The Noise-Balancing Antenna Bridge

A simple version of the noise balancing bridge is shown in Figure 2. It may be used with any high frequency communication receiver and when properly adjusted will provide over 15 dB rejection of power line noise while dropping the desired signal less than 3 dB. Because of variations between receivers, setting of the coil taps will have to be done by experiment. The taps and capacitor settings are adjusted to balance out the power line noise while retaining maximum signal strength.

A more effective noise balancing antenna bridge is shown in Figure 3. A ferrite core wideband transformer is used with the noise antenna connected to one winding and the station antenna connected to a second winding. The windings are connected out of phase. The resulting net signal is taken from a third winding which is connected to a balun (balance-to-unbalance) transformer. Ideally, if the signal in the noise winding is equal in amplitude and phase to the noise component of the signal in the antenna winding, only the signal component will be found in the third winding which is coupled to the station receiver through the balun.

This exact balance of signal and noise is unlikely to occur so additional controls are added to adjust the amplitude of noise components from each antenna to equalize each other in the output winding of the transformer.

Constructing the Noise-Balancing Bridge

The components of the bridge are mounted in a small aluminum box approximately 6" x 3" x 2" in size. Capacitor C1 must be insulated from the box with a shaft extension made of insulated rod to reduce hand capacity during adjustment. The capacitor is supported by an insulating bracket bolted to the box. The coil L1 can be supported between a capacitor terminal and a phenolic tie-point strip. A small clip is used to tap the coil. It will be easier to attach the clip to the coil if every other turn is indented (pushed in 1/8-inch) to provide more space for the clip.

Transformers T1 and T2 are wound on small ferrite toroid forms (Q2 material). Transformer T1 is trifilar wound, that is, three windings are wound on the core in parallel as one winding. Before the wires are wound on the core, they are twisted together at one end and held in a vise. The other ends are temporarily twisted together and anchored in the chuck of a hand drill. Give the drill a tug to take out the kinks in the wire and then wind the wires with the drill, twisting them to about four twists per inch.

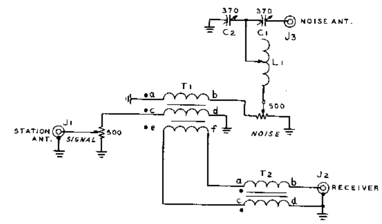

Fig. 3 Noise balancing bridge. C1, C2: 370 pF compression-type trimmer with shaft (air capacitors may be used). L1: 45 turns No. 22 enamel wire, 1-inch in diameter, turns spaced wire diameter. T1: 16 turns No. 18, trifilar wound on 3/4-inch diameter ferrite core, Q2 material (permeability of 125). J.W. Miller F-125-2 or Amidon FT-82-61. T2: Same core material, 18 turns No. 18 bifilar wound. Note: dots on drawing indicate adjacent ends of windings.

The two wires of balun T2 are twisted in the same manner. When completed, the wire skeins are wound on the cores, spacing the turns neatly so as to fill out the core area.

The last step is to strip the insulation from the ends of the windings and, with an ohmmeter, locate the respective wires *ab*, *cd*, and *ef*. Join *a* to *d*, pair off *e* and *f*, which leaves *b* and *c*. The bridge is then wired as in the illustration.

Using the Noise-Balancing Bridge

A good level of noise should be established to aid in the initial balance of the bridge. The two antennas are connected and the potentiometers set for maximum noise signal (control R1) and a low level of desired signal (control R2). Next, adjust capacitors C1 and C2 and the tap on coil L1 for maximum noise. The bridge is now ready to balance.

First, advance control R2 (signal) to maximum and control R1 (noise) to minimum. Now, slowly rotate R1 from the minimum setting to a point where the noise drops in strength. Alternately adjust R1 and R2 for best noise null, trying to achieve this with R2 near its maximum position for