Amplitude Equalizer Uses Reactively Loaded T-Pad

By Richard M. Kurzrok, PE
RMK Consultants

For a small range of amplitude slope, a reactively loaded T-pad attenuator can provide continuous equalization at intermediate frequencies. The circuit can be adjusted for both positive and negative slopes. Return losses are usable and adjustments are quite simple. The equalizer is implemented using low-cost components.

Equalizer circuit description

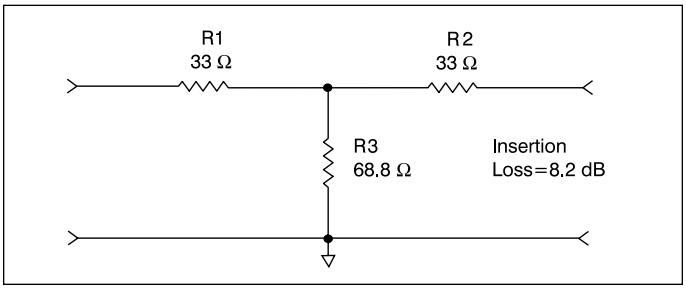
The basic circuit for a 75-ohm T-pad attenuator is shown in Figure 1. By replacing the grounded shunt resistor with a larger resistor in parallel with a lossy resonant circuit, the adjustable amplitude circuit of Figure 2 is obtained. The potentiometer R5 and the variable capacitors C1 and C2 are adjusted for the desired equalization slope around the 70 MHz center frequency.

In the frequency range of 70 MHz plus or minus 18 MHz, the amplitude equalizer is assembled using a singly clad epoxy glass PC board that is 1/16 inch thick. The PC board is mounted on four 1/4-inch diameter × 4-40 male/female standoffs that are fastened to a Bud CU-124 die-cast aluminum box. To adjust R5, C1 and C2 for desired amplitude slope, the cover of the enclosure must be temporarily removed.

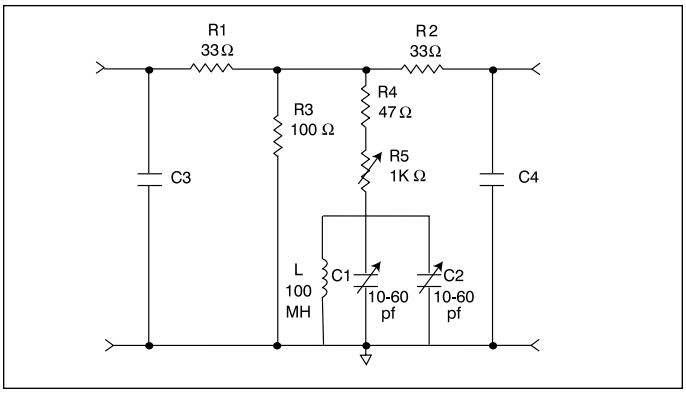
The fixed resistors are 1/4-watt composition with 5 percent tolerance. The potentiometer is a single turn Cermet unit. The fixed inductor is a four turn 1/4-inch diameter air core solenoid (mounted parallel to the PC board) using number 18 AWG magnet wire. The capacitors C1 and C2 are adjustable ceramic units with less than one turn of adjustment range. The optional fixed capacitors C3 and C4 are used to improve the return loss of the BNC female connectors and associated wire leads to the PC board.

Equalizer performance

The equalizer unit is capable of providing ±2-1/2 dB amplitude slope over the 36 MHz IF bandwidth, centered at 70 MHz. The variable components adjust the magnitude and direction of the amplitude slope. Absolute equalizer insertion losses are typically 6 to 10 dB. Return losses, within the rated range of adjustment, are in excess of 20 dB when the input and output BNC connectors are properly matched. This matching might not be necessary if the 50-ohm BNC connectors are replaced by 75-ohm BNC connectors.



▲ **Figure 1. T-pad attenuator schematic.**



▲ **Figure 2. Adjustable amplitude equalizer schematic.**

Conclusion

A relatively simple adjustable amplitude equalizer can be realized providing a modest range of amplitude slopes and usable return loss. Equalizer adjustments are continuous rather than discrete. Low cost components are used throughout. ■

Author information

Richard M. Kurzrok, PE, is an independent consultant specializing in filters and equalizers from baseband through microwave frequencies. He can be reached at RMK Consultants, 82-34 210th Street, Queens Village, NY, 11427-1310; Tel: 718-776-6343; Fax: 718-776-6087; E-mail: rmkconsulting@aol.com.