

Test Report: PMP21927

15-W Multi-Output Off-Line Flyback Reference Design



Description

This reference design takes a universal Vac input and creates three isolated 15-Vdc outputs. The main output can be loaded up to 1-A and achieves over 86% efficiency. The other isolated 15-V outputs can be loaded to 50-mA. These outputs have linear regulators to keep the voltages within 1% regardless of cross-loading conditions.

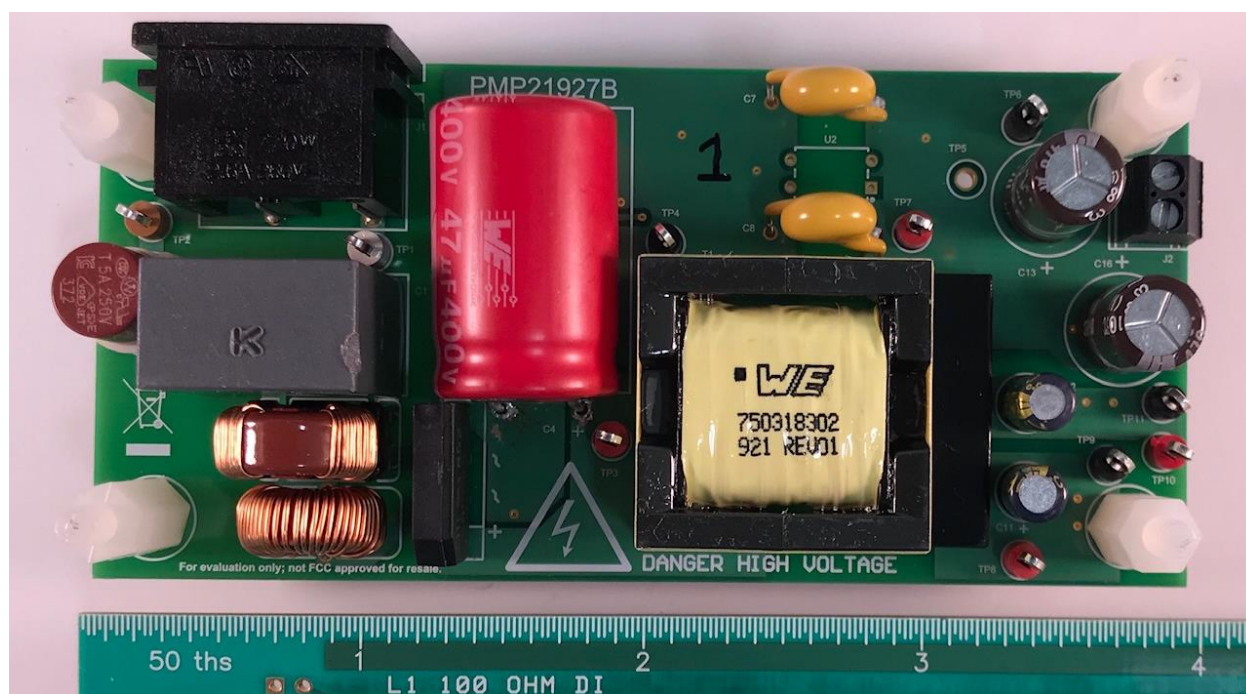


Figure 1. Board Top

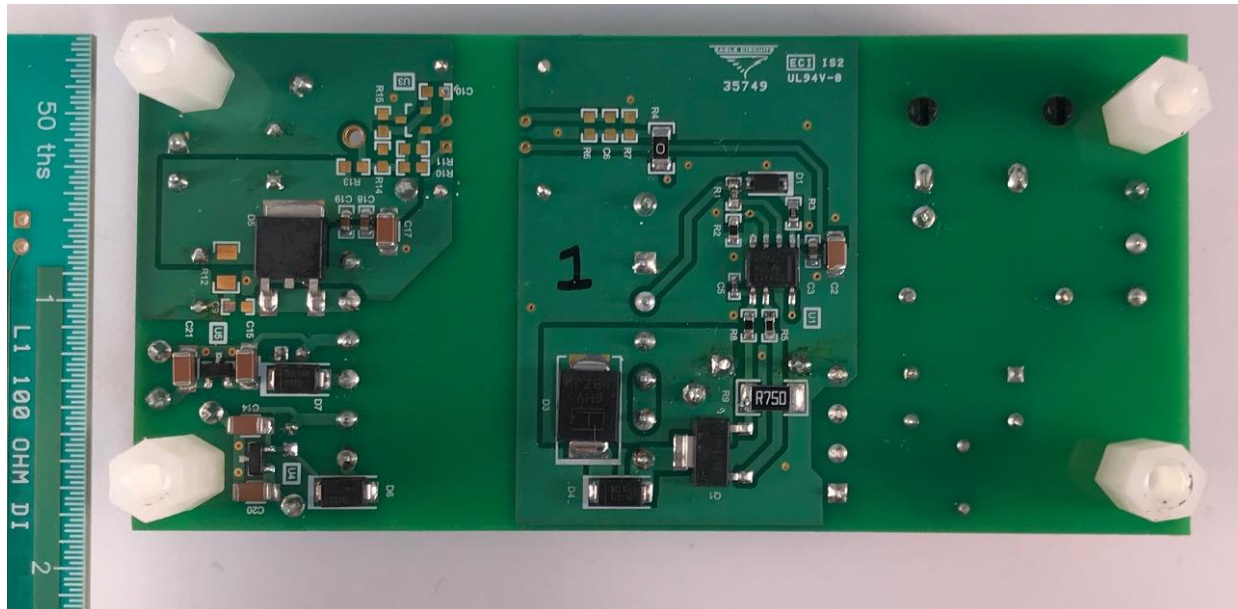


Figure 2. Board Bottom

1 Test Prerequisites

1.1 Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
Input Voltage Range	85 Vac – 265 Vac, 120 Vac nominal
Output Voltage 1	15 V +/- 3%
Output Current 1	1 A
Output Voltage 2	15 V +/- 1%
Output Current 2	50 mA max
Output Voltage 3	15 V +/- 1%
Output Current 3	50 mA max
Switching Frequency	74 kHz

2 Testing and Results

2.1 Efficiency Graphs

Efficiency was measured by loading the main 15 V output. The other 15 V outputs were kept in regulation from the LDOs.

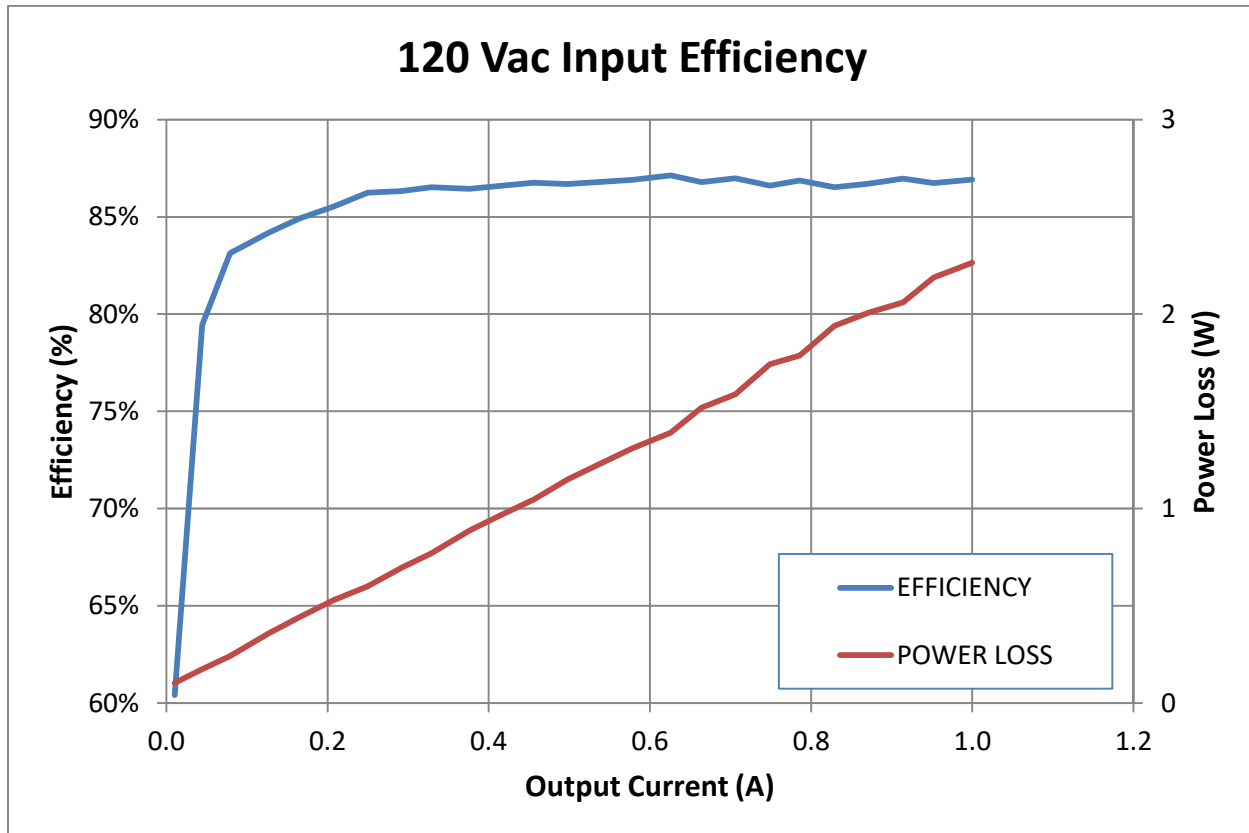


Figure 3. Efficiency with 120 Vac Input

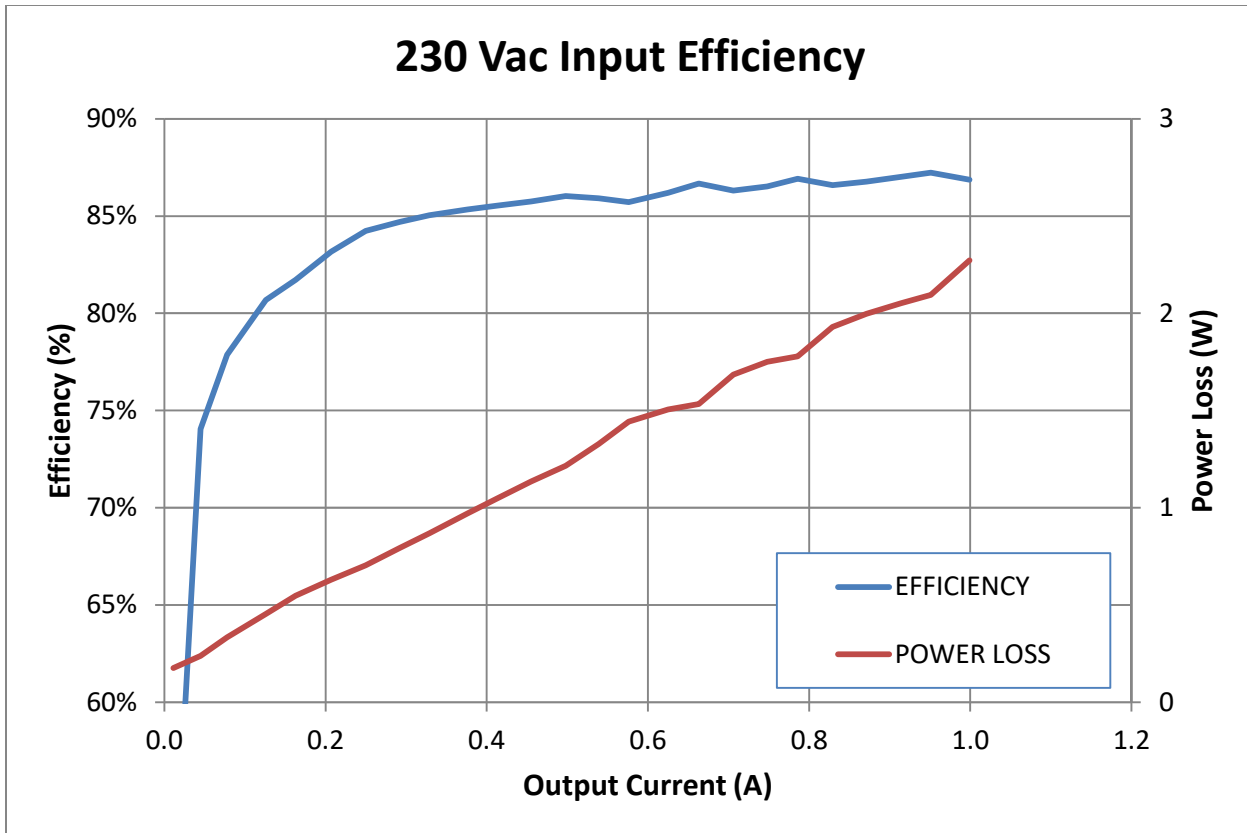


Figure 4. Efficiency with 230 Vac Input

2.2 Load Regulation

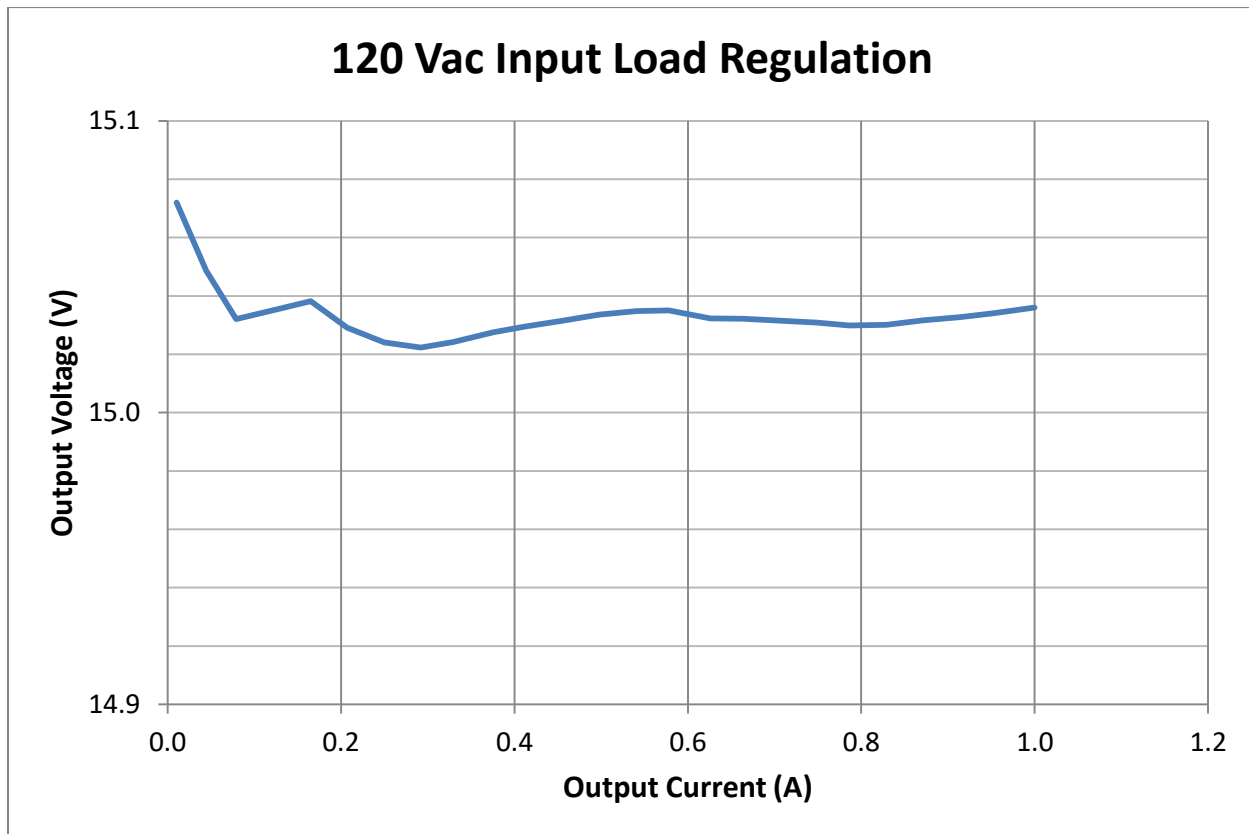


Figure 5. Load Regulation with 120 Vac Input

2.3 Efficiency Data

120 Vac Input					
PIN (W)	VO (V)	IO (A)	POUT (W)	EFF (%)	PLOSS (W)
0.8430	15.0487	0.0445	0.6697	79.44	0.1733
4.3555	15.0240	0.2500	3.7560	86.24	0.5995
8.6366	15.0336	0.4980	7.4867	86.69	1.1499
13.0000	15.0309	0.7490	11.2581	86.60	1.7419
17.3000	15.0361	1.0000	15.0361	86.91	2.2640
230 Vac Input					
0.9160	15.0410	0.0451	0.6784	74.06	0.2376
4.4599	15.0265	0.2500	3.7566	84.23	0.7033
8.6973	15.0237	0.4980	7.4818	86.02	1.2155
13.0000	15.0385	0.7480	11.2488	86.53	1.7512
17.3000	15.0427	0.9990	15.0276	86.87	2.2724

2.4 Thermal Images

Thermal images were taken after 5 minutes of running the 15 V rail at 1 A with a 120 Vac input and no airflow.

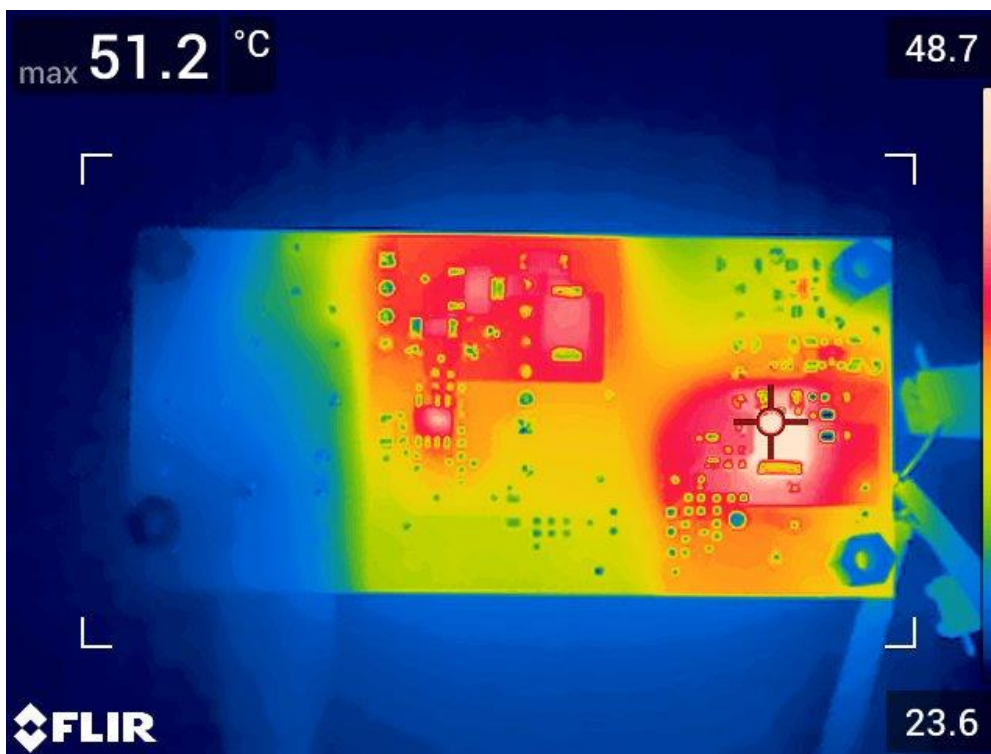


Figure 6. Board Bottom

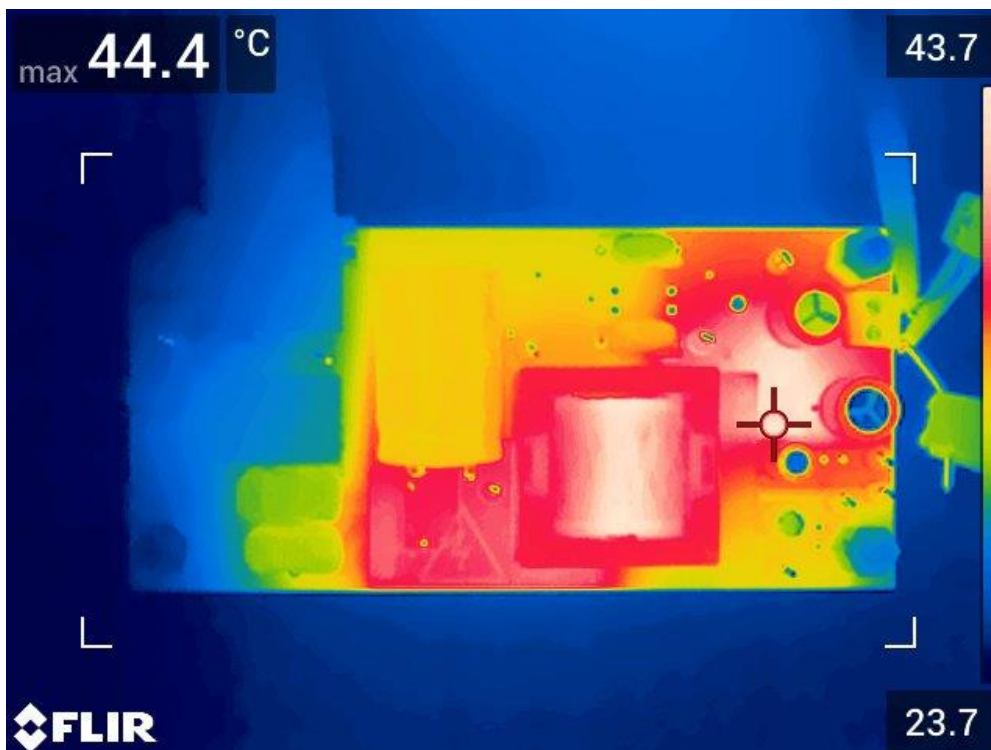


Figure 7. Board Top

3 Waveforms

3.1 Switching

The switch node was measured with the main 15 V output at full load.

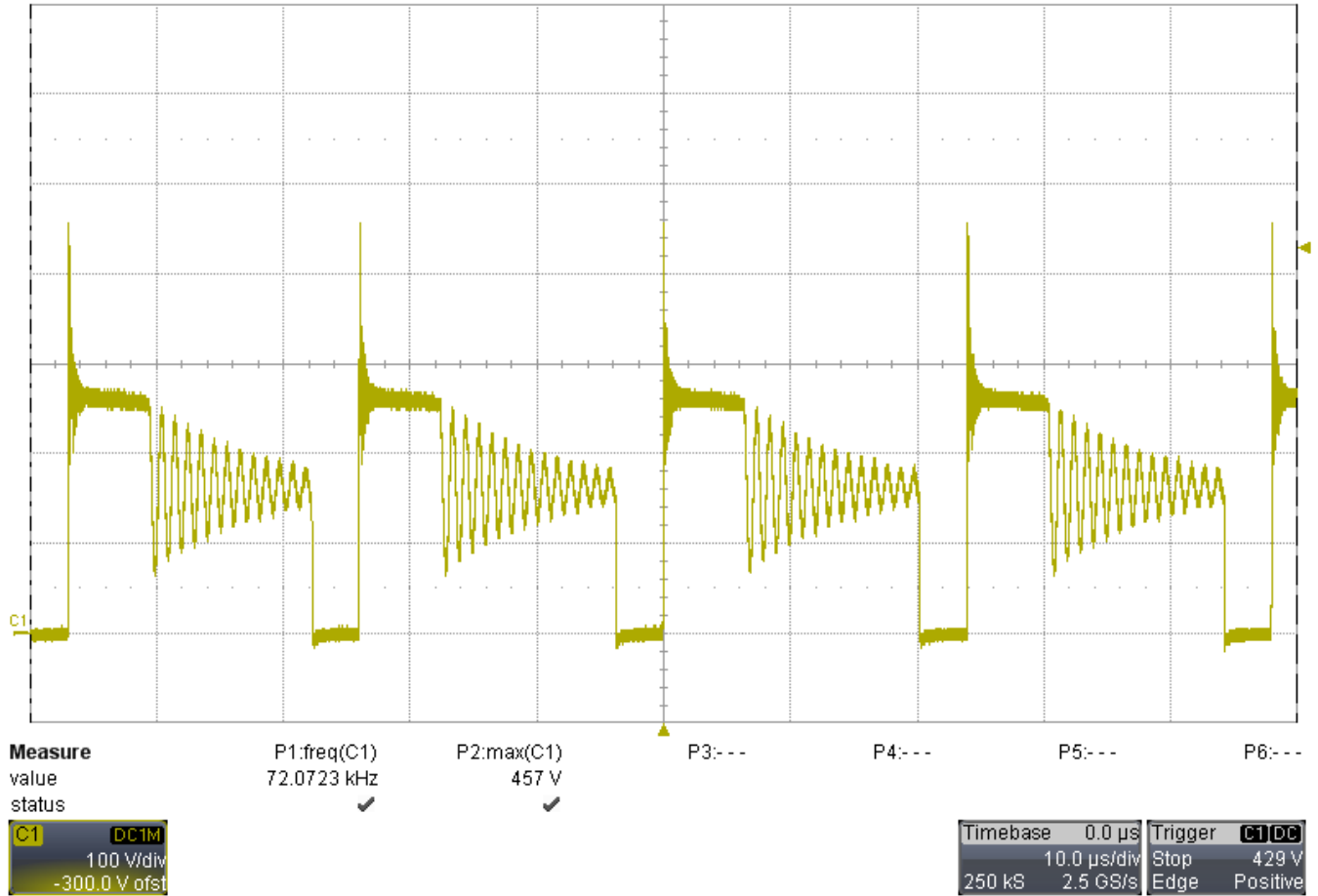


Figure 8. Primary Switching Node with 120 Vac input

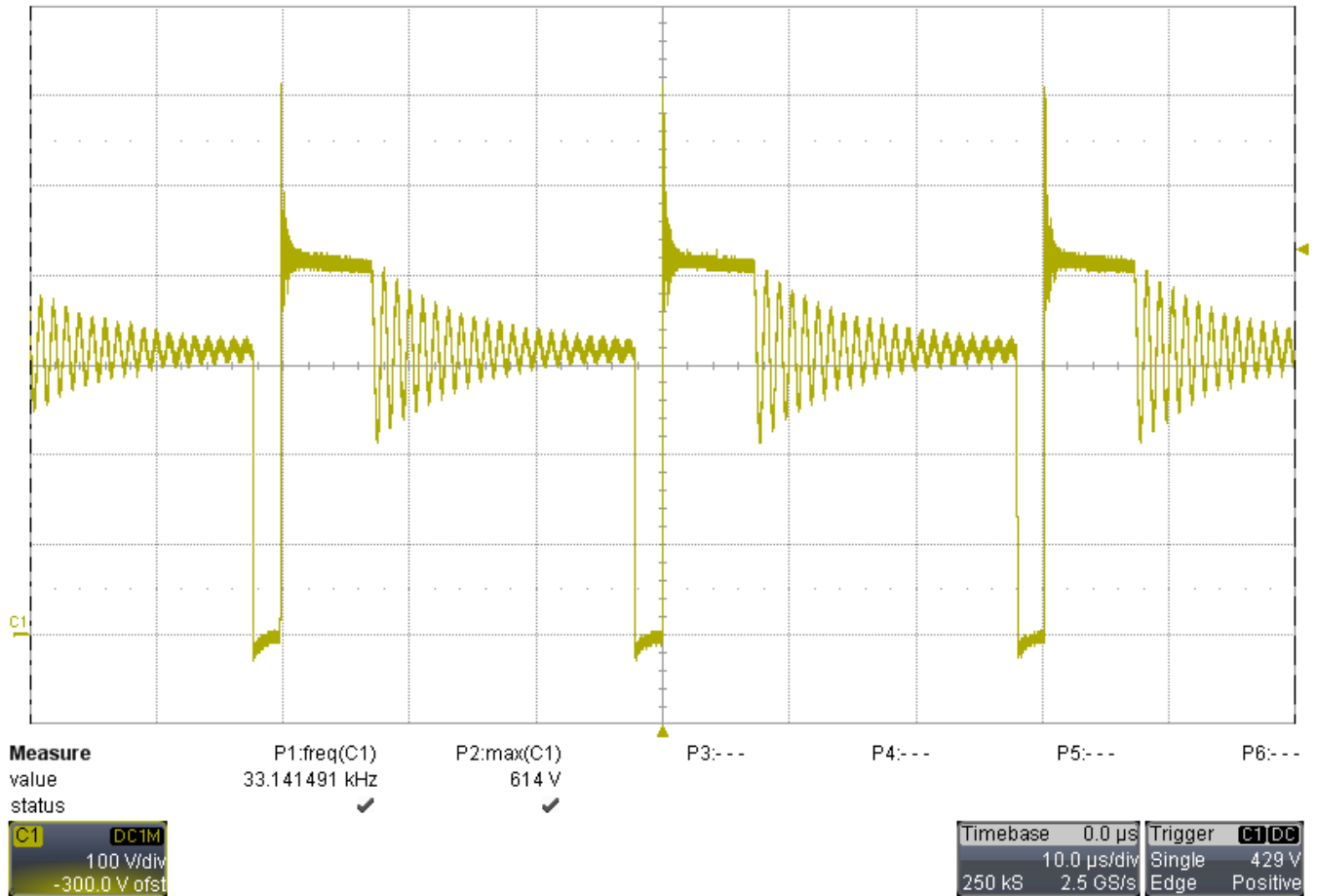


Figure 9. Primary Switching Node with 230 Vac input

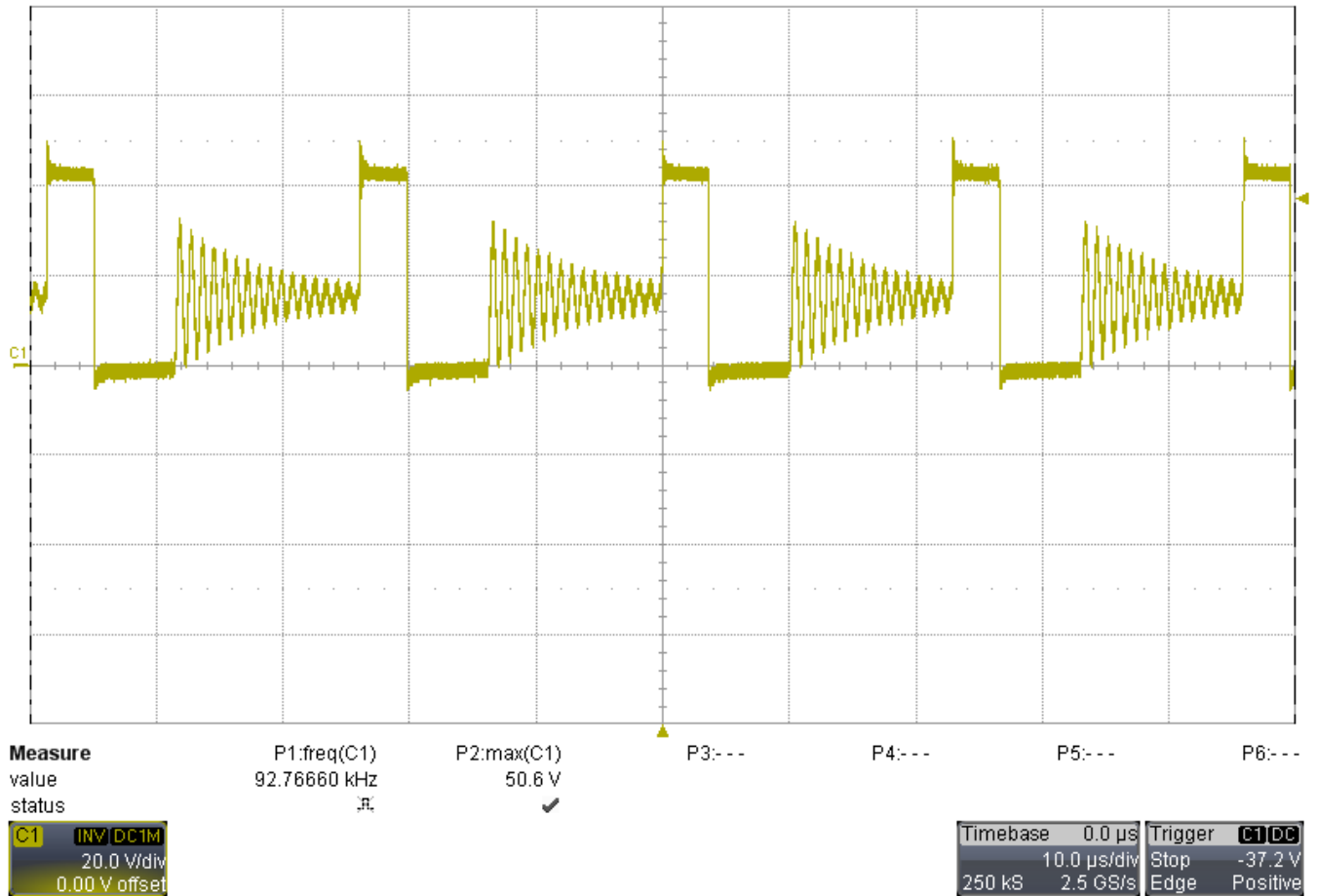


Figure 10. Secondary Switching Node with 120 Vac input

3.2 Output Voltage Ripple

Measurements were taken using the tip and barrel method across the output caps of the 15 V rail. Figure 5 shows the output ripple at full load and 120 Vac input.

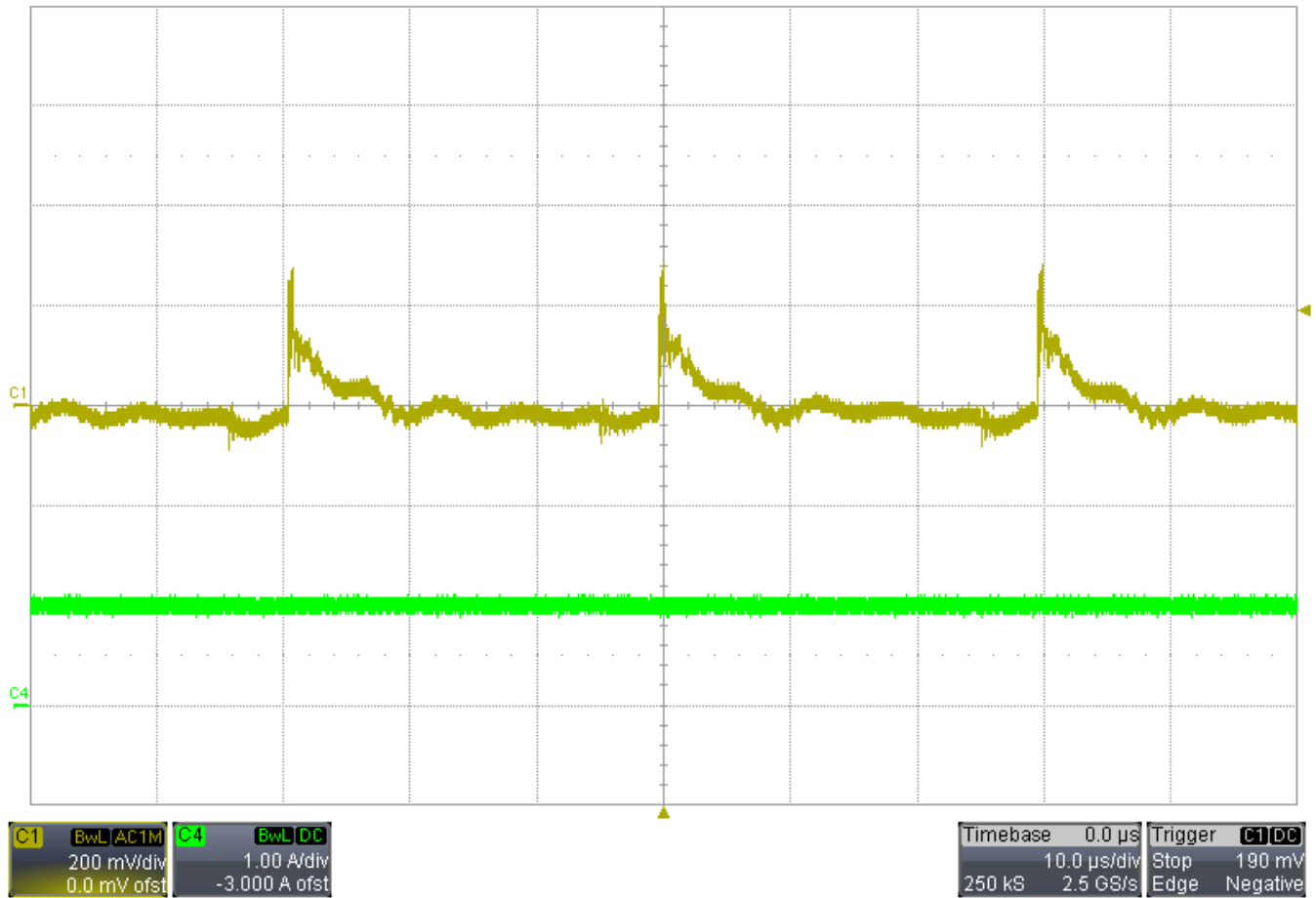


Figure 11.

3.3 Load Transients

In Figure 8, the main 15 V rail was given a step between 0.2 A and 0.8 A with a 120 Vac input.

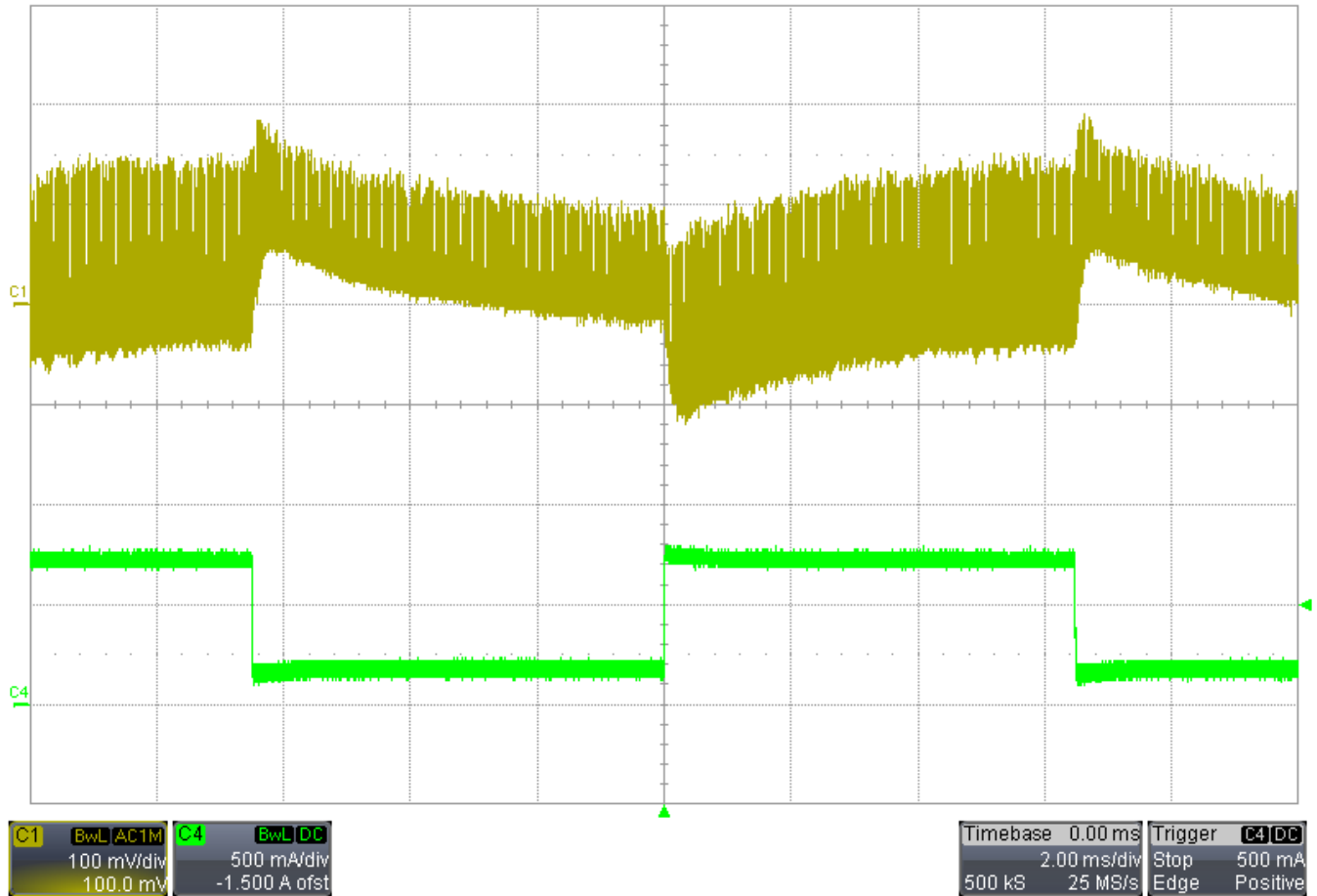
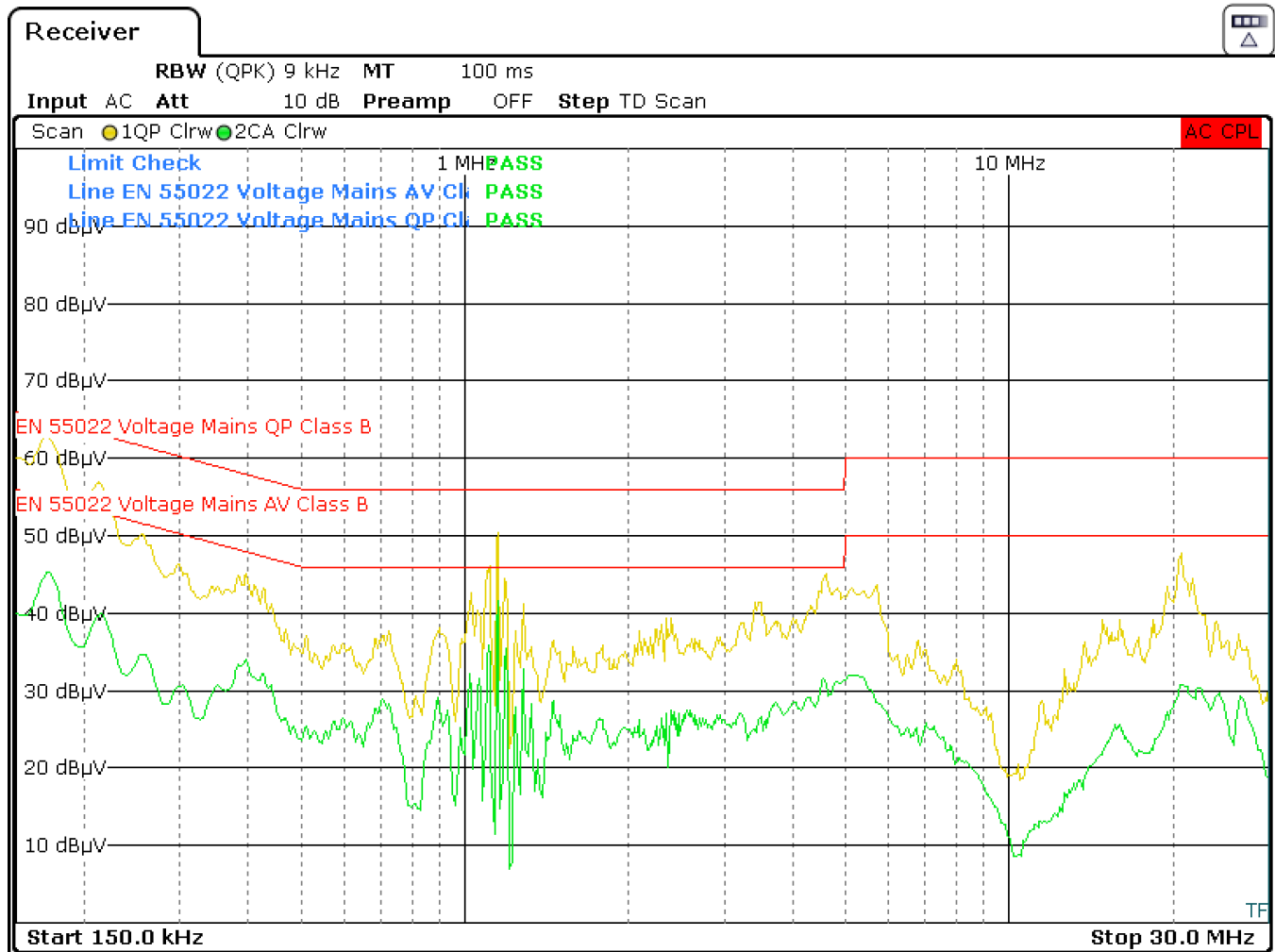


Figure 12.

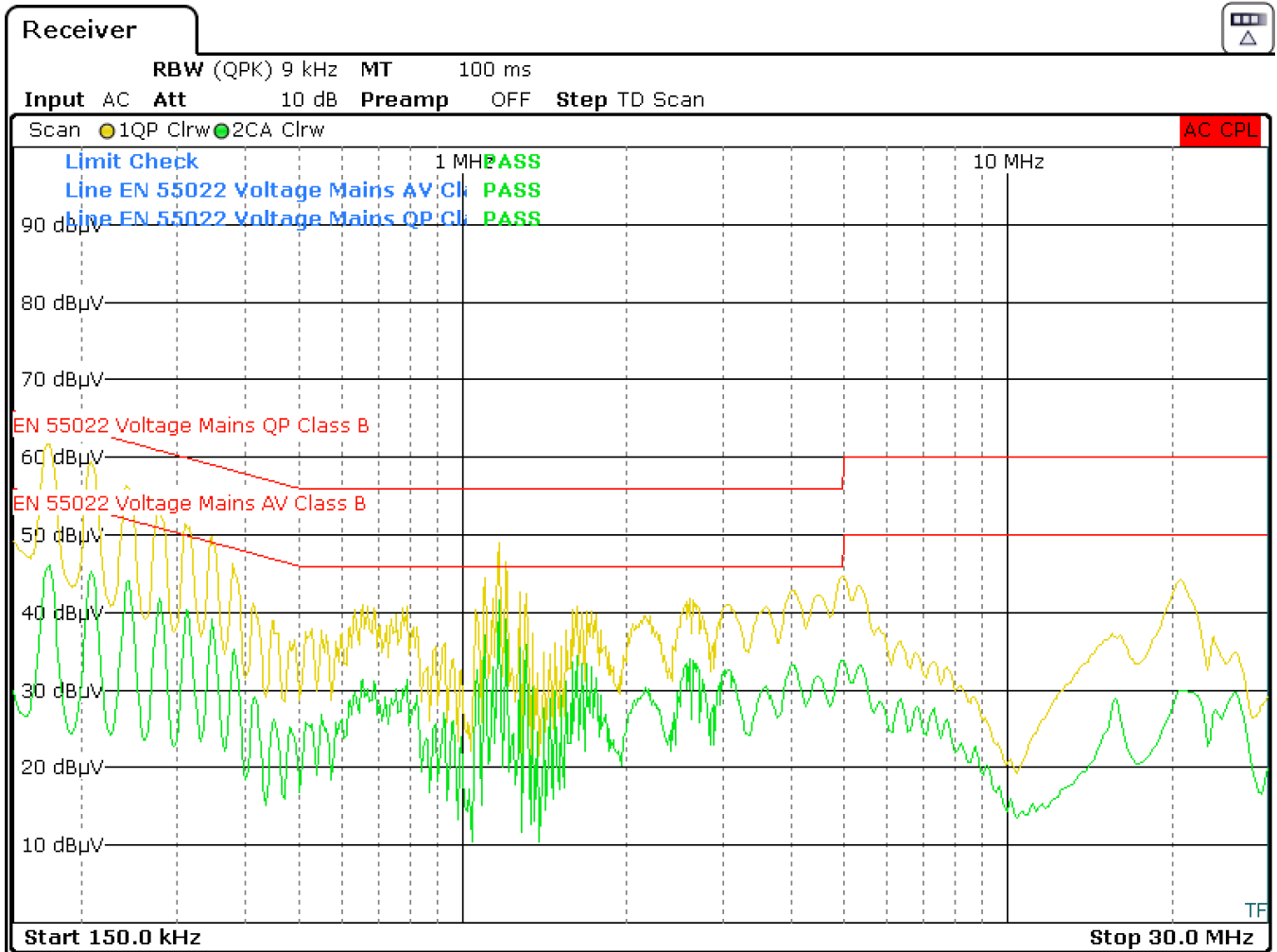
3.4 Conducted EMI

The following conducted emissions measurements were taken using both quasi peak detector and average peak detector methods (yellow and green traces, respectively). The measurements are compared to the CISPR-25 Class B regulations for quasi-peak and average tests. For these tests the 15 V output was loaded to 1 A with a resistive load.



Date: 5.JUN.2019 08:44:00

Figure 13. Measurement with 120 Vac input



Date: 5.JUN.2019 08:41:03

Figure 14. Measurement with 230 Vac input

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