

Designing Broadband Autotransformers for HF

Introduction:

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Since 1959 * many articles have appeared in technical journals, ham radio magazines and other publications describing the design and construction of broadband ferrite power transformers. The majority of these articles are predicated on the use of "Transmission Line" techniques to attain maximum bandwidth. A second technique, about which very little has been written, is the Broadband Autotransformer. With this approach high power transformers can be built covering 1.8 to 30 MHz and beyond.

Transmission line transformers have several problems not present in autotransformers.

1. Very few impedance ratios are available. Ratios of 1:1, 2:1, and 4:1 are common but greatly limit their application.
2. Other ratios can be done but are overly complex.
3. Insertion loss cannot be designed and usually is too high for a high power (1500watt) transformer.

An autotransformer can be designed for a 50 ohm input impedance to match any load from 2 ohms to greater than 100 ohms. Also it can be designed to have an insertion loss lower than 1% (.05db) of the power being handled.

The key to achieving this performance is maximum mutual coupling between all turns of the transformer. One would think that toroid construction would have tight mutual coupling but in actual fact the low permeability of common materials used at HF frequencies allows a great deal of leakage flux between turns and results are very poor.

The most successful construction technique has been found to be the ferrite loaded (copper or brass) tube with the additional turns wound thru the hole.

In this article I will deal with transformers designed to handle 1500 watts although the technique should work even better with smaller cores, tubes, and shorter wire lengths. The steps to design this transformer are as follows.

Step #1 Decide on the frequency range to be covered and the average power level, in this case 1500 watts. For some applications a single frequency or ham band may be all that is required, such as feeding a short vertical antenna.

