POE EMI Considerations

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This application note looks at Electromagnetic Interference (EMI) in Power over Ethernet (PoE) applications with regards to the Powered Device (PD). It will offer some suggestions on improvements that can be made and common mistakes made during testing.

For this application note the Ag9700-S will be used as an example of one of our typical PD products.

In PoE applications the main output voltage supplied by the Power Sourcing Equipment (PSE) is typically 48V (42V to 57V). For most applications this is not a very useful voltage and has to be stepped down by the PD to a more useable voltage, such as 3.3V, 5V or 12V.

The most common method used to step down this voltage is with a DC/DC buck converter. These are capable of handle the high input voltages and offers good efficiency. However, one of the down sides of using a DC/DC converter is the switching frequency. The DC/DC converter has to be designed to limit the amount of noise that is output to the load and that is sent back down the Cat5e cable.

Linear regulators do not generate as much noise as a DC/DC converter. They are not often used because of the high input voltage requirement and they are generally much less efficient and need a lot of heatsinking.

The Ag9700-S only requires a few external components and tested on a simple interface board (shown in Figure 4) passes the EMI requirements of the following test standards:

EN55022:2006

CFR 47 Part 15(FCC Rules) of July 10th 2008

EN55024:1998: + A1:2000 + A2:2003

But the Ag9700-S will be just one component within your overall system. Therefore, it is impossible for us to say if or what external filtering is required, to get your overall system compliant with these standards.

Figures 1 & 2 show the basic test setups use to check for EMI. The load used is a wire-wound resistor (set to draw the maximum load) and is connected to the board via two 30cm test lead feed through a single turn ferrite choke. The PSE is simulated by a 48V power supply (outside the test chamber) and is connected to the board via a Cat5e cable approximately 30 metres long. This cable runs approximately 1 metre from the test platform to a filter, then out of the test chamber and to the PSE.

During emission (pre-compliance) testing (Figure 1), the test platform can be rotated 360˚ and the antenna polarity change horizontal and vertical.

Full compliance testing is performed at 10 metres, usually in a open air site.

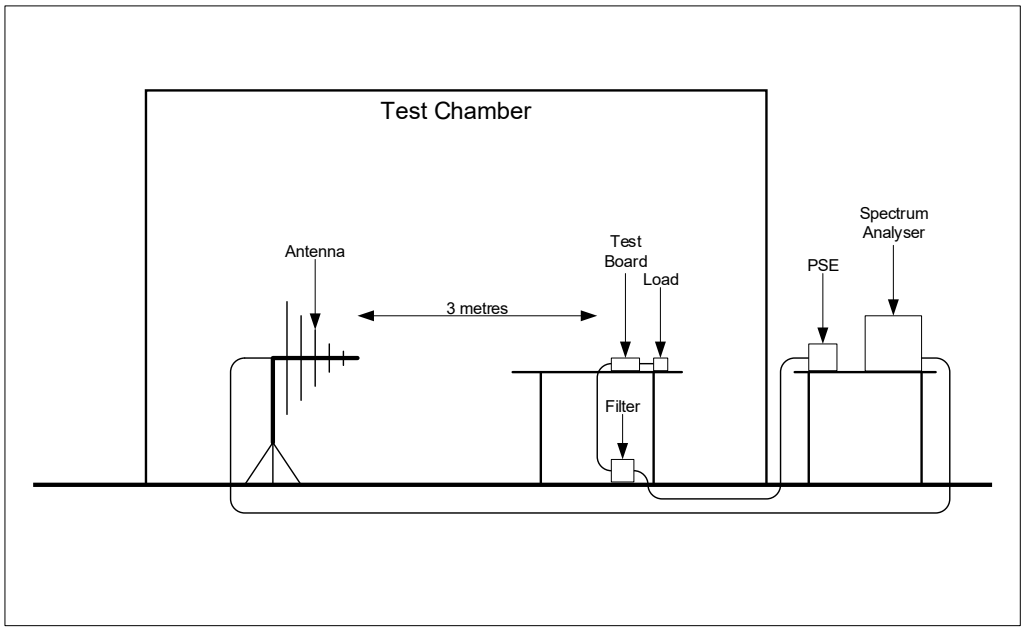


Figure 1: Test Setup – Emissions

For the conducted emission test (see Figure 2), it is very important that the correct data type of Impedance Stabilization Network (ISN) for coupling/decoupling networks is used to measure common mode disturbances.

There are two common mistakes: -

1. Using a Mains ISN - this will give you get completely wrong results.
2. Measuring differential disturbances - you cannot differentiate between the disturbance and any data.

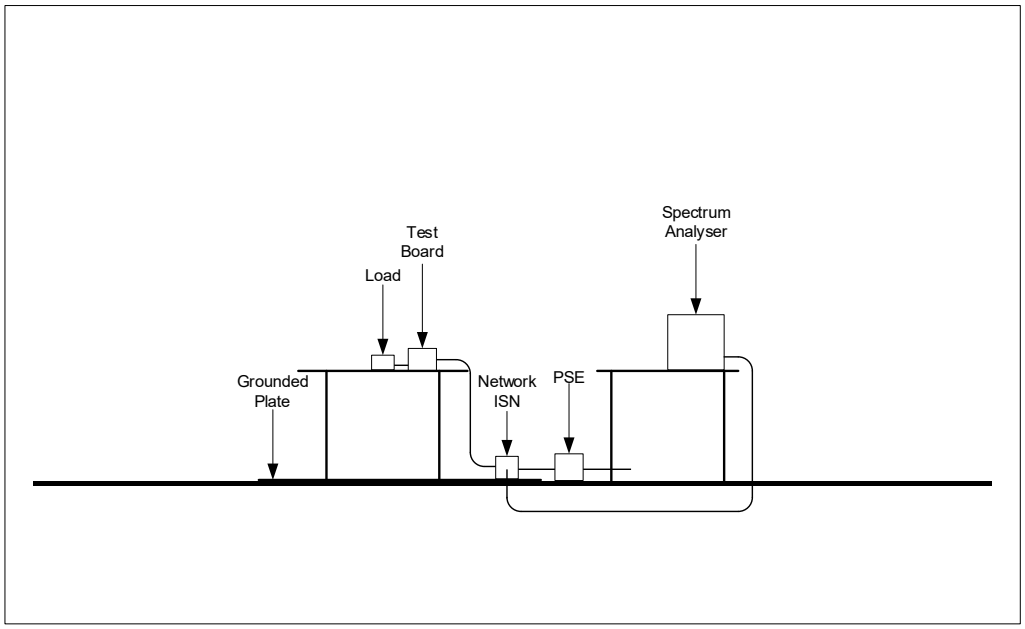


Figure 2: Test Setup – Conducted

For many applications, the basic configuration shown in Figure 3 where your circuit would be the load, will be all that is needed to pass.

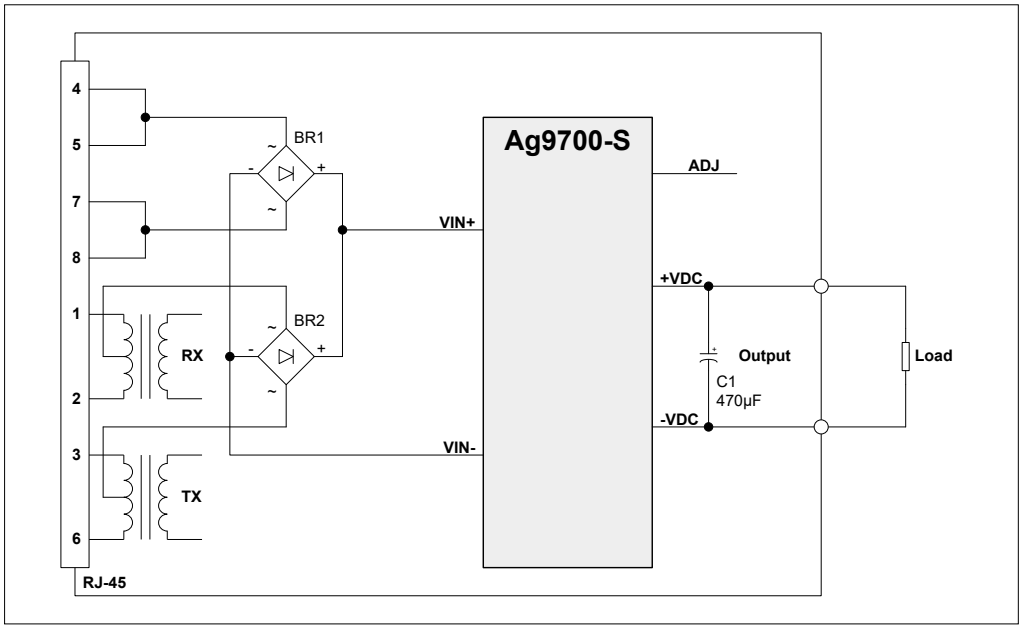


Figure 3: Basic Test Board Circuit

However, it may be necessary to add additional filtering to meet the EMI requirements.

One inexpensive solution, that may be useful for marginal failures, is to add chip beads in series with each input line (VIN+ and VIN−). Figure 4 shows an example circuit using TDK MPZ2012S102AT000 chip beads. These have a nominal impedance of 1000Ω at 100MHz, a DC resistance of 150mΩ, and a rated (maximum) current of 1.5A.

If noise continues to be an issue, even with the ferrite chip beads in series with each centre tap. The addition of a “V” capacitor filter will reduce the noise further with capacitor values of C2 to C5 ranging from 1nF to 10nF dependent on the level of noise needed to suppress. Because these capacitors cross the isolation barrier, they will need to be capable of handling the 1500Vdc impulse test.

Figure 5 shows an example using both these methods which is practical to all our PoE modules.

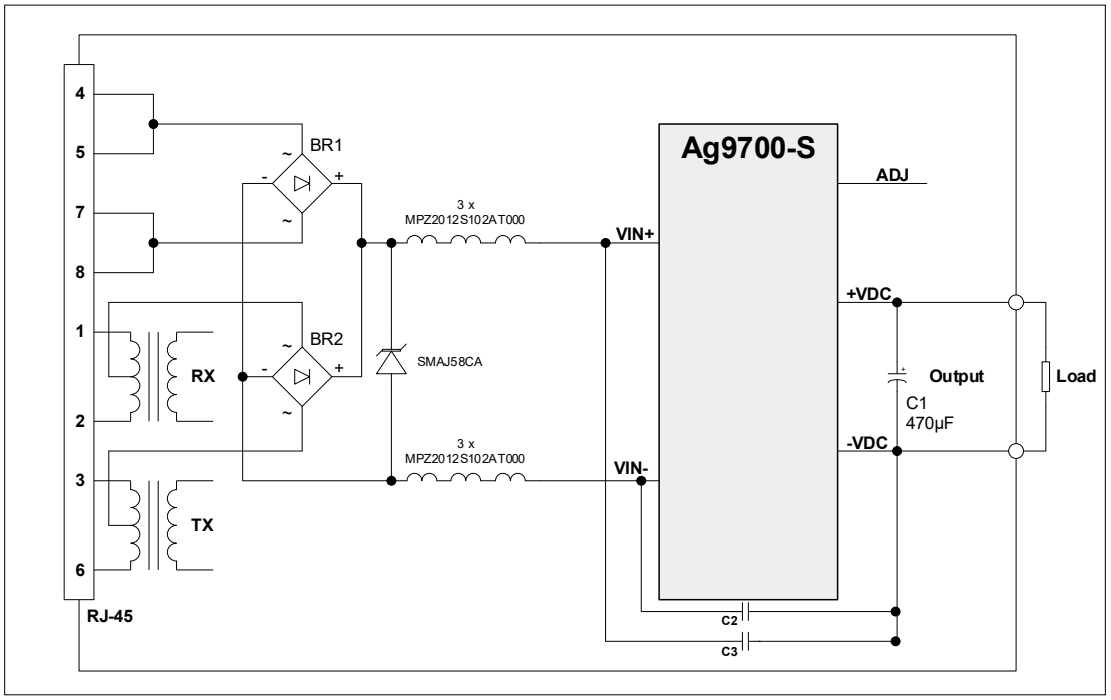


Figure 4: Chip Bead and 'V' Capacitor Filter for -S

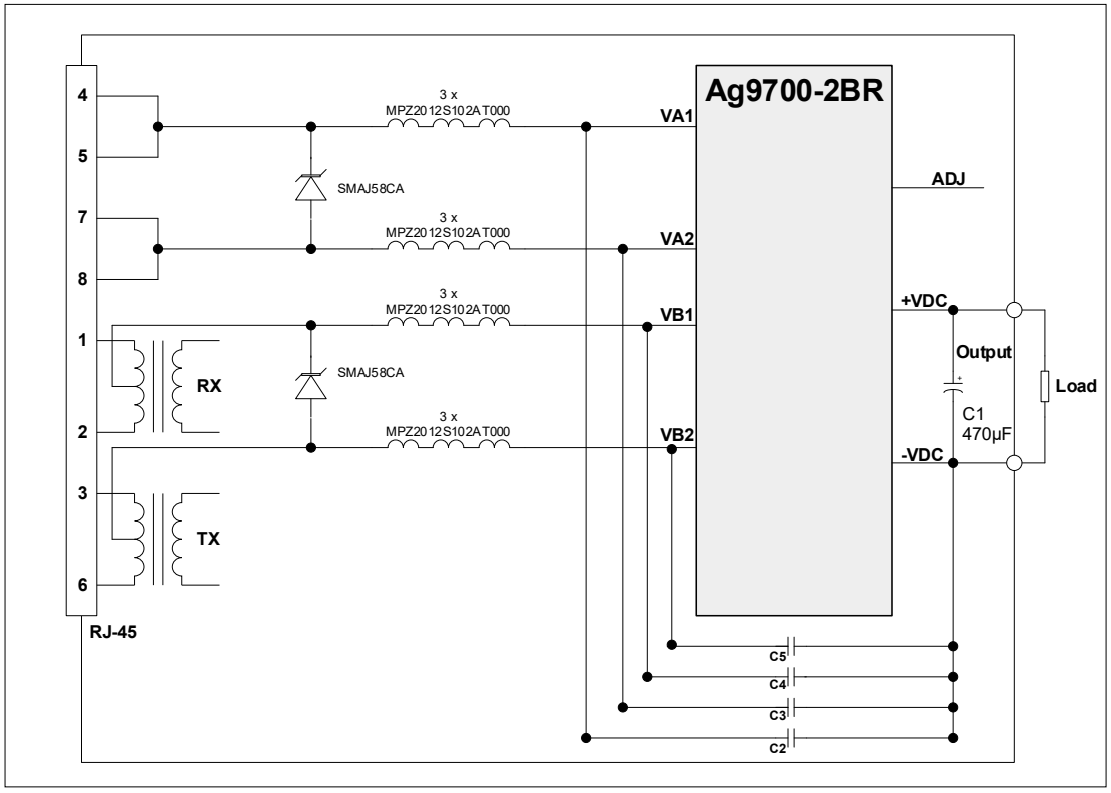


Figure 5: Chip Bead and 'V' Capacitor Filter for -2BR or -FL