Test Data
For PMP9481
08/19/2014

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1. Design Specifications

Vin Minimum	**6.5VDC**
Vin Maximum	**20VDC**
Vout	**12VDC**
Iout	**0.25A**
Approximate Switching Frequency	**500KHz**

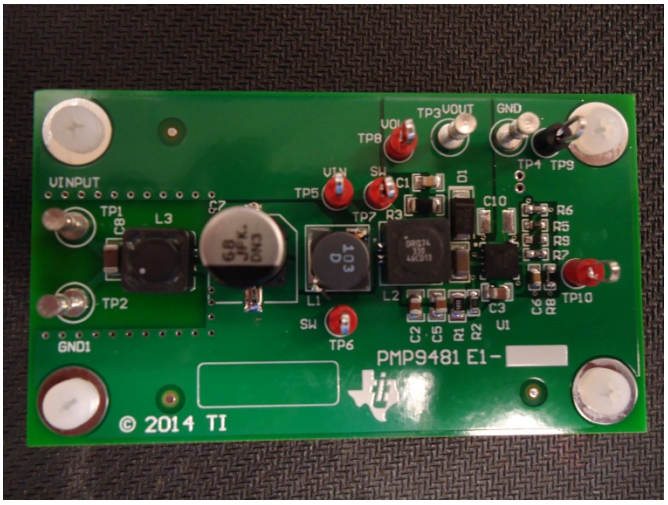
2. Circuit Description and PCB details

PMP9481 is a conducted EMI optimized (CISPR 25)3W SEPIC Converter for Wide Range Vin automotive application using the LM5001 regulator IC. The design accepts an input voltage of 6.5Vin to 20Vin and provides an output of 12Vout capable of supplying 0.25A of current to the load. It features a small size and is an inexpensive and more efficient solution to using boost converters and linear regulators.

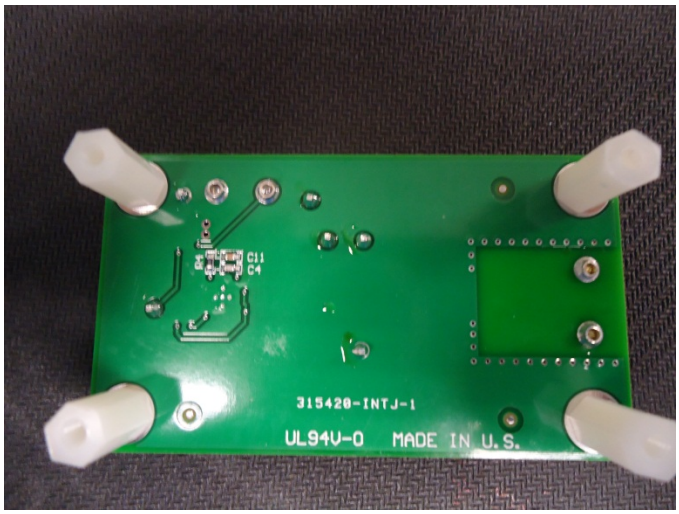
The Board dimension of PMP9481 PCB is 75mm * 40mm. Four layer PCB was used for the design.

3. PMP9481 Board Photos

Board Dimensions: 75mm x 40mm

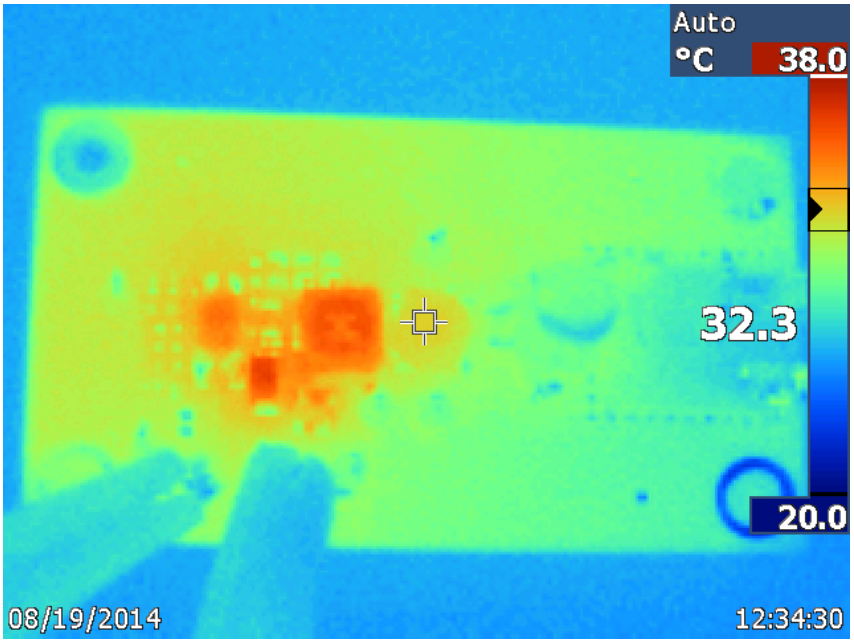


Board Photo (Top)

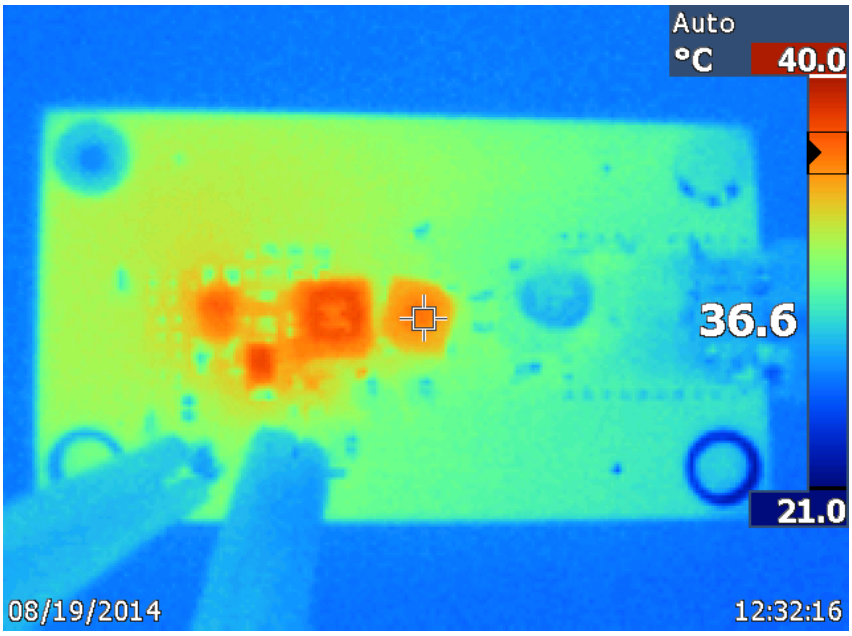


Board Photo (Bottom)

4. Thermal Data



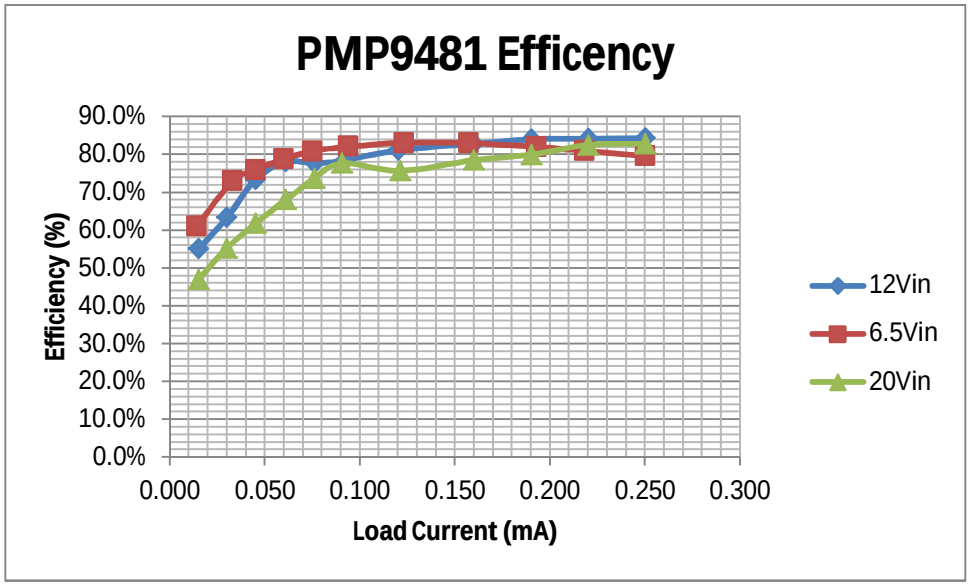
IR thermal image taken at steady state with 12Vin and 250mA load (no airflow)



IR thermal image taken at steady state with 6.5Vin and 250mA load (no airflow)

5. Efficiency

5.1 Efficiency Chart



5.2 Efficiency Data

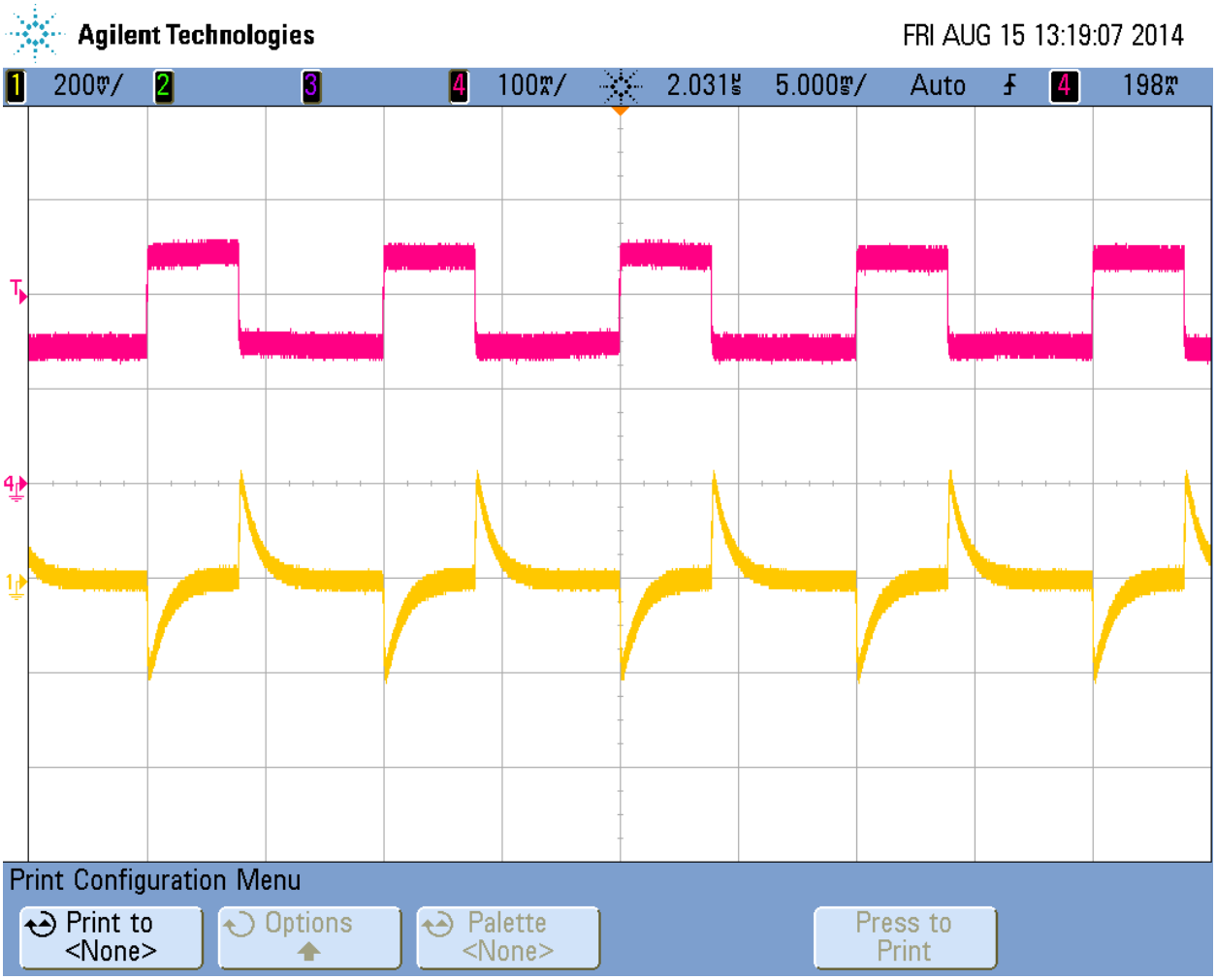
Vin	Iin	Iout	Vout	Pout	Losses	Efficiency
12.05	0.027	0.015	11.908	0.18	0.146	55.1%
12.00	0.047	0.030	11.908	0.36	0.207	63.3%
11.96	0.061	0.045	11.908	0.54	0.194	73.4%
11.92	0.078	0.061	11.908	0.73	0.204	78.1%
11.87	0.098	0.076	11.908	0.91	0.258	77.8%
11.83	0.118	0.092	11.908	1.10	0.300	78.5%
12.06	0.146	0.120	11.908	1.43	0.331	81.2%
12.04	0.191	0.160	11.908	1.91	0.394	82.9%
12.02	0.224	0.190	11.908	2.26	0.430	84.0%
12.01	0.259	0.220	11.908	2.62	0.491	84.2%
12.00	0.294	0.250	11.908	2.98	0.550	84.4%

Vin	Iin	Iout	Vout	Pout	Losses	Efficiency
6.66	0.041	0.014	11.908	0.17	0.106	61.1%
6.56	0.082	0.033	11.908	0.39	0.145	73.1%
6.72	0.105	0.045	11.908	0.54	0.170	75.9%
6.71	0.135	0.060	11.908	0.71	0.191	78.9%
6.69	0.165	0.075	11.908	0.89	0.211	80.9%
6.68	0.204	0.094	11.908	1.12	0.243	82.1%
6.65	0.265	0.123	11.908	1.46	0.298	83.1%
6.62	0.340	0.157	11.908	1.87	0.381	83.1%
6.59	0.425	0.193	11.908	2.30	0.503	82.0%
6.57	0.488	0.218	11.908	2.60	0.608	81.0%
6.53	0.572	0.250	11.908	2.98	0.758	79.7%

Vin	Iin	Iout	Vout	Pout	Losses	Efficiency
20.02	0.019	0.015	11.908	0.18	0.202	47.0%
20.19	0.032	0.030	11.908	0.36	0.289	55.3%
20.16	0.043	0.045	11.908	0.54	0.331	61.8%
20.14	0.053	0.061	11.908	0.73	0.341	68.1%
20.12	0.061	0.076	11.908	0.91	0.322	73.7%
20.09	0.069	0.091	11.908	1.08	0.309	77.7%
20.03	0.095	0.121	11.908	1.44	0.462	75.7%
20.21	0.120	0.160	11.908	1.91	0.520	78.6%
20.20	0.140	0.190	11.908	2.26	0.565	80.0%
20.20	0.157	0.220	11.908	2.62	0.552	82.6%
20.19	0.178	0.250	11.908	2.98	0.617	82.8%

6 Waveforms

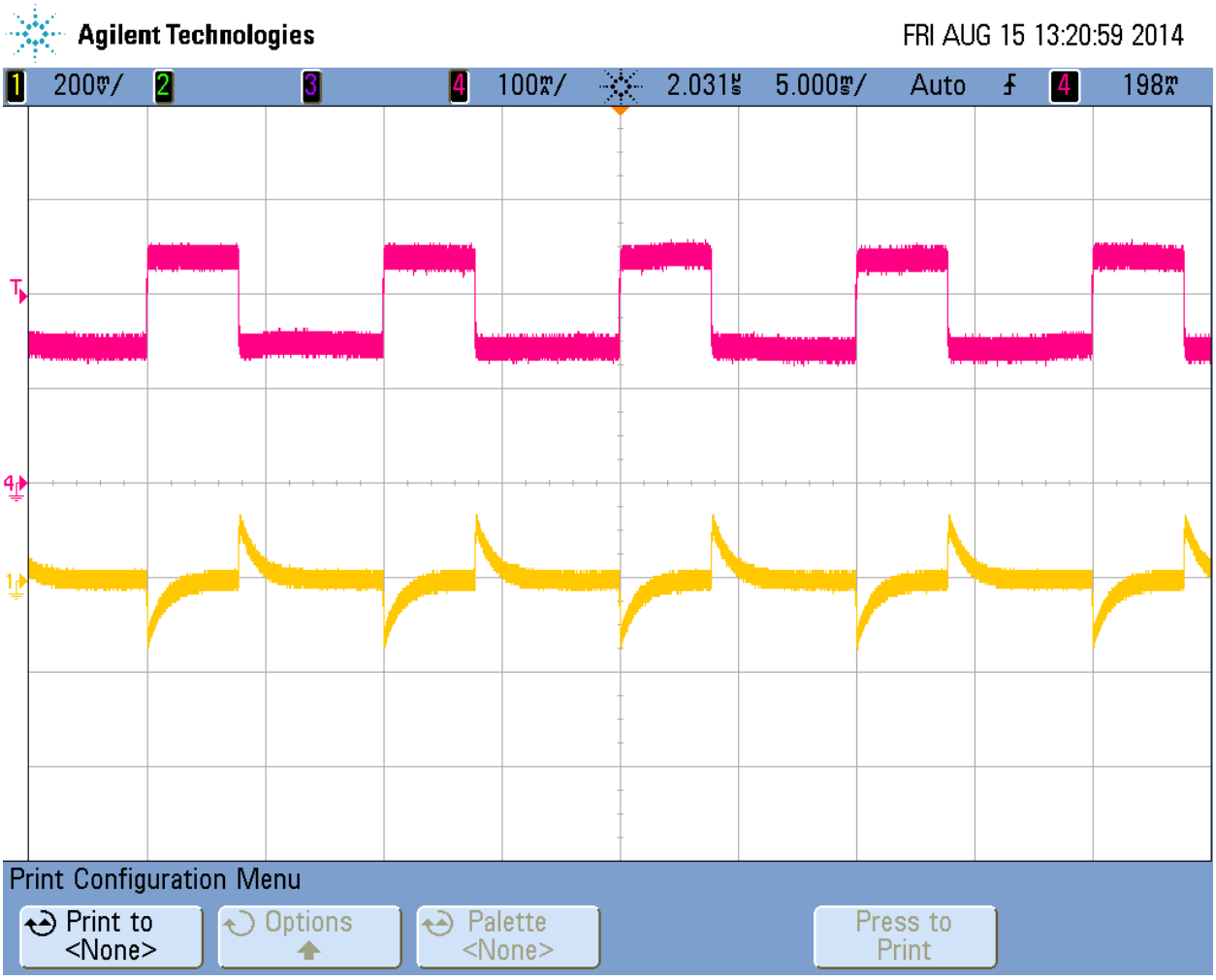
6.1 Load Transient Response



Load Transient Response at 6.5Vin and 60%-to-100% (150mA-to-250mA) Load Step

Ch1 – Vout (AC coupled)

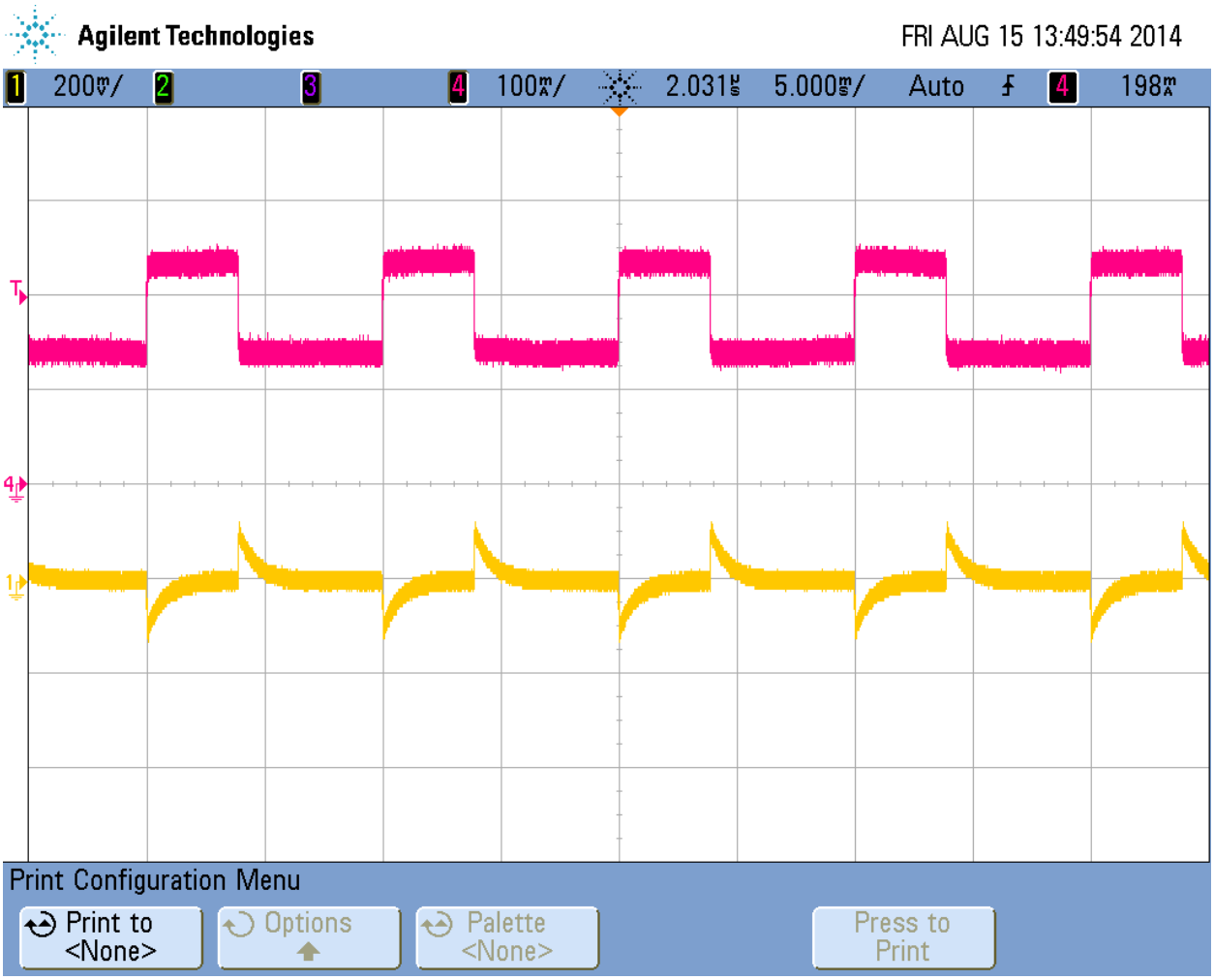
Ch4- Iout



Load Transient Response at 12Vin and 60%-to-100% (150mA-to-250mA) Load Step

Ch1 – Vout (AC coupled)

Ch4- Iout

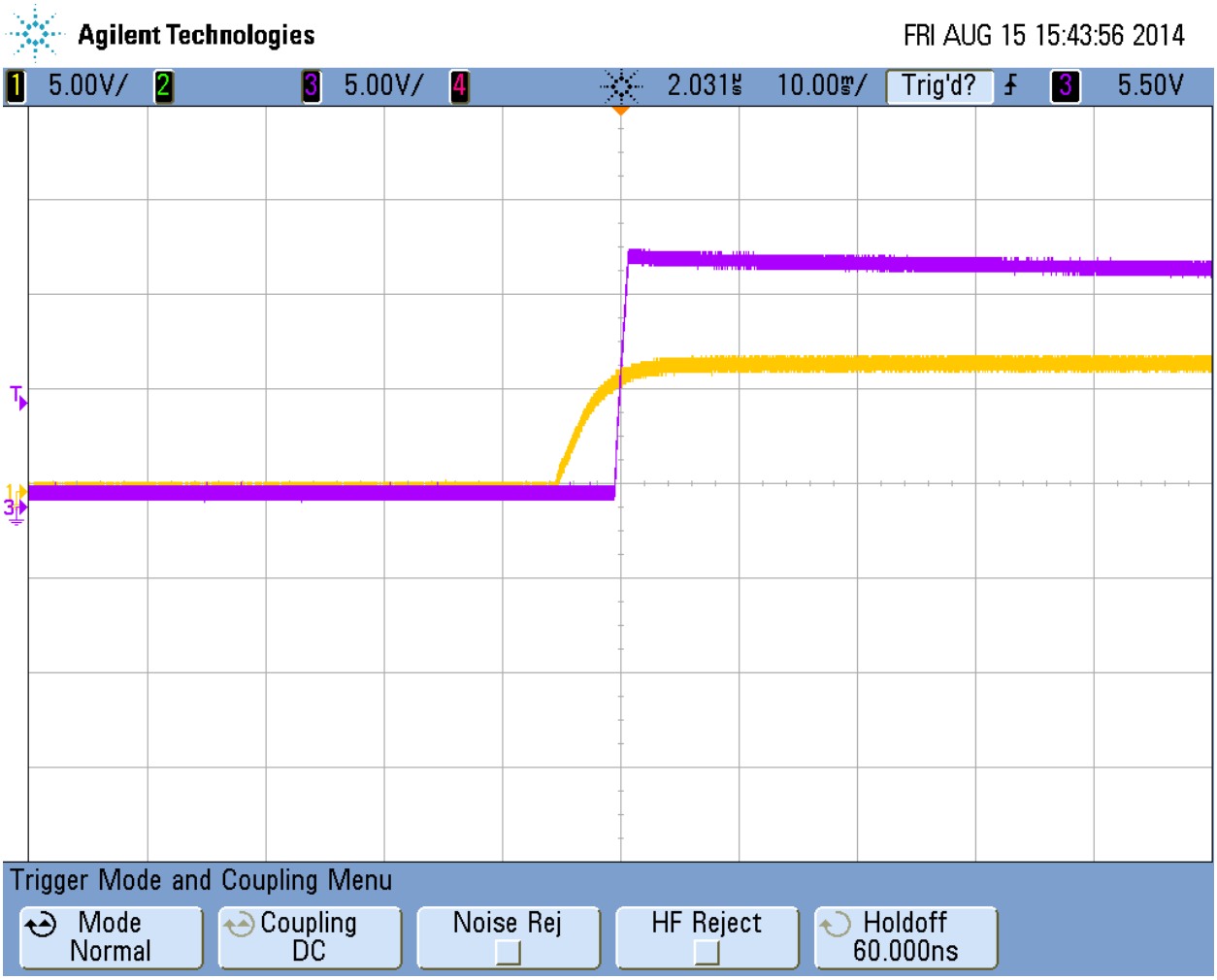


Load Transient Response at 20Vin and 60%-to-100% (150mA-to-250mA) Load Step

Ch1 – Vout (AC coupled)

Ch4- Iout

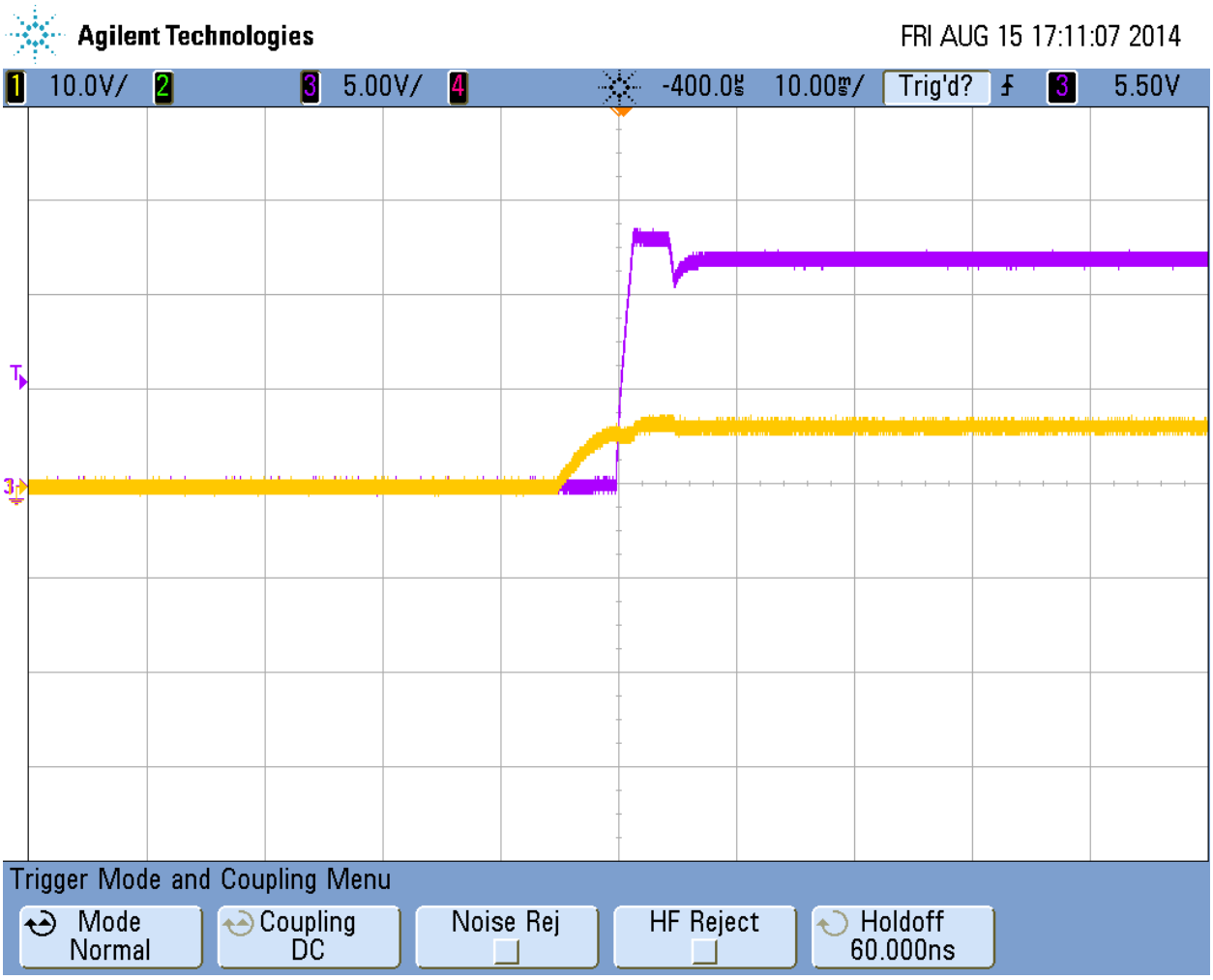
6.2 Startup



Startup into No Load at 6.5Vin

Ch1-Vin

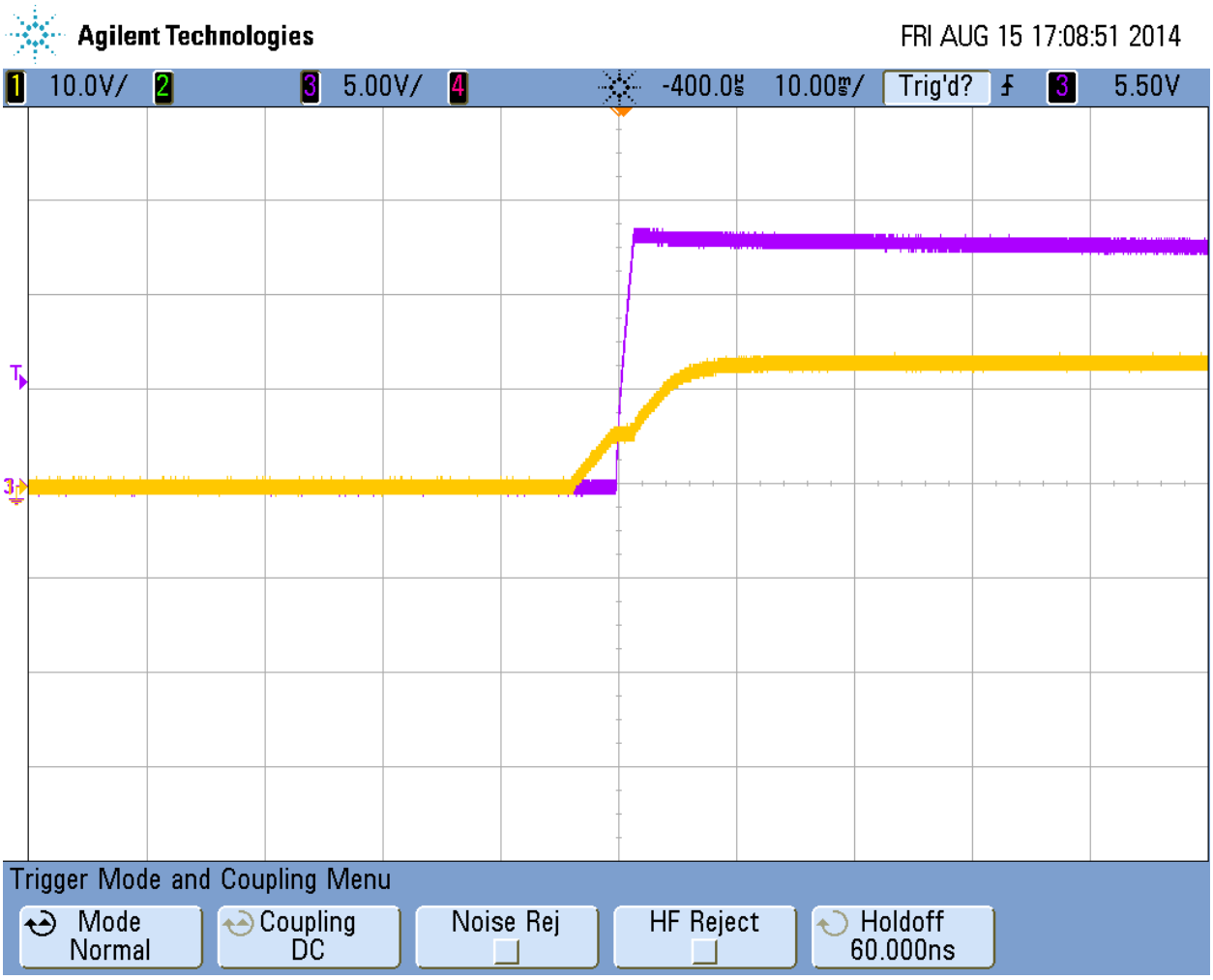
Ch3-Vout



Startup into Full (250mA) Load at 6.5Vin

Ch1-Vin

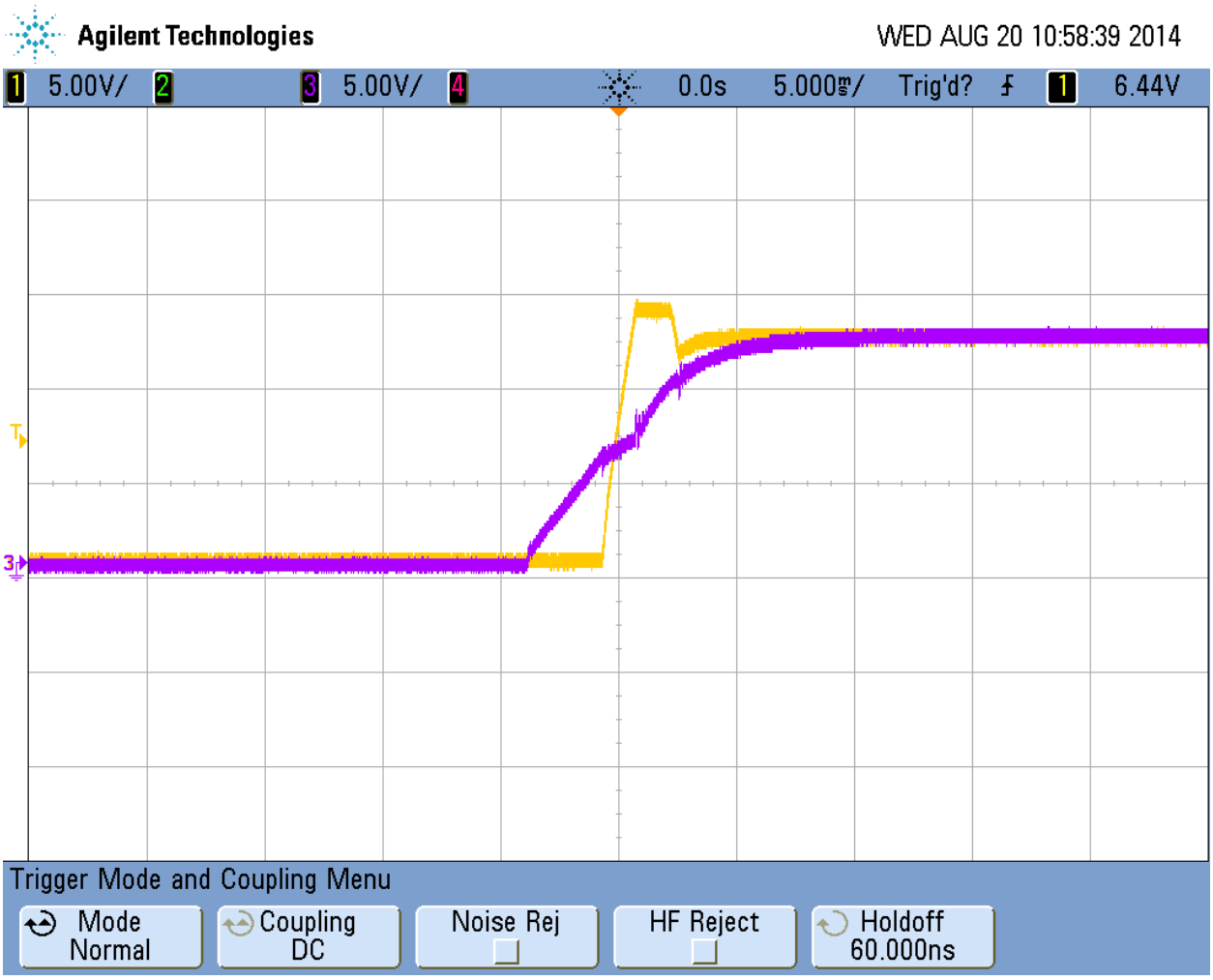
Ch3-Vout



Startup into No Load at 12Vin

Ch1-Vin

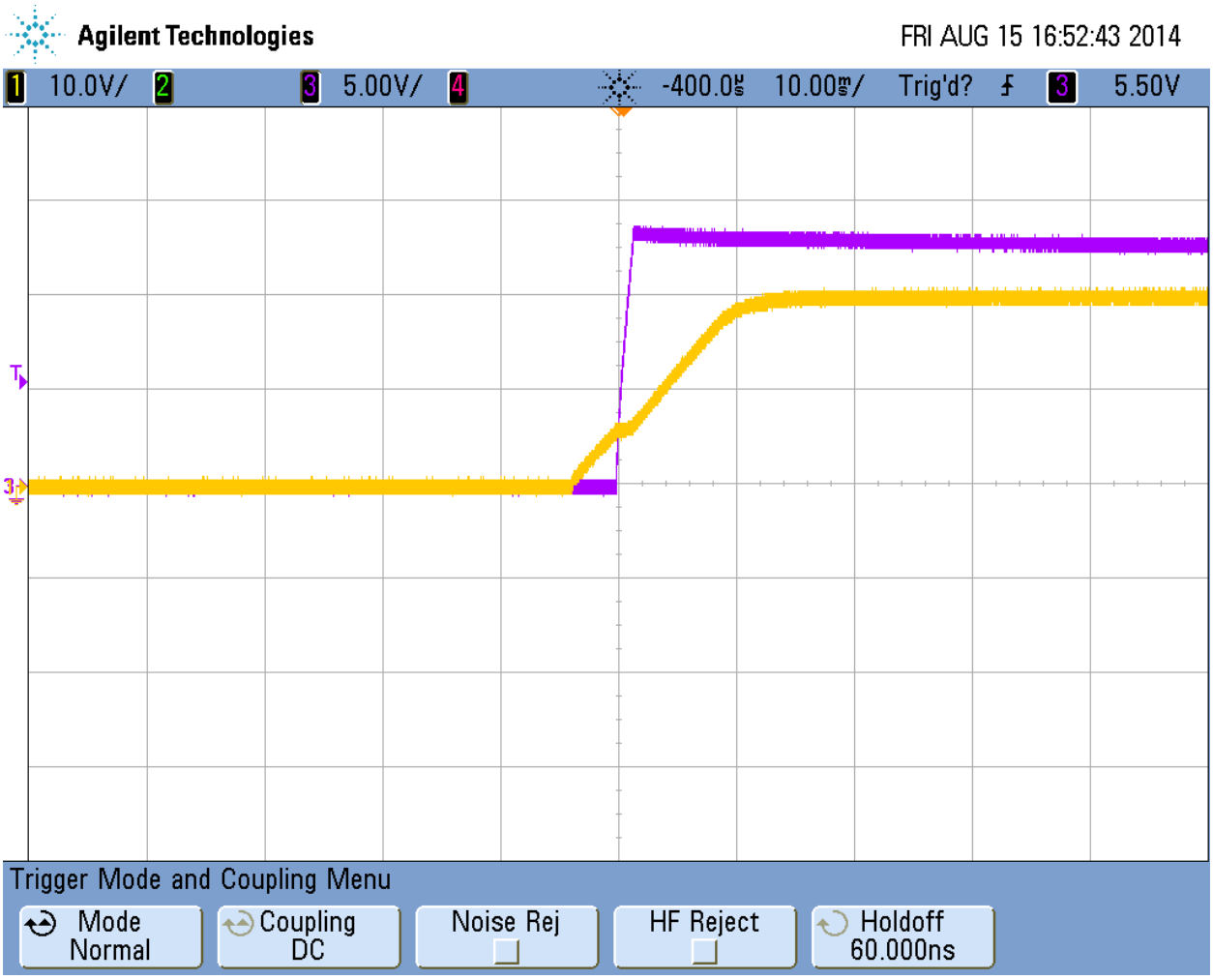
Ch3-Vout



Startup into Full (250mA) Load at 12Vin

Ch1-Vout

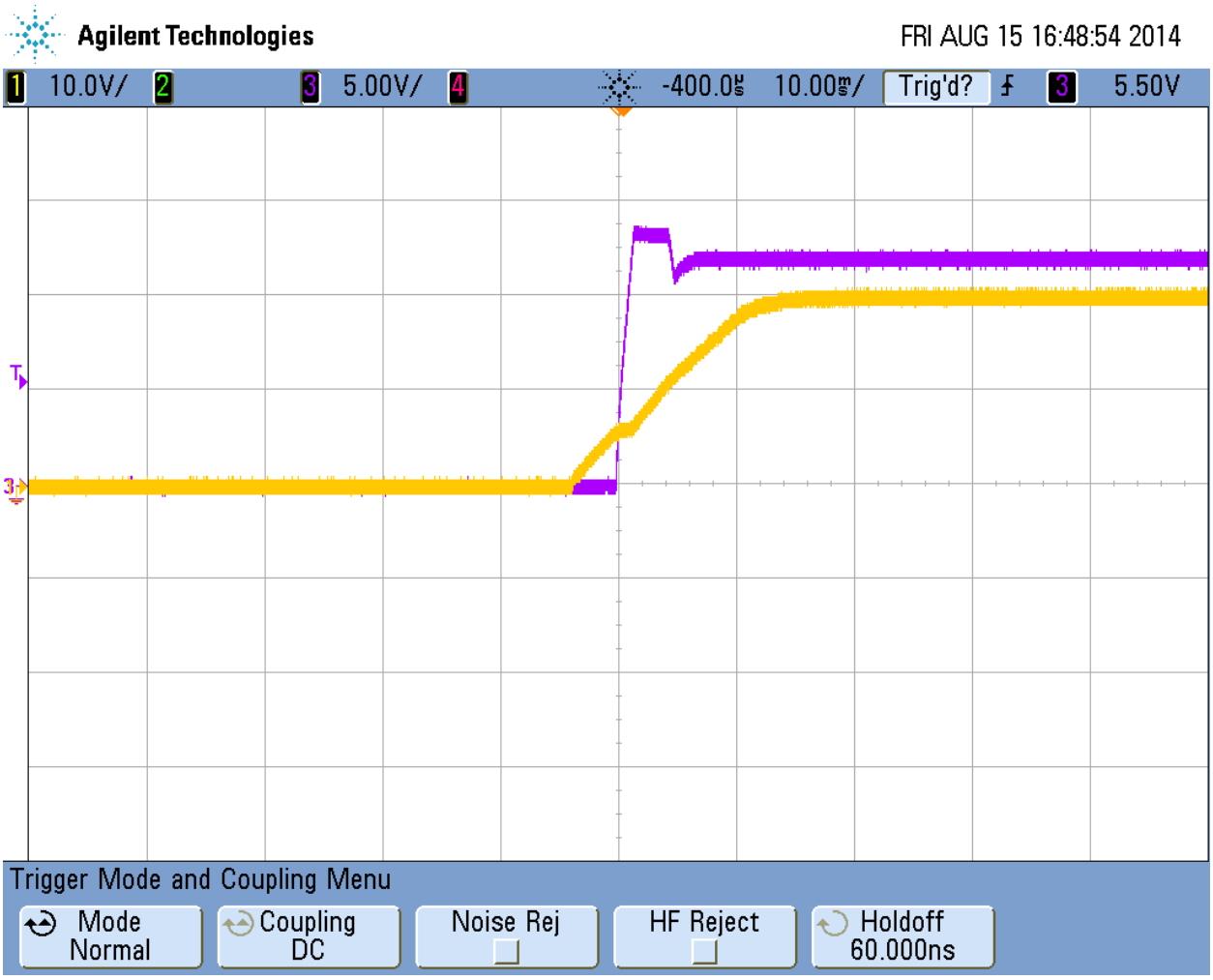
Ch3-Vin



Startup into No Load at 20 Vin

Ch1-Vin

Ch3-Vout

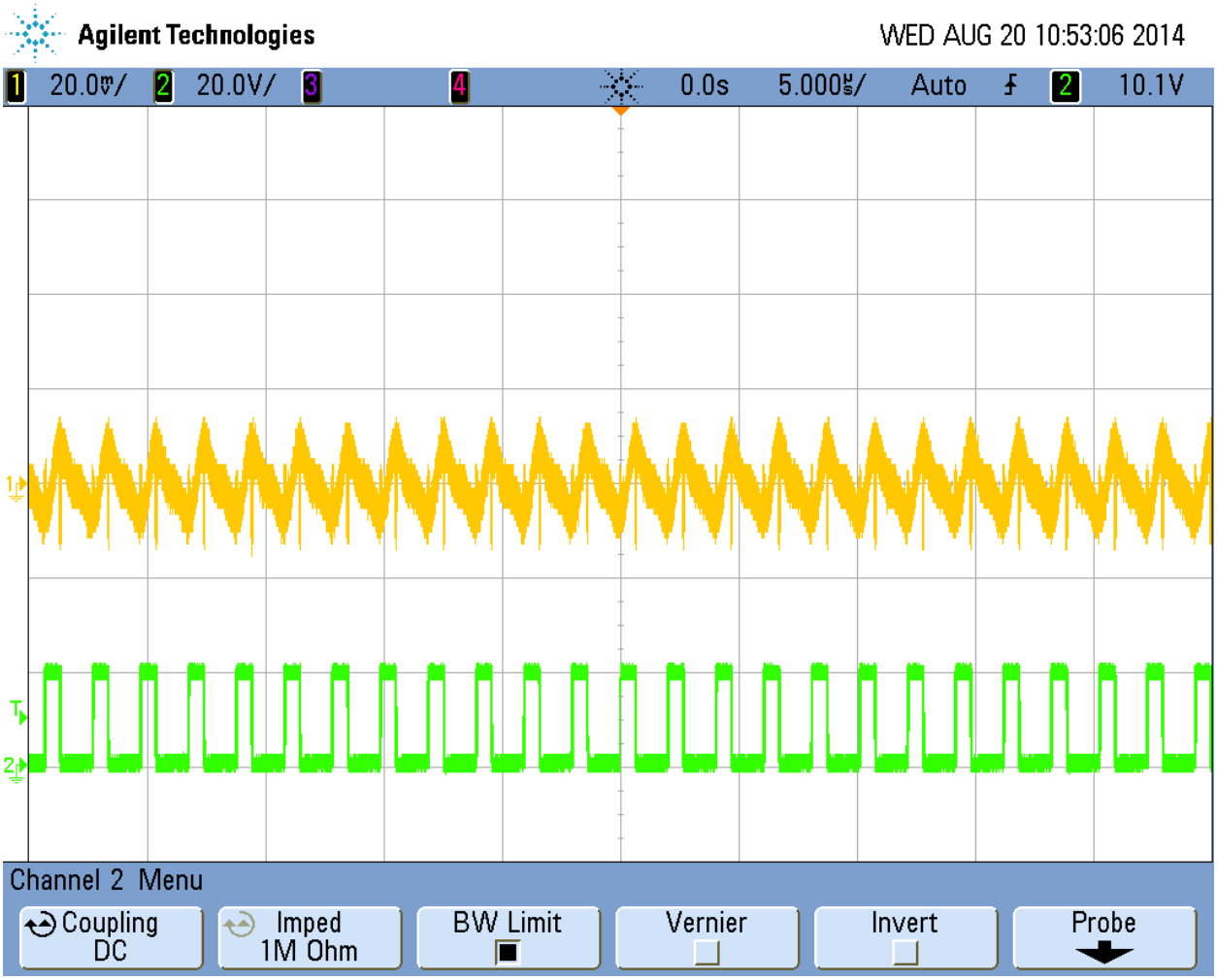


Startup into Full (250mA) Load at 20Vin

Ch1-Vin

Ch3-Vout

6.3 Output Voltage Ripple and Switch Node Voltage



Switch Node Voltage and Output Voltage Ripple at 6.5Vin and Full (250mA) Load (Vripple < 20mVp-p)

Ch1-Vout (AC Coupled)

Ch2-Switching Waveform

Switch Node Voltage and Output Voltage Ripple at 12Vin and Full (250mA) Load (Vripple < 20mVp-p)

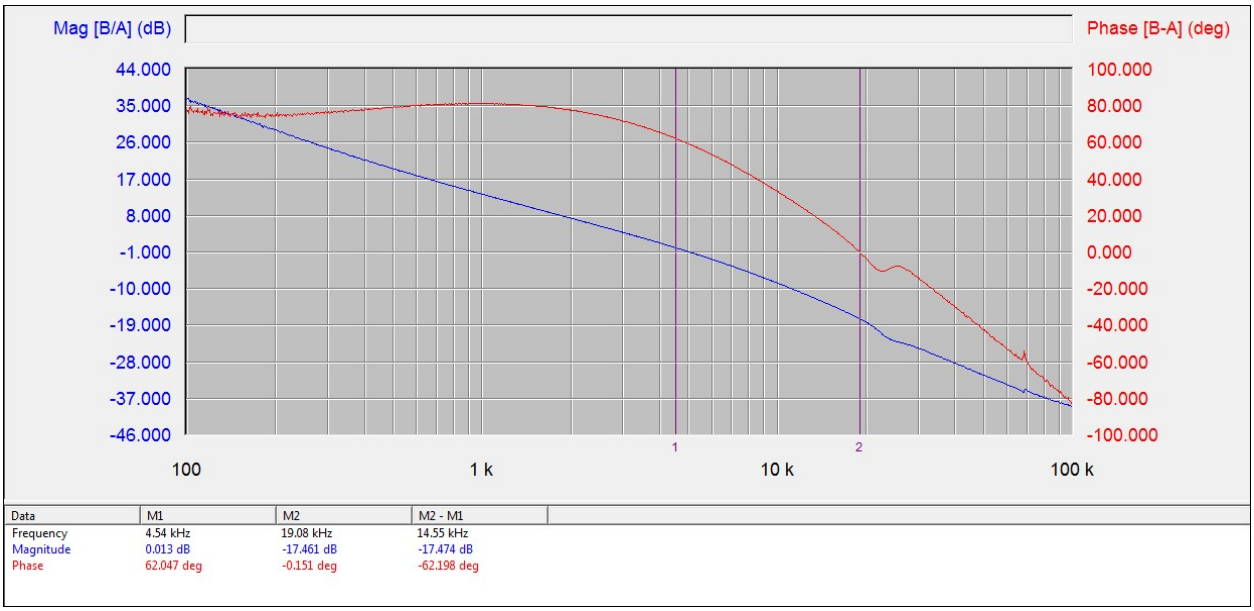
Ch1-Vout (AC Coupled)

Ch2-Switching Waveform

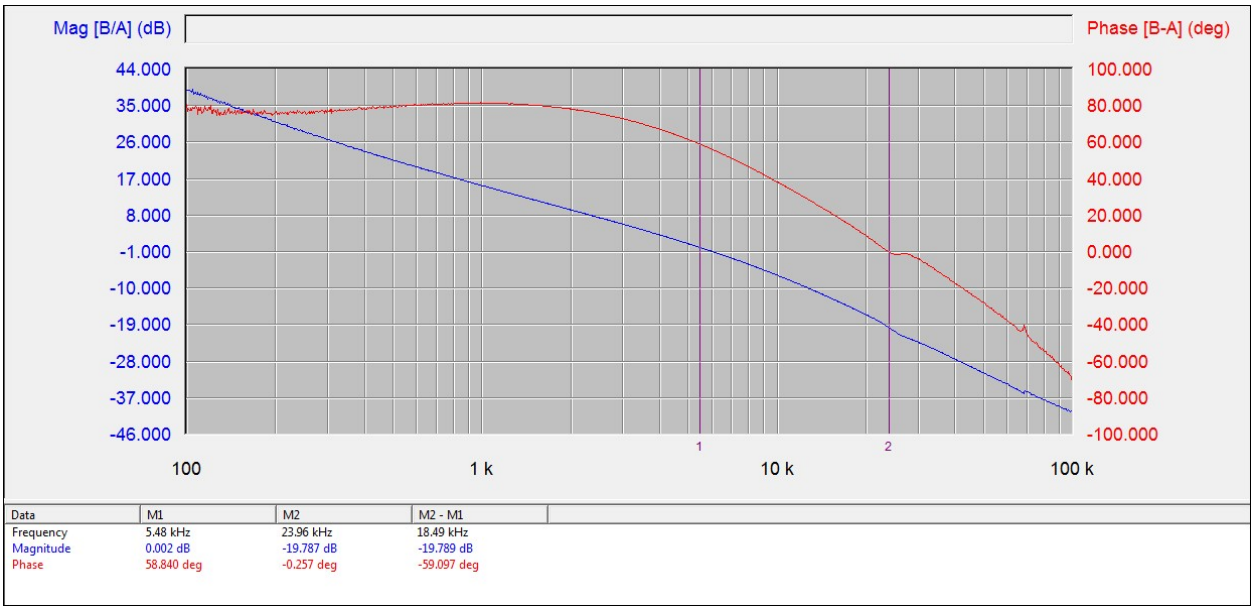
Switch Node Voltage and Output Voltage Ripple at 20Vin and Full (250mA) Load (Vripple < 20mVp-p)

7. Frequency Response

The output was loaded with 250mA .For gain/phase plot 1 , the input was 9V and for gain/phase plot 2 , the input was 12V



Gain/Phase plot 1 at Vin =9V ,Vout =12V@250mA

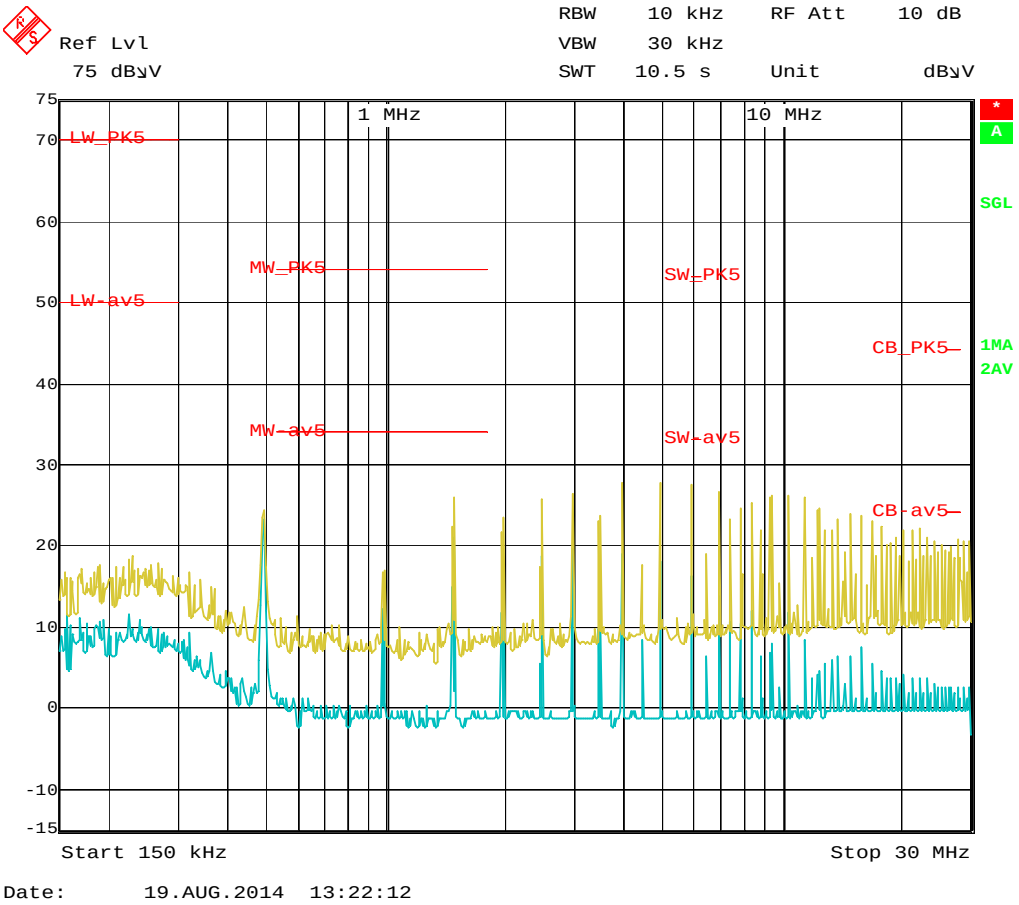


Gain/Phase plot 2 at Vin=12V, Vout =12V@250mA

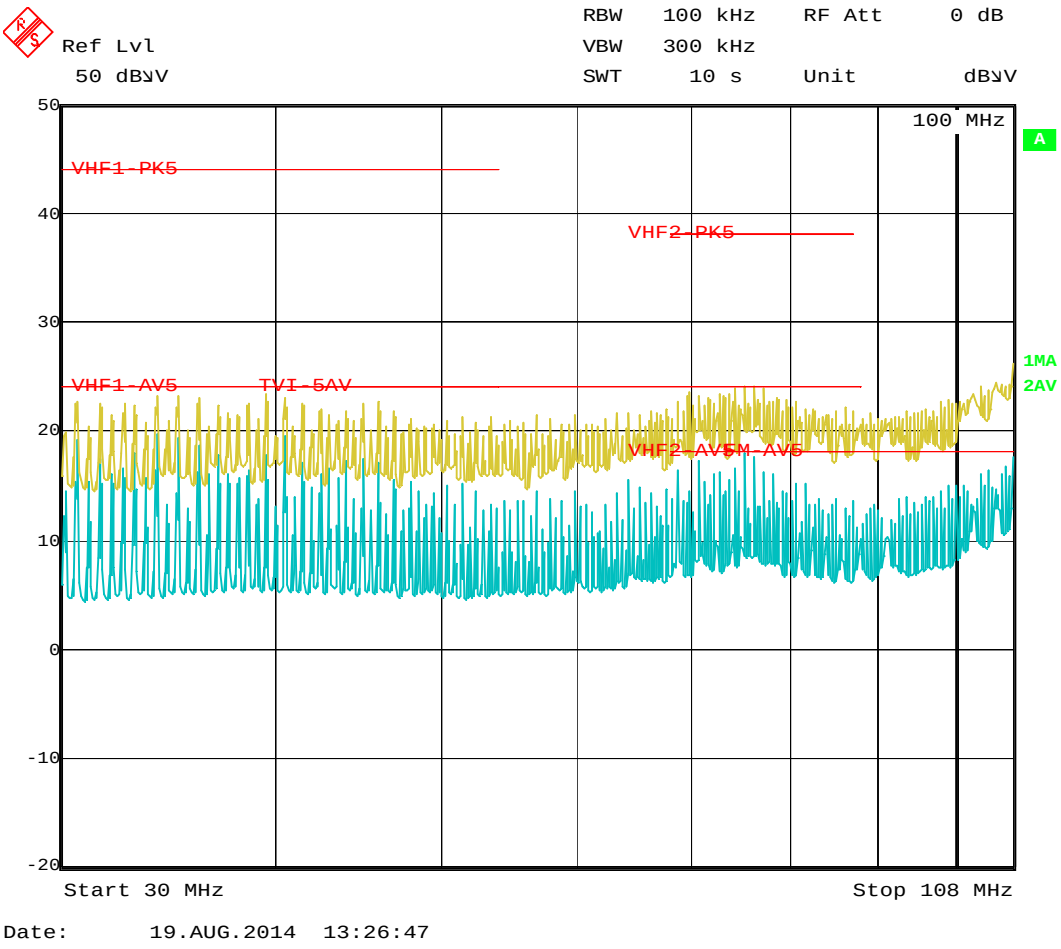
8. Conducted Emissions

The conducted emissions is tested followed the of CISPR 25 standards. The frequency band examined spans from 150 kHz to 108 MHz covering the AM, FM radio bands, VHF band, and TV band specified in the CISPR 25.

The test results are shown in below two Figures. The first Figure show the test result using peak detector as well as Average detector measurement upto 30MHz , and the second Figure show the test result using average detector as well as Peak Detector measurement from 30MHz to 108MHz. The limit lines shown in red are the Class 5 limits for conducted disturbances specified in the CISPR 25; the yellow(Peak Detector measurement) and blue(Average detector measurement) traces is the test result. It can be seen that the power supply operates quietly and the noise is below the stringent Class 5 limits too.



Test result – Upto 30MHz Conducted Emission



Test result –30MHz to 108MHz Conducted Emission

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