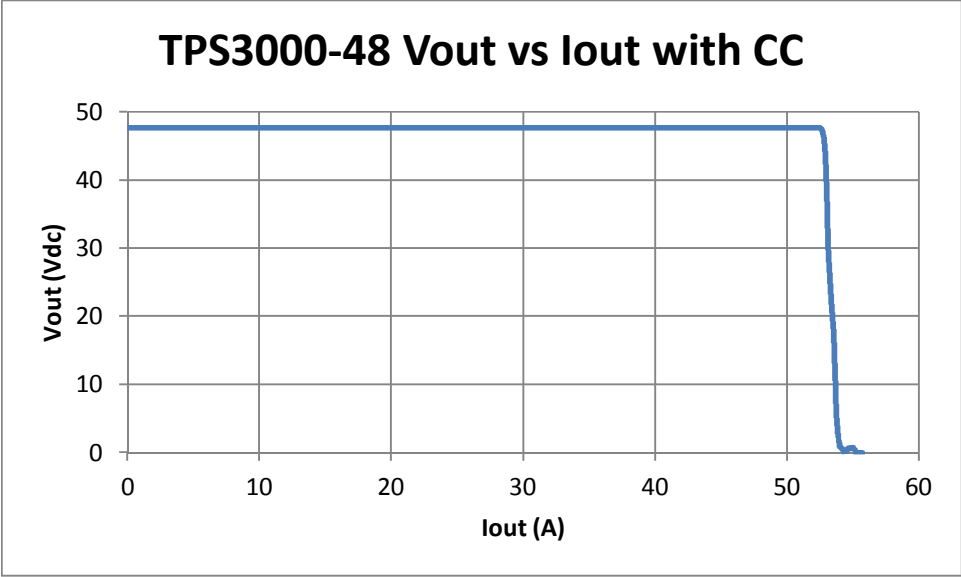


Figure 31: Dropout Curve. Ilim setpoint = 50A. Remote Mode

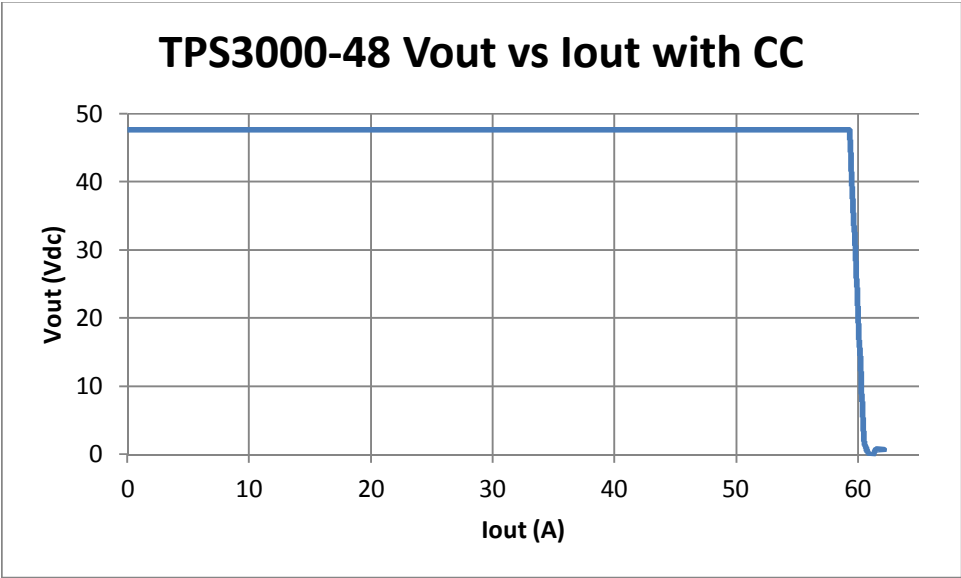


Figure 32: Dropout Curve. Ilim setpoint = 56A. Remote Mode

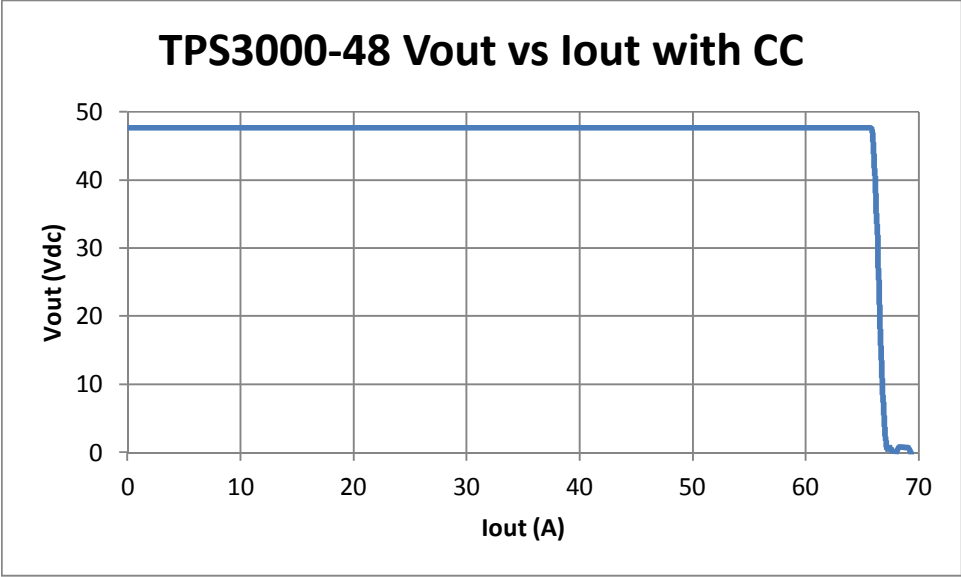


Figure 33: Dropout Curve. Ilim setpoint = 62A. Remote Mode

## Conducted Emissions

EN 55022:2010 + AC:2011 Class A

$V_{out} = 48V_{dc}$ ,  $T_a = 25^{\circ}C$ , %100 Load = 63A

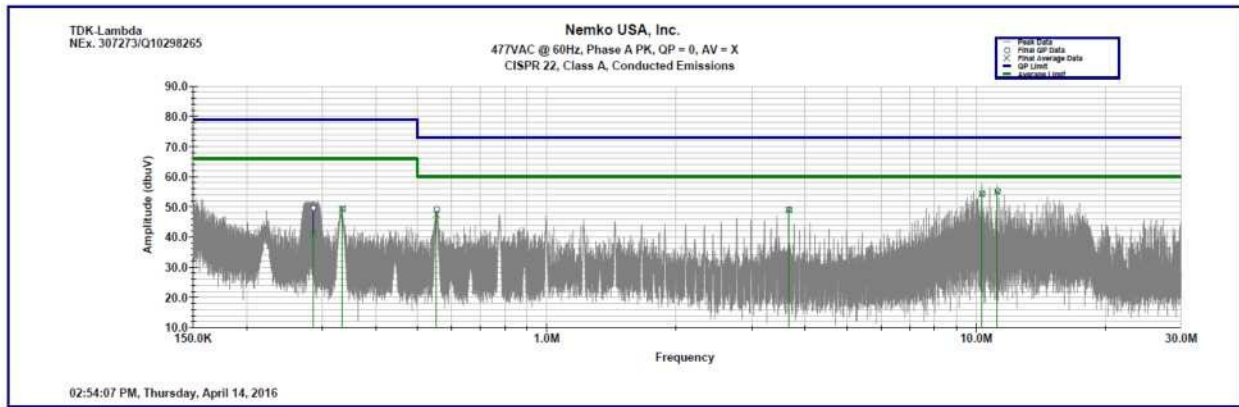


Figure 34: Phase A Conducted Emissions.  $V_{in} = 477V_{ac}$

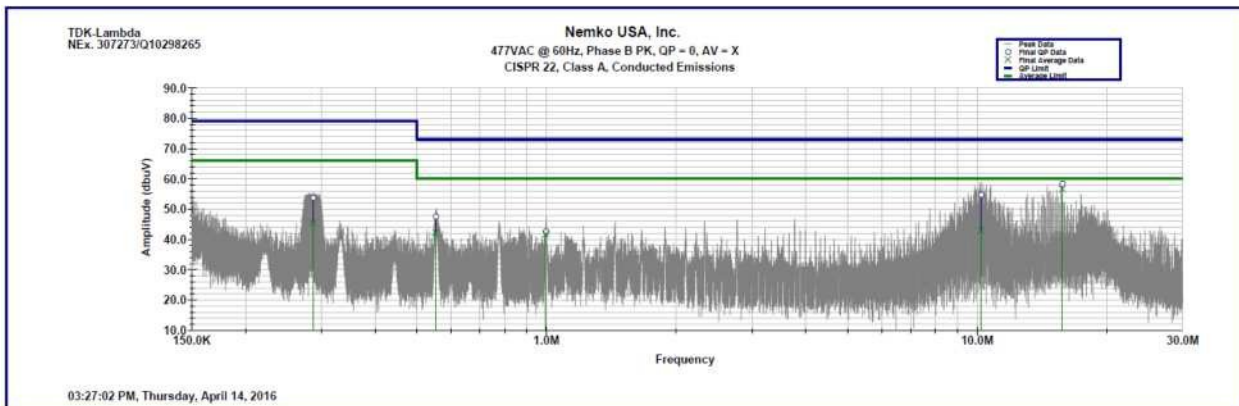


Figure 35: Phase B Conducted Emissions.  $V_{in} = 477V_{ac}$

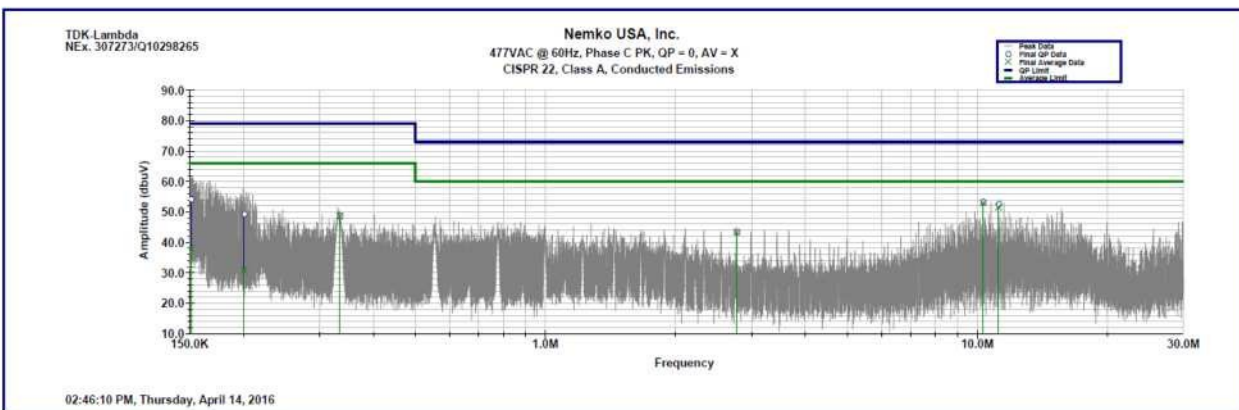


Figure 36: Phase C Conducted Emissions.  $V_{in} = 477V_{ac}$

## Radiated Emissions

FCC Part 15 B/ EN55032 Class A/ EN55022 Class A

Vout =48Vdc, Ta=25°C, %100 Load = 63A

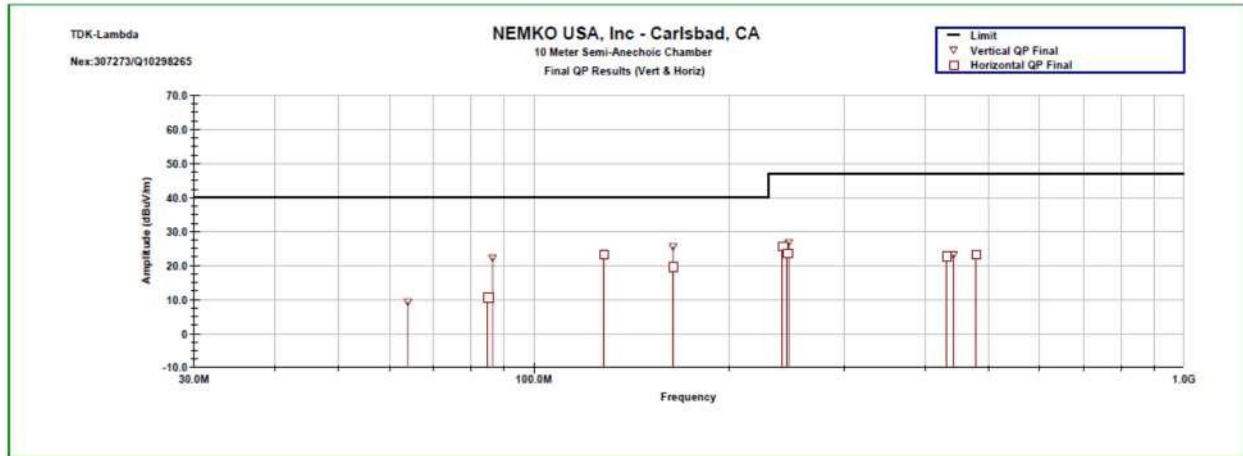


Figure 37: FCC Part 15 B Radiated Emissions

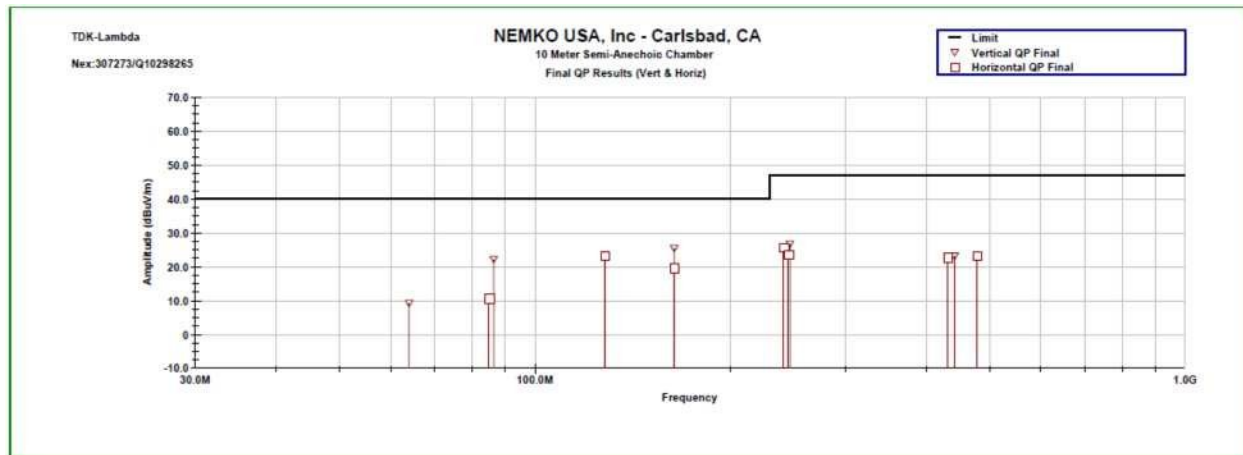


Figure 38: EN55022/EN55032 Class A Radiated Emissions



## Current Share

$V_{in} = 480V_{ac}$ ,  $V_{out} = 48V_{dc}$ ,  $T_a = 25^{\circ}C$

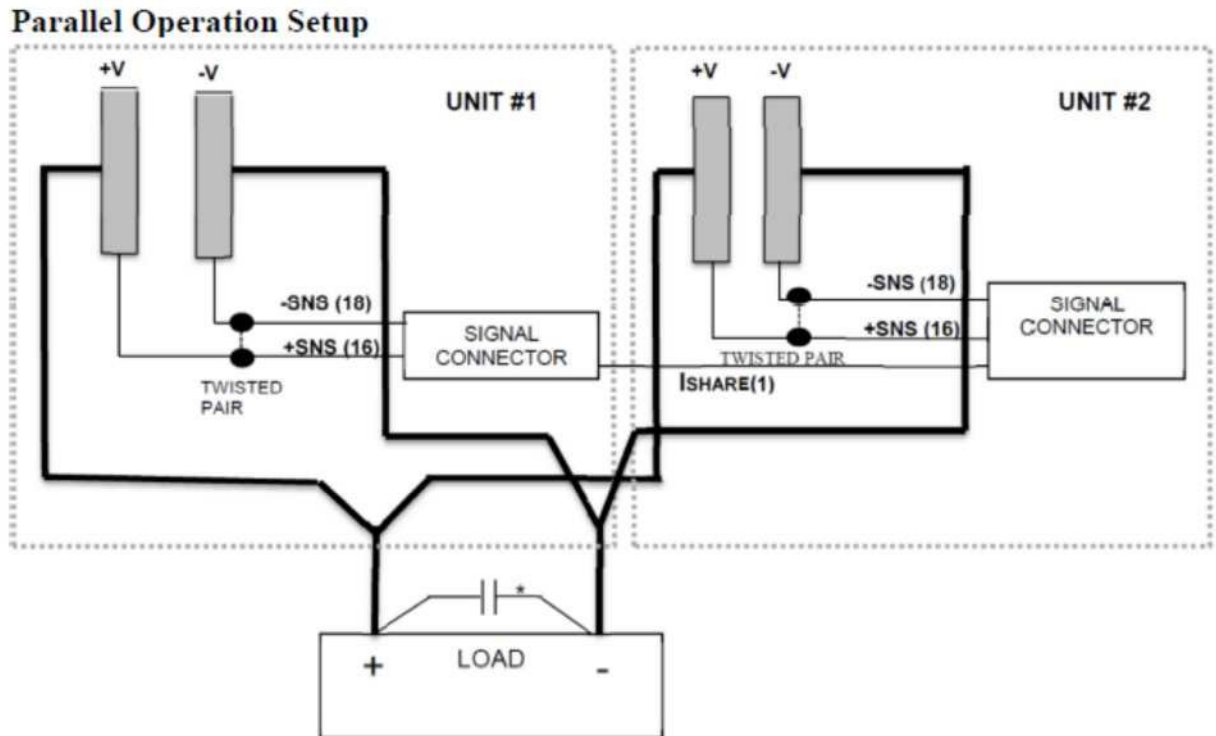
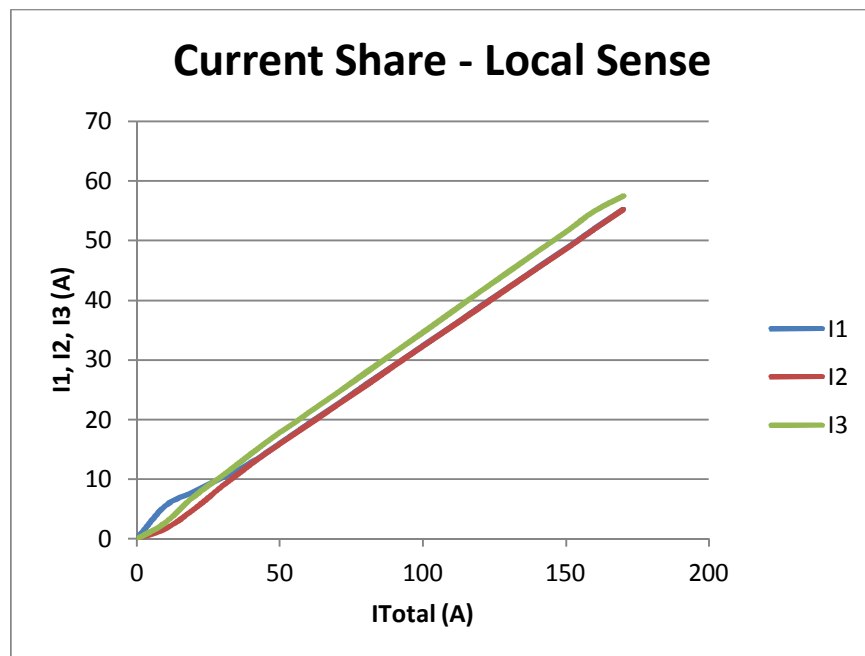


Figure 39: Typical Local Sense Parallel Operation Setup



<b>I<sub>total</sub></b>	<b>I<sub>1</sub></b>	<b>I<sub>2</sub></b>	<b>I<sub>3</sub></b>	<b>Delta I [% of I total]</b>
0	0.00	0.00	0.00	N/A
10	5.53	1.68	2.71	38.54%
20	7.87	4.96	7.12	14.57%
30	10.25	8.87	10.66	5.96%
40	12.79	12.58	14.31	4.32%
50	16.00	15.92	17.80	3.76%
60	19.28	19.17	21.13	3.26%
70	22.54	22.43	24.47	2.92%
80	25.84	25.74	27.85	2.64%
90	29.14	29.04	31.27	2.48%
100	32.39	32.30	34.65	2.35%
110	35.67	35.59	38.06	2.25%
120	38.92	38.84	41.44	2.17%
130	42.23	42.15	44.85	2.08%
140	45.48	45.40	48.21	2.01%
150	48.74	48.66	51.57	1.94%
160	52.04	51.97	54.98	1.88%
170	55.28	55.23	57.52	1.35%

**Table 1: Current Share - Local Sense (Sense signals connected to bus bars)**

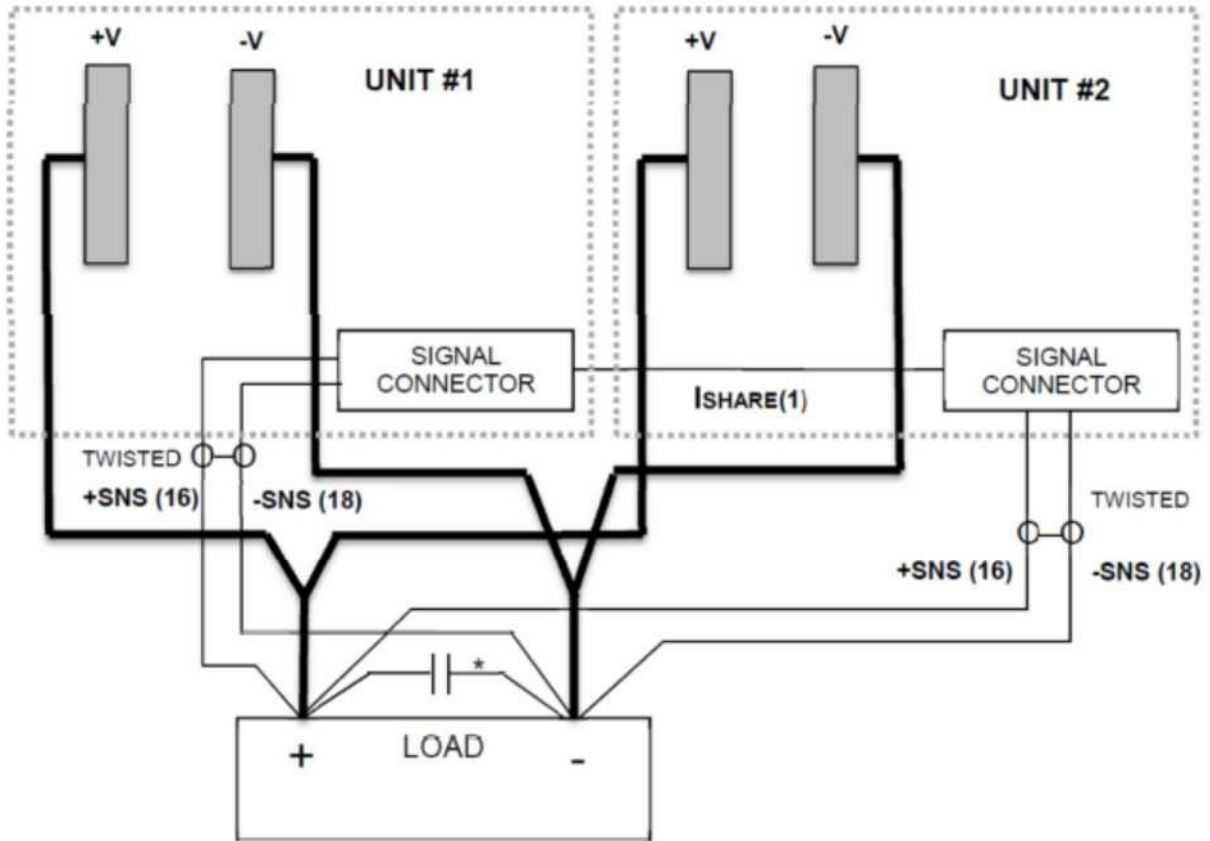
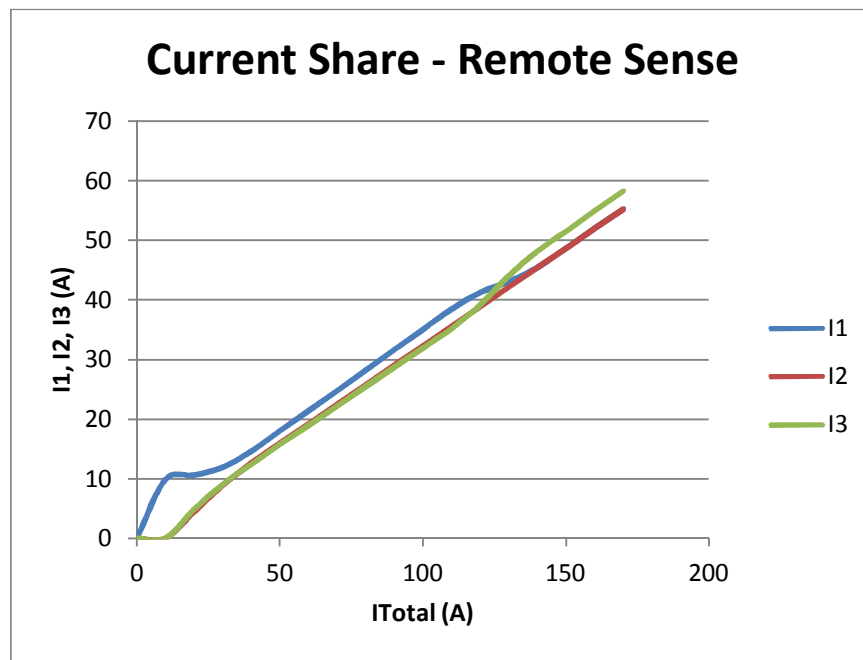


Figure 40: Typical Remote Sense Parallel Operation Setup



<b>I<sub>total</sub></b>	<b>I<sub>1</sub></b>	<b>I<sub>2</sub></b>	<b>I<sub>3</sub></b>	<b>Delta I [% of I total]</b>
0	0.00	0.00	0.00	N/A
10	9.86	0.00	0.00	98.58%
20	10.59	4.50	4.85	30.48%
30	11.90	8.87	9.05	10.08%
40	14.64	12.62	12.46	5.44%
50	18.05	15.95	15.75	4.60%
60	21.41	19.21	18.97	4.07%
70	24.79	22.47	22.20	3.69%
80	28.23	25.77	25.48	3.43%
90	31.66	29.07	28.73	3.26%
100	35.06	32.33	31.96	3.11%
110	38.49	35.62	35.21	2.99%
120	41.25	38.87	39.20	1.99%
130	43.08	42.18	44.10	1.48%
140	45.47	45.44	48.20	1.97%
150	48.72	48.70	51.56	1.91%
160	52.02	52.01	54.97	1.85%
170	55.26	55.26	58.33	1.80%

Table 2: Current Share- Remote Sense (Sense signals connected at load)