SDX-1153 Interference Report

07/22/2014

The SDX-1153 TIA instrument was returned due to an interference signal present on the output. This interference was verified at Gentec-EO USA. The interference signal is shown in figure 1.

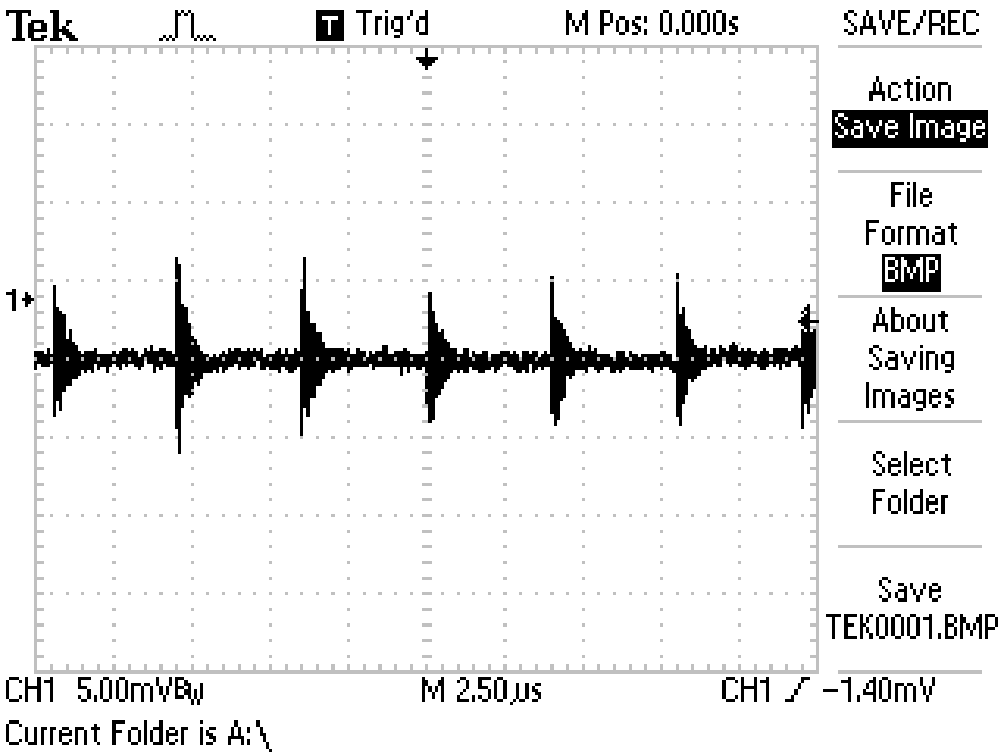

Figure 1, Interference Signal

This is clearly an interference signal and not broadband noise; therefore it must have a source, a receiver, and a coupling mechanism. The amplitude of the interference signal was found to be independent of the TIA gain, so the interference is not a current induced at the TIA input, but the TIA is the receiver. Probing with an oscilloscope quickly found the source is the USB DC Voltage isolation circuit. Figure 2 shows the switch node of the isolator along with the interference. The two signals are synchronized.

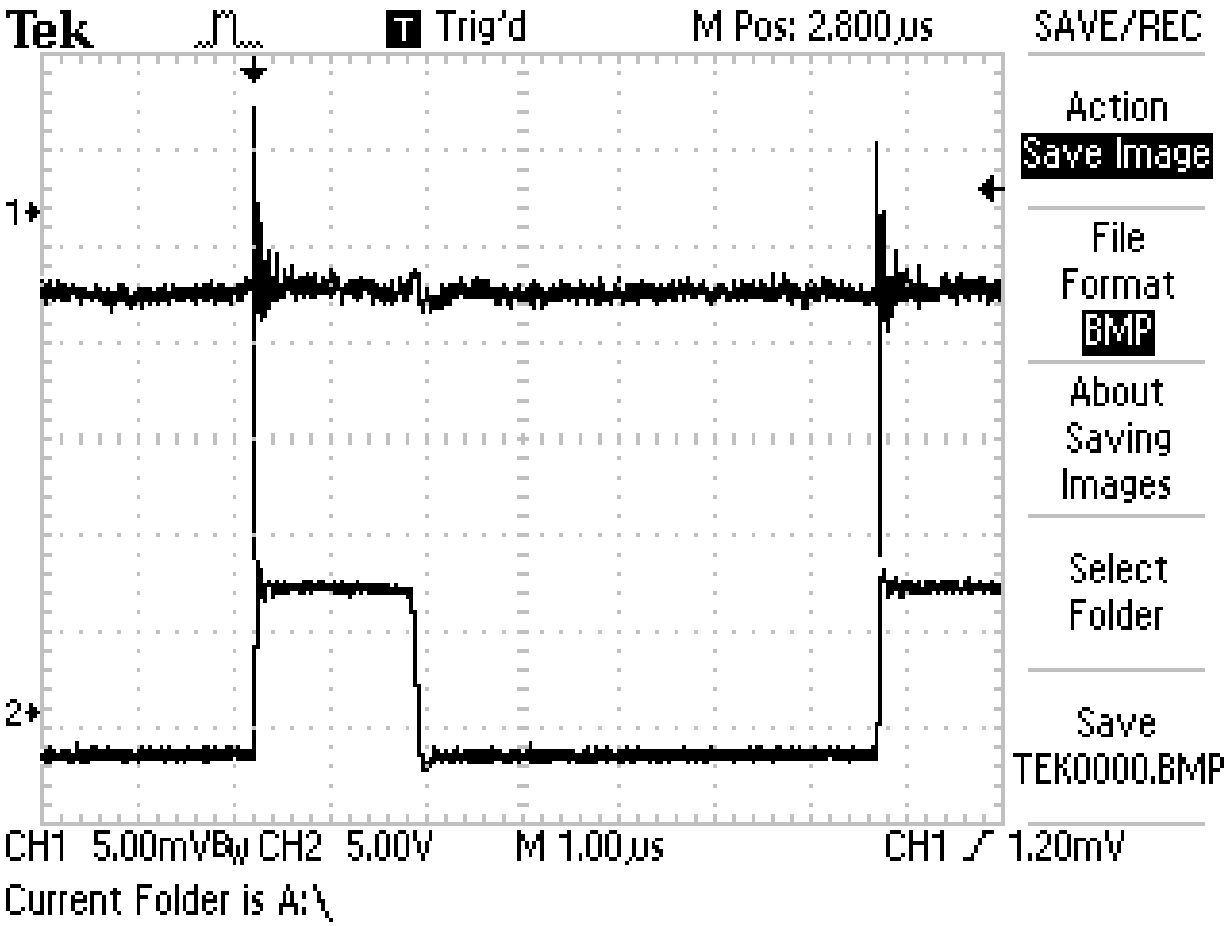

Figure 2, USB DC isolation switch and signal interference

The next step was to disable the USB isolation circuit and power the SDX-1153 with an external DC supply. Figure 3 shows the result.

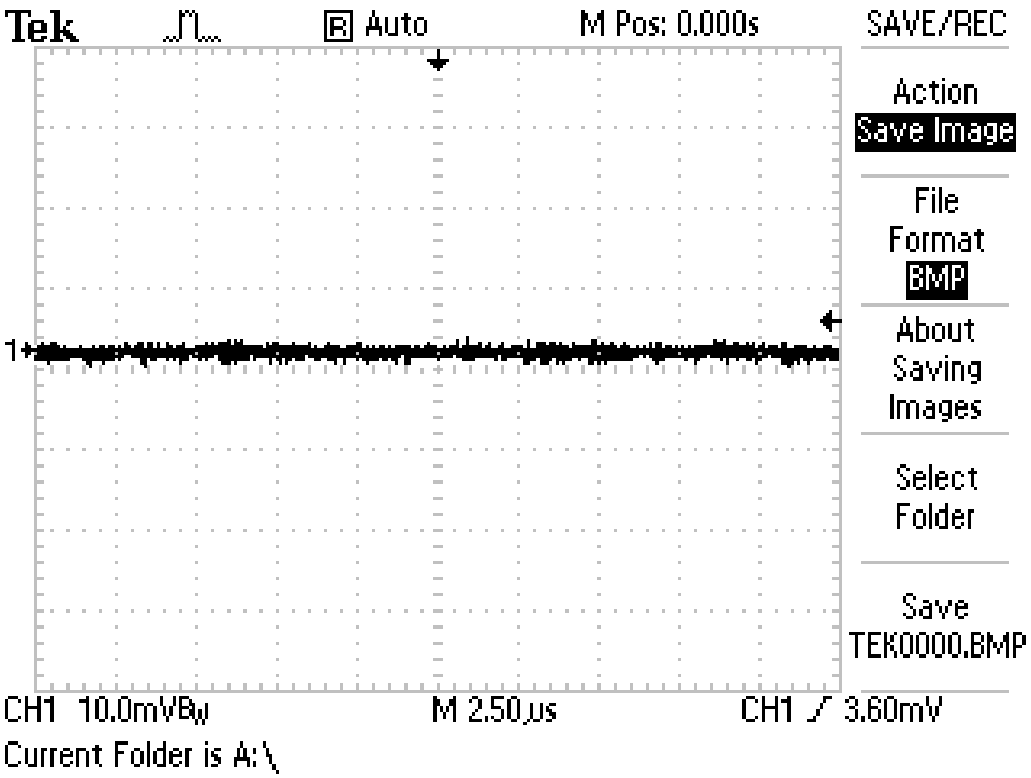

Figure 3, SDX-1153 on external 5V DC supply

The isolation circuit is clearly the source. Modifications to the circuit were tried to remove the transmission path and isolate the TIA, including the addition of filters, ferrites, magnetic and electrical shielding, and different values of compensation networks. While some improvements were obtained, the interference could not be eliminated.

Next the DC isolation circuit was disabled and the SDX-1153 power supply circuit was connected to the +5V USB supply with no DC isolation to eliminate the source of the interference. The result is shown in figure 4 Figure 4 is shown on a 2mV per div scale. The signal interference due to the isolation circuit has been eliminated.

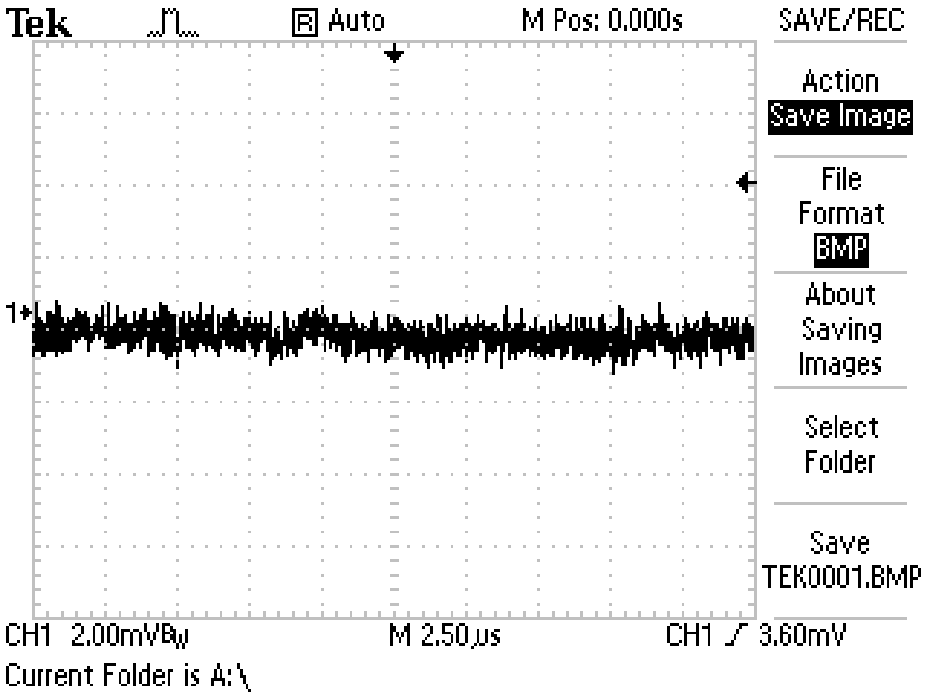

Figure 4, SDX-1153 on USB supply, no isolation circuit

A second scope (Tektronix TDS460) with an external a low noise amplifier (Tektronix ADA400A) was connected and it was seen that there still remains a 400µVpp interference at a 1MHz frequency. The second scope does not have screen capture capabilities, so the scope shot is not in this report. The interference signal was traced to the inverting switcher used to make the negative voltage supplies. This interference was present when running on the external supply as well as the USB power. Both the inventor and the USB isolation circuit use inductors or transformers. It may be possible to remove or reduce this second interference by designing an inverting switcher based on capacitor charge pump architecture, or using magnetically shielded inductors. This will require extensive PCB modifications and carries a risk of damage to the PCB as the IC solder pads are susceptible to lifting and heat damage with rework.

Conclusion

The interference at the output of the SDX-1153 has been reduced from 15mVpp to 400µVpp with the modifications described. This represents a reduction from 0.15% of full scale to 0.004%. Further improvements may be possible, but will require more extensive modifications that carry a risk of damage to the PCB.