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To: EDGES Group
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Subject: Balun with improved balance

The EDGES uses a “choke” balun. This balun is normally made by increasing the common mode inductance of a coax line using a ferrite core. The balance can be improved by adding another compensating choke as illustrated in Figure 1. The equivalent circuit is also shown in figure 1. Without compensation the transfer function is

$$\left[\frac{(v_1 - v_2) - v_2 R/2z}{(2 + 3R/4z)} \right]$$

and with the compensating inductance the transfer function is

$$\left[\frac{(v_1 - v_2)}{(2 + R/2z)} \right]$$

The cost of the improved balance is a doubling of the loss for a lossy ferrite. For a 500 ohm real impedance the loss without compensation is 2.5% which increases to 5% with compensation. Better balance can offer a small improvement in the RFI rejection of vertical polarization at the horizon for the EDGES antenna.

The Common Mode Rejection Ratio (CMRR) measured by 2 methods which gave similar results is given in Table 1. In the first method a dual trace oscilloscope was connected to the balanced output and the ratio of added signal to subtracted signal measured with the scope inputs set to 50 ohms and + 3dBm from a signal generator. In the second method the balanced port was connected to a spectrum analyzer input via two 25 ohm resistors and the path loss measured.

| Frequency MHz | CMRR dB |
|---------------|---------|
| 50 | 50 |
| 100 | 45 |
| 200 | 43 |

Table 1. Measured CMRR

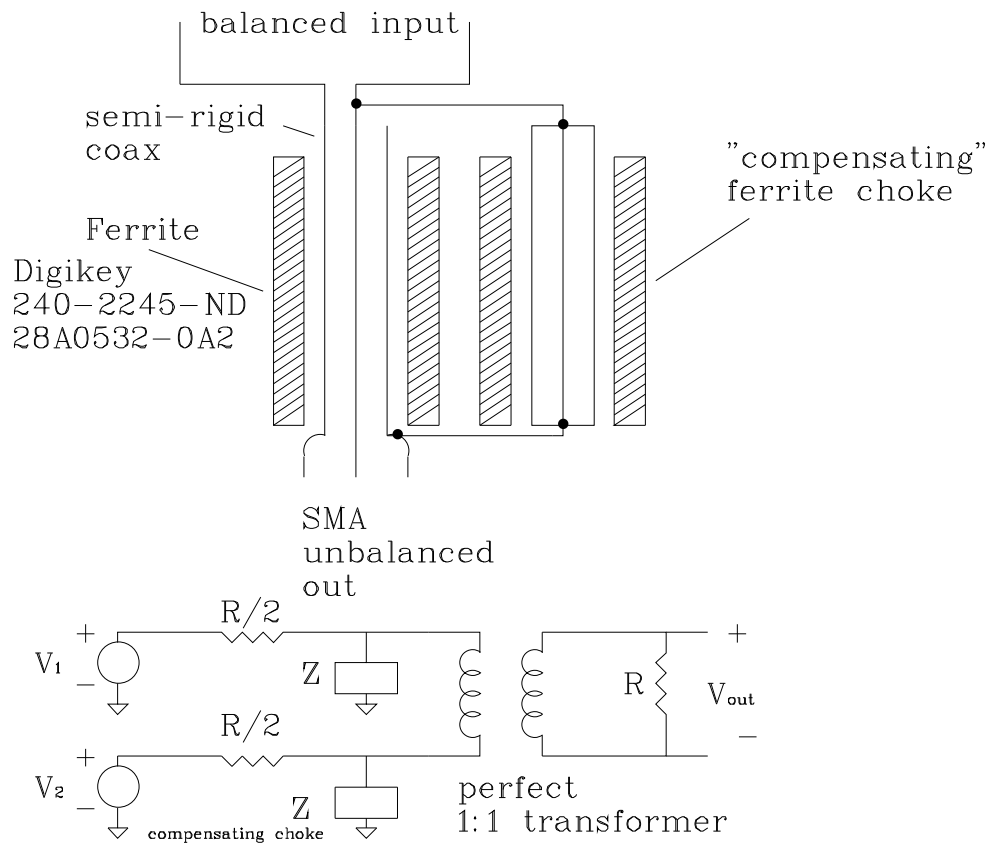


Figure 1 Compensated choke balun