TRADITIONAL BROADBAND TRANSFORMERS

Broadband Transformers, as the name implies, are transformers which will operate over a broad frequency range. They can also provide a step-up or a step-down impedance transformation, match an unbalanced source to a balanced load, or serve both purposes

The two-hole, or 'binocular' type, ferrite core, known as the multi-aperture core, is very popular for low power applications. Multi-aperture cores were developed to provide maximum impedance per length of turn in order to better serve the broadband transformer. Two-hole multi-aperture cores are widely used as 75 ohm and 300 ohm matching transformers for receivers and low power UHF and VHF applications.

The bandwidth of a broadband transformer has practical limitations. The functions which control the low frequency performance are parallel inductance and parallel resistance. This combination must remain sufficiently high in order to maintain an acceptable match. Unless a very low 'Q' core is used these will be the dominant factors. Normally, the inductive reactance at the lowest frequency should be four times greater than the source impedance. However, in order to achieve this ratio, we may find that excessive turns may be required which will adversely affect the high frequency performance. Using a core of high permeability will minimize the number of required turns.

The factors which limit the high frequency response are distributed capacitance and inductance leakage due to uncoupled flux. The more the distributed capacitance and the flux leakage can be minimized, the better will be the high frequency performance of the transformer. The best compromise between distributed capacitance and leakage inductance can be obtained by twisting the conductors together prior to winding. This greatly minimizes the leakage inductance in small transformers.

In applications which generate minimal flux, such as in low power applications and one to one ratio transformers, the goals can best be accomplished by using a high permeability core in order to minimize turns at the lowest frequency. This in turn, will minimize the distributed capacitance which will improve the high frequency response.

Generally, ferrite cores are preferred for broadband transformers because of their high permeability factors. However, in power applications the high permeability ferrite cores can be easily saturated, and care must be taken to keep the induced flux density well below the maximum flux density rating of the core in order to confine the signal energy to the linear portion of the flux density curve. Detailed information can be found in the 'Ferromagnetic Design and Applications Handbook' by Doug DeMaw.

The main concern in power applications is core loss generated by the net induced flux. In this case, iron powder cores are generally preferred because of their higher maximum flux density rating. Core loss increases at a squared rate with flux density at any given frequency. When extremely high voltages are encountered, such as in a high impedance ratio step-up transformer, we recommend that the core first be wrapped with glass-electrical tape before winding, such as 3M-27, This will provide added protection against voltage breakdown and arcing.

A high grade of wire insulation is required when operating with high voltages. We recommend 'Thermoleze' insulated wire. This is a very tough vinyl-like insulation having a voltage breakdown potential of better than 2000 volts and a temperature rating of 200°C.

- **Amidon now offers High Power Transmission Line Baluns and Ununs (unbalanced to unbalanced) transformers. Please call for brochure.**
  - **1 MHz to 50 MHz frequency range**
  - **2 KW to 10 KW power level**
  - **0.2dB loss (98% efficient)**
  - **Baluns: 50Ω:12.5Ω; 50Ω:50Ω; 50Ω:75Ω; 50Ω:100Ω; 50Ω:200Ω; 50Ω:300Ω; 50Ω:450Ω; 50Ω:600Ω**
  - **Ununs: Range from 50Ω:3Ω up to 50Ω:800Ω**