DC Circuit Model of the HL940X Series Ultra-Broadband Baluns

Jason Yoho, Ph.D., Agoston Agoston, Ph.D.

OVERVIEW

The HL940X series are a set of signal splitters and combiners that offers industry-leading amplitude and phase match. HYPERLABS fields a series of questions regarding the need of DC blocks when using our baluns, so this discussion will serve as customer guidance depending on each user's application.

BALUN CONSTRUCTION

The HYPERLABS HL940X balun line is based on the Marchand balun design first reported in the December 1944 issue of *Electronics* [1]. Nathan Marchand provided a novel means of converting from a coaxial structure to a dual conductor transmission line.

A typical balun construction when used as a differential driver is shown in *Figure 1*, where we have a single coaxial drive connected to a second coaxial cable with a split outer shield. The coaxial drive center pin attaches to the inverting side shield of the balun while the shields are common on the non-inverting side. The center pin of the inverting and non-inverting sides is continuous.

The output center pin is a floating loop with no DC path to ground. There is a DC short between the inverting and the non-inverting outputs.

The input is a DC short to ground, as depicted in *Figure 1.*

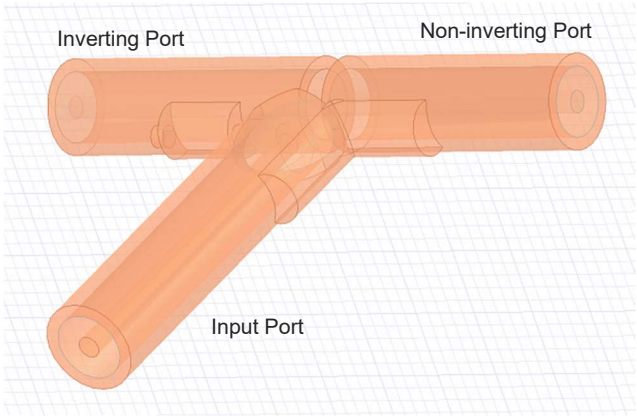

Figure 1: Typical balun Interconnect Topology

DC MODELS CONSTRUCTION

We will present the DC modelling of the output loop to start. As mentioned previously, the output center conductor is a floating loop that connects the inverting and non-inverting ports directly. Considering this topology has no isolation between the two output ports, broadband attenuators can be placed on the outputs. This trades some signal lost for increased isolation between the two output ports.

Another consideration are the DC levels of the two output ports. If they are maintained at the same DC level, no DC block would be needed. DC blocks will need to be added if the two output DC levels are at different potentials.

Conversely, the input structure is a direct DC short. We can equivalently model the input as a parallel LR termination as shown in *Figure 2*. We recommend DC coupling the input if the user's driver is incapable of driving a DC short.

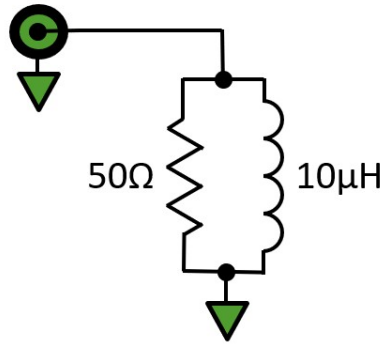

Figure 2: Input Circuit Model

CONCLUSION

Presenting the DC models and understanding of the balun construction and modelling we hope to enable our customers to implement our baluns properly in a wide variety of systems and applications. We are always available to assist in any applications. Feel free to contact us.

[1] Nathan Marchand, "Transmission Line CONVERSION TRANSFORMERS", Electronics, Vol 17, December 1944, pp. 142-14

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Phone: (503) 524-7771 | info@hyperlabs.com | www.hyperlabs.com