Radio FUNdamentals

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

The Coax Balun

Hav e you read the great series of CQ
articles on ferrite baluns written by Jerry
Sevick, W2FMI? If not, better get out your
back copies of this magazine and go over
this important and interesting information. Jerry mentions air-core coax baluns in passing, but the main theme of his work deals with ferrite-core devices. However, there is a place in the world for the air-core design, and I'd like to discuss here two interesting, inexpensive baluns of this type.
An advantage of the ferrite-core balun is it has a greater frequency range and is usually more compact than its air-core counterpart. And conversely, the air-core balun is larger and more bulky than the ferrite equivalent, especially if the former is wound with coax as the conductor. The air-core coax balun, on the other hand, can be made cheaply and is not subject to core saturation, which can cause a number of unpleasant things to happen. The balun core can saturate and overheat with accompanying power loss, causing an increase in harmonic gener-ation and intermodulation.

It is interesting and easy to build an air-core balun, and here are some coax types with which you can experiment and draw your own conclusions as to their utility.

The 1-to-1 Coax Balun

The first I read of a wideband coax balun was in the 1959 publication Principles of Single Sideband, published by the Col-lins Radio Company. This book dis-cussed baluns in the chapter describing feed systems suited to 52 ohm coax line (which had become the feedline of choice in the 1950s). A simple parallel-conduc-tor balun was described (fig. 1). This de-vice converts an unbalanced line to a bal-anced load, as any unbalanced currents flowing from A to C due to its direct con-nection to the antenna will be cancelled at C by the exact counterpart of current flowing from B to C. Thus, there is no cur-rent flowing on the outside of the coax be-yond point C.

The length of the balun (L) need not be a quarter-wavelength for the cancelling

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Fig. 1- Parallel-conductor type balun with 1:1 impedance transfer.

Fig. 2- Broad-band coax balun with 1:1 impedance transformation. Center con-ductor of right-hand coil is unused.

effect to take place, but any departure of magnitude from this length will upset the 1-to-1 ratio of the balun. Unfortunately, this linear balun is not a broadband de-vice. In addition, it is cumbersome, so it was not generally used with amateur an-tennas.
A form of broadband coax balun which is very useful in amateur service is shown in fig. 2. It may be visualized as the balun of fig. 1 wound into a coil. This physical rep-resentation does not cover the real op-eration of the device, which is somewhat more complex. However, a coiled coax balun is capable of operating over a much wider range of frequencies than is its linear counterpart, shown in fig. 1, without up-setting the impedance at the output termi-nation.
The coax balun is wound to a diameter limited by the bending radius of the coax (about 15 times the cable diameter). The ends of the resulting coil are then symmet-

rically trimmed until resonance is achieved at the desired frequency, which is usually the mean frequency of the range of opera-tion. The trimming is done with the aid of a dip meter with the balun disconnected from the load and the transmission line and with the loop connection open.
No more information of a helpful nature was provided in the Collins book, so it was left to the reader to build up a balun and try out the idea. I proceeded to do this.1

A Practical Coax Balun
For 7 to 30 MHz

Operation of the broadband coax balun may be seen from the analogy shown in fig. 3. In (A) is a drawing of a balun known as a "ladder transformer" in TV service. This balun can be compared to a multi-ple-winding inductor (B), with the excit-ing voltage applied to one winding. Vol-tage across each coil is equal, and proper polarization of the windings provides out-put voltage balanced to ground. An equivalent HF balun can consist of three windings, two of which may be made of coax, and the third winding a single sec-tion of wire. In most cases, for symmetry and ease of construction, it is made of a matching length of coax cable. In this case, the inner and outer conductors of this section are shorted together.

The input and outputterminations of the balun may be transposed, if desired, for easier physical attachment to the anten-na (fig. 4). Operation of the balun is the same in either case.

I made up a balun consisting of a length of RG-213/U coax 16 ft. 6 in. long, wound into a single-layer coil the inside diame-ter of which was 63

/4 inches. This result-
ed in a 9-turn coil, with a couple of inch-es left at each end for connections. I used a section of gray PVC water pipe as the coil form.

I wound the coil on the form temporar-ily and marked the points on the PVC cor-responding to the ends of the winding. I then removed the winding and drilled small holes through the wall of the form at each spot previously marked with the pencil. The coil was then rewound on the
form and held in place temporarily with
plastic wire wraps passed through the
holes I had just drilled. The center junc-
tion of the winding is exactly 41

/2 turns

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