

General Description

The DDB115R1 Demo Board showcases the [AP68255Q](#), [AP68355Q](#), [AP6A255Q](#), [AP6A355Q](#) DC-DC buck converter family, the [AP74700AQ](#) ideal diode controller, and the usage of an EMI input filter.

It demonstrates a system-level solution with reverse voltage protection, ISO 7637-2 transient pulse protection (using suitable TVS), EMI filtering that passes CISPR 25 Class 5, as well as the DC-DC buck converter.

The input filter contains a common-mode choke with capacitors on either side of it in a Pi configuration. This is connected in series with an LC low pass filter containing an inductor and capacitor. This combination makes the board CISPR 25 class 5 compliant.

Key Features

- All components qualified for automotive applications
- CISPR 25 Class 5 Compliance
- V_{IN} 5.5V to 65V
- V_{OUT} Adjustable from 1.2V to 50V
- Overcurrent Protection (OCP)
- Fast reverse current block response time of $< 0.75\mu s$
- -65V Reverse Battery Voltage
- Green electronics
- Compliance with Automotive Transient Requirements with Appropriate TVS
 - ISO 7637-2
 - ISO 16750-2

Applications

- General-purpose point-of-load DC-DC power conversion
- Distributed power systems
- 48V automotive applications

Evaluation Board

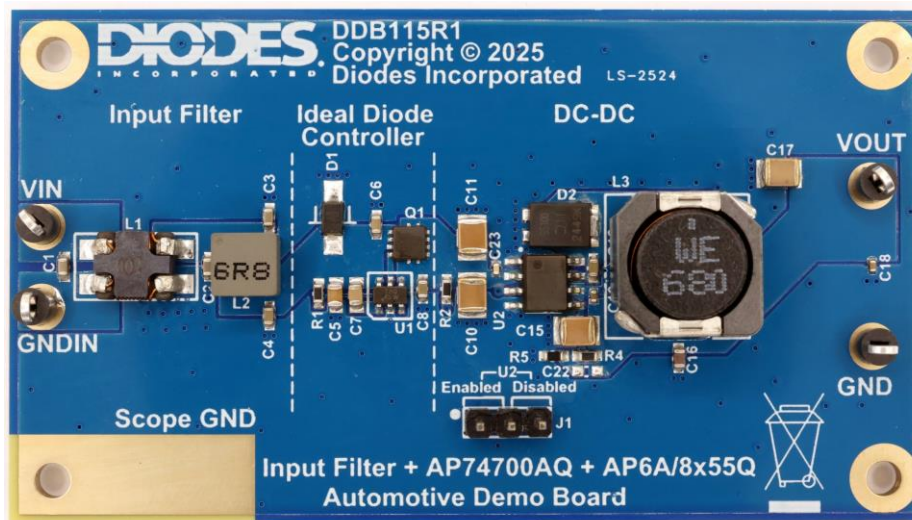


Figure 1: EVM Top View

Board Layout

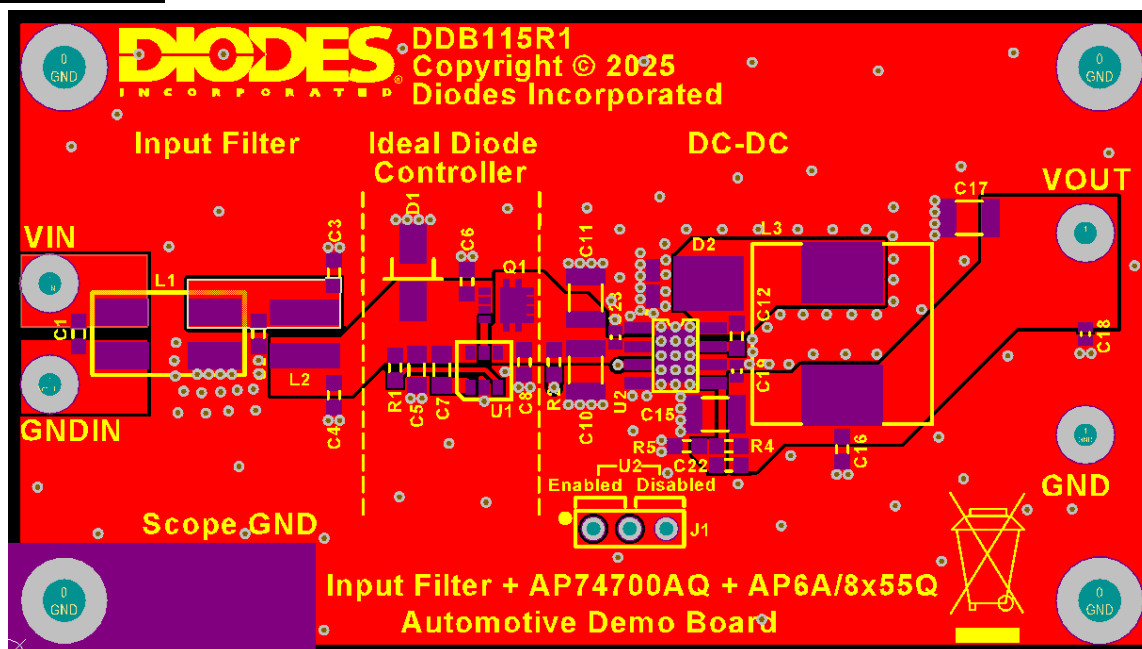


Figure 2: PCB Top Layer (Top View)

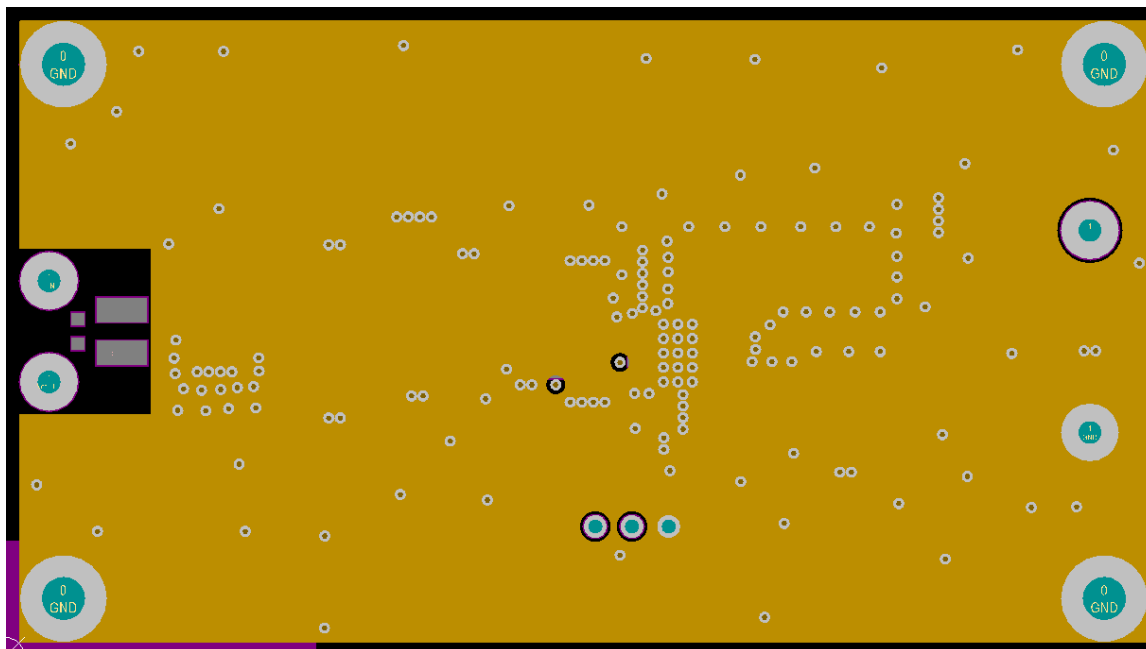


Figure 3: PCB Mid Layer 1 (Top View)

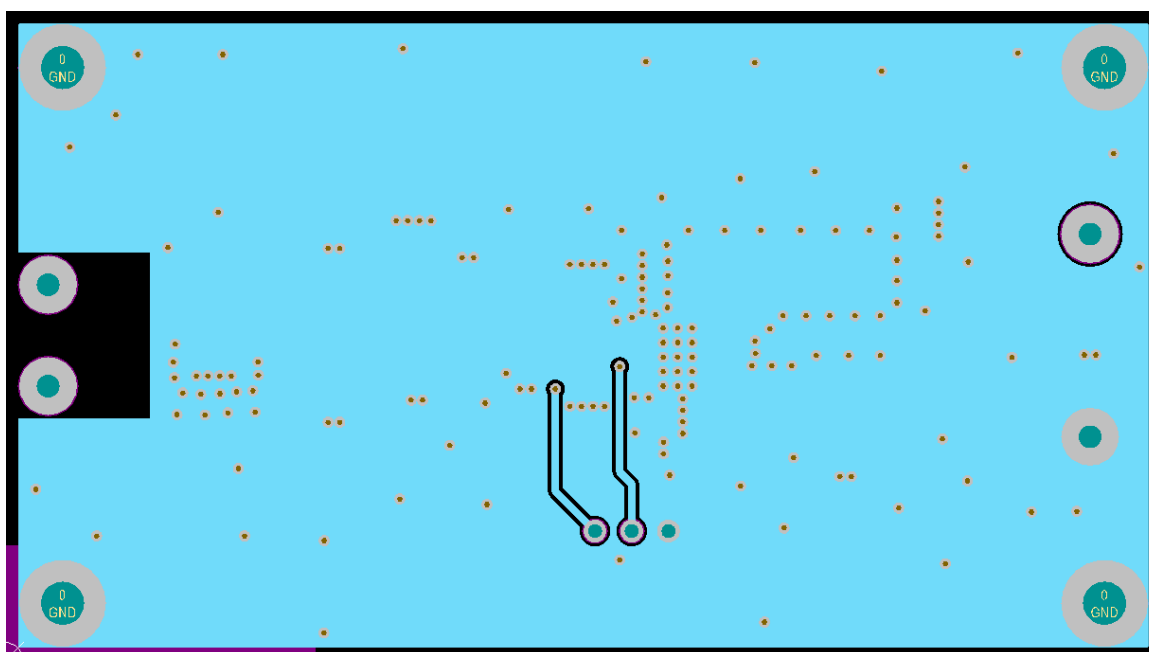


Figure 4: PCB Mid Layer 2 (Top View)

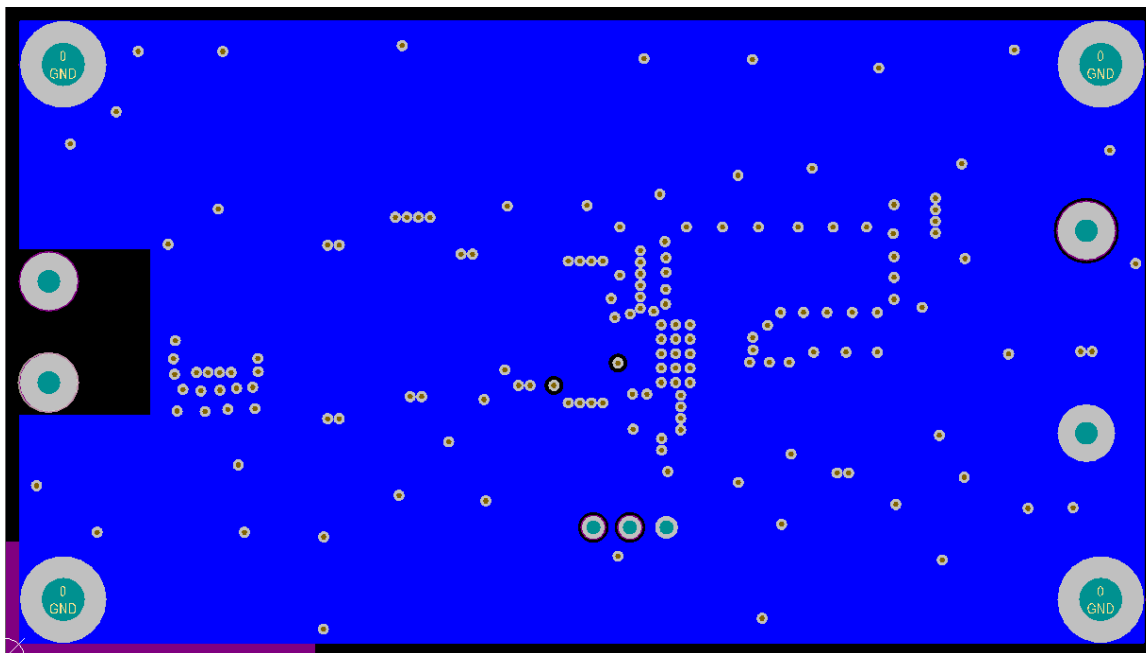


Figure 5: PCB Bottom Layer (Top View)

Quick Start Guide

To evaluate the performance of the DDB115R1 demo board, follow the procedure below.

1. Connect a power supply to the input terminals V_{IN} and GNDIN. Set V_{IN} to 48V
2. Connect the positive terminal of the electronic load to V_{OUT} and negative terminals to GND.
3. To Enable the board, J1 needs to be enabled. Place the header in the highlighted **enabled** position.
4. The demo board should power up with a 5V output voltage.
5. Check for correct output voltage of 5V ($\pm 1\%$) at the output terminals V_{OUT} and 0V using a multimeter or similar.
6. Set the electronic load to 0.5A and increase to 2.5/3.5A. Check for stable output voltage and SW signal using an oscilloscope.

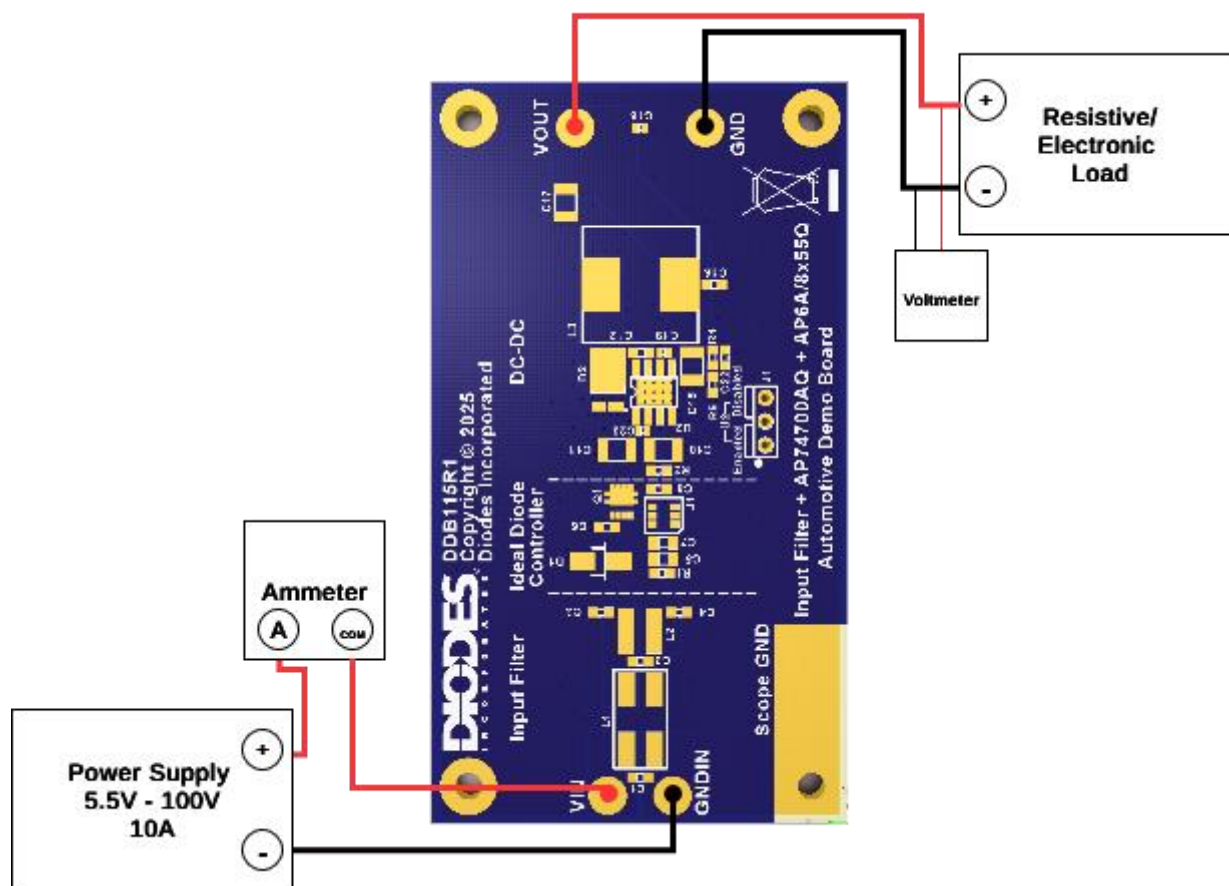


Figure 6: Test Setup

Measurement/Performance Guidelines

- When measuring the output voltage ripple, maintain the shortest possible ground lengths on the oscilloscope probe. Long ground leads can erroneously inject high frequency noise into the measured ripple.
- For efficiency measurements, connect an ammeter in series with the input supply to measure the input current. Connect an electronic load to the output for output current.

Evaluation Board Schematic

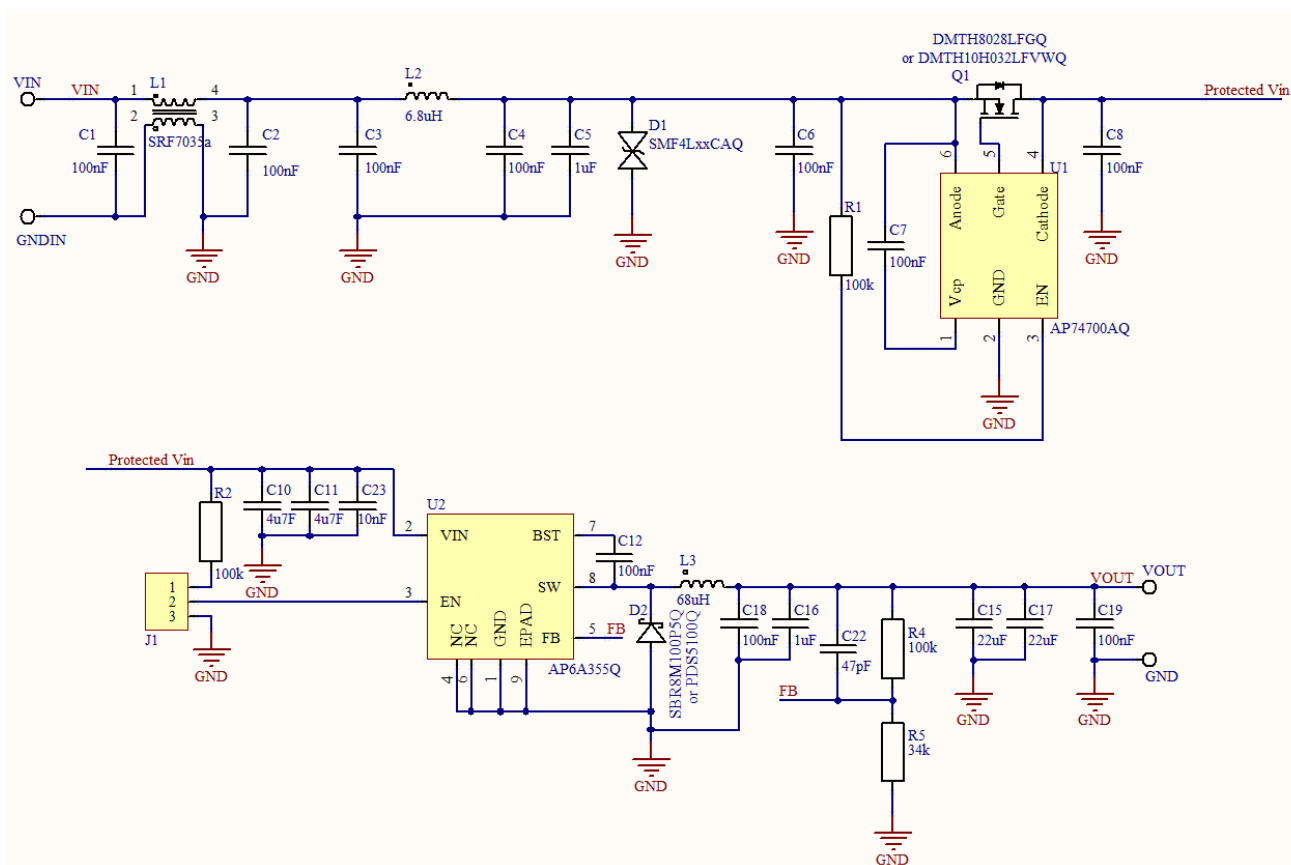


Figure 7: Schematic Circuit

DDB115R1 EVB User Guide

Input Filter + AP74700AQ + AP68xxxQ/AP6AxxxQ System Solution

Bill of Materials

Qty.	Ref.	Value	Description	Package	Manufacturer	Manufacturer P/N
1	U2	-	AP68255Q/AP68355Q/AP6A255Q/ AP6A355Q	SO8-EP	Diodes Incorporated	Provided by Customer
1	U1	-	AP74700AQ	SOT26	Diodes Incorporated	Provided by Customer
1	Q1	-	DMTH8028LFGQ/DMTH10H032LF VWQ N-Channel MOSFET	PowerDI333-8	Diodes Incorporated	Provided by Customer
1	D1	-	SMF4LxxxAQ TVS	DO219-AA	Diodes Incorporated	Provided by Customer
1	D2	-	SBR8M100P5Q / PDS5100Q Rectifier	PowerDI5	Diodes Incorporated	Provided by Customer
1	C7	100nF	Ceramic Capacitor 100V X7R 10%	0805	Murata	GCM21BR72A104KA37L
2	C18, C19	100nF	Ceramic Capacitor 50V X7R 10%	0402	Murata	GCM155R71H104KE02D
1	C16	1μF	Ceramic Capacitor 50V X7R 10%	0603	Yageo	CC0603KRX7R9BB105
1	C23	10nF	Ceramic Capacitor 100V X7R 10%	0402	Yageo	CC0402KRX7R0BB103
1	C22	47pF	Ceramic Capacitor 100V C0G/NP0 5%	0603	Vishay	VJ0603A470JXBAC
2	C10, C11	4.7μF	Ceramic Capacitor 100V X7S 10%	1210	Murata	GCM32DC72A475KE02L
2	C15, C17	22μF	Ceramic Capacitor 25V X7R 10%	1210	Murata	GCM32EC71E226KE36L
1	C5	1μF	Ceramic Capacitor 100V X7S 10%	0805	Murata	GRJ21BC72A105KE11L
7	C1, C2, C3, C4, C6, C8, C12	100nF	Ceramic Capacitor 100V X7R 10%	0603	Murata	GRM188R72A104KA35D
1	L1	-	Common-mode Choke	7mm x 6mm x 3.5mm	Bourns	SRF7035A-102Y
1	L2	6.8μH	Shielded Inductor	5050	Coilcraft	XGL5050-682MEC
1	L3	68μH	Shielded Inductor	12mm x 12mm	Coilcraft	MSS1278-683MLD
2	R1, R2, R4	100kΩ	Film Resistor	0603	Panasonic	ERJ3EKF1003V
1	R5	11kΩ	Film Resistor	0603	Panasonic	ERJPA3F3402V
2	VIN, VOUT	-	1.6mm Red Test Eyelets	1.6mm	Keystone	5005
2	GNDIN, GND	-	1.6mm Black Test Eyelets	1.6mm	Keystone	5006

CISPR 25 Compliance

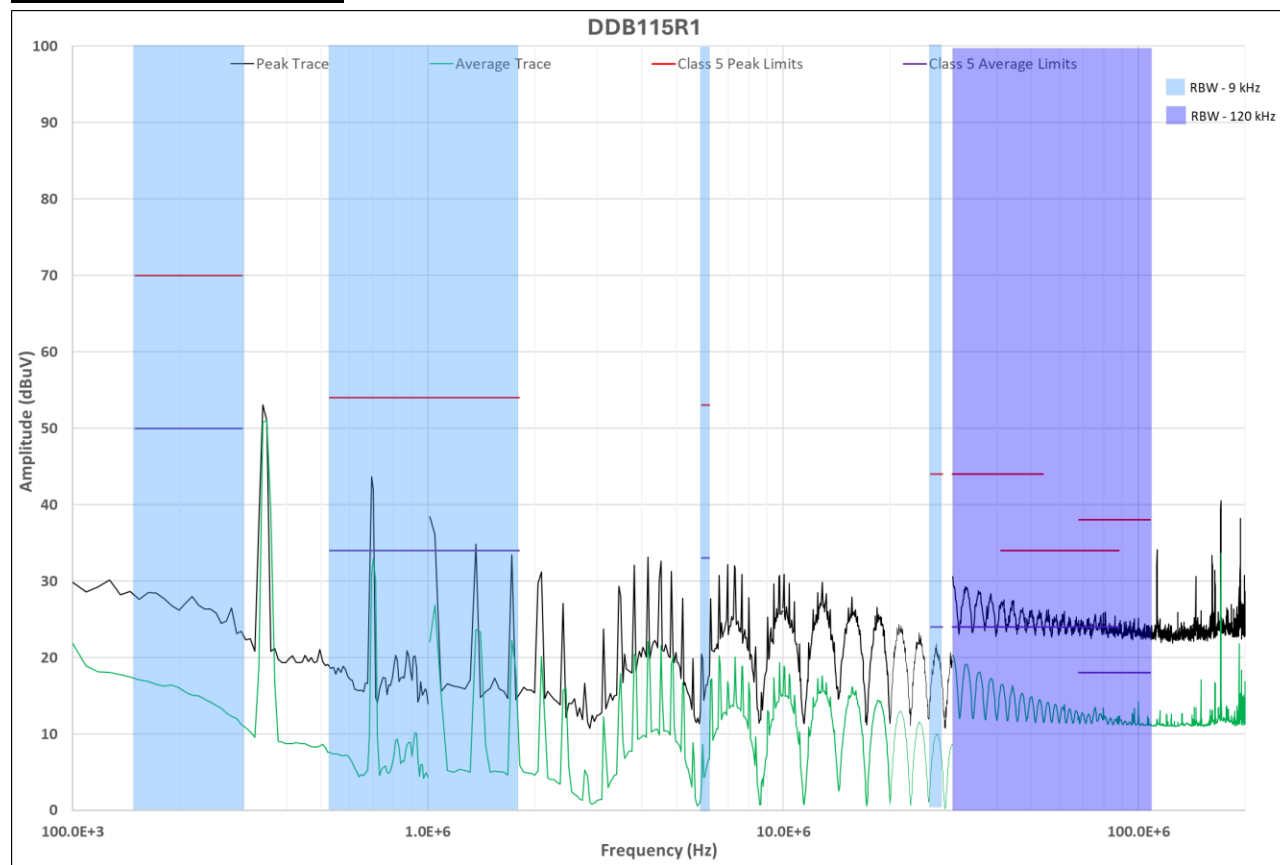


Figure 8: Conducted CISPR 25 EMI Plot, Class 5 Limits, 48 V_{IN}, 5 V_{OUT} @ 2.5A, additional 68μF filter capacitor added

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