Reflector Impedance Control within Yagi Antennas (2) - in Practice

by Justin Johnson, G0KSC

In the first part of this article, I discussed various Yagi topics, matching and connection methods and the associated problems that can arise with the feed-points of VHF/UHF Yagis [1]. I also described the importance of maintaining a constant impedance throughout the feedline and connectors, and the use of a single connector tail between any masthead amp and the antenna feed-point. In the remainder of this article, we will assume that the 'best practice' already discussed will be used throughout the building of the example antenna described below. I will describe the considerations within the software model that help ensure model replication is more achievable along with the extended design criteria employed to provide a mode-focused (EME) Yagi design.

Balun and feedline

I have been asked many times for the best method of feeding Yagis, especially those within stacked or EME systems and whilst the X-pol arrangement has far more considerations to take into account, the single-plan multi-antenna stack is far easier to successfully install without issue. As discussed last time, I recommend a single-line connection between the feed-point and any masthead amp or in the case of stacked antennas, any power divider or splitter. There is one other important consideration, the balun.

I have shifted my opinion, through practical experimentation and testing, from recommending chokes using coax to ferrite sleeve arrangements on the coax cable feeding the antenna. There are a number of reasons for this but the most important issues are outlined below.

First, the effectiveness of the coaxial choke balun (air-spaced or core wound coax cable at the feed-point) varies greatly from one example to another due to many factors. For example, the type of coax used and the band in use can vary the effectiveness of the balun performance. Experiments conducted by G8FJG show that most good quality coax cables do not provide a good basis for a coil-wound balun at VHF or UHF, because the outer jacket of the coax is far too thick to provide the needed capacitance between the coil turns.

Next, performance of the coil-wound choke is affected by the presence of the boom. When close against a metallic boom, the magnetic field that would normally run through and around the choke is impeded. To be effective, the choke needs to sit above the boom and often this is not known by the constructor and therefore not implemented. A method of doing this that provides a reliable, long-term solution would be difficult to achieve. Finally, the size and shape of the choke (especially when spaced above the boom) can cause problems with X-pol antennas because the balun/choke structure extends a significant distance into the EH field of the opposite polarity structure, so the choke of the plane not in use can degrade the performance of the antenna polarisation in use.

I have found that placing ferrite cores over the coax at the feed-point, covering them with a length of adhesive-lined heat shrink sleeving, followed by a finishing layer of rubber sealant provides a much cleaner, more rounded balun. The additional benefit is that the coiled coaxial choke is fairly narrow in bandwidth, the ferrite core balun is effective over a much greater range. For example, the material I use for 2m is good for from around 30 MHz to 300 MHz and therefore even VHF dual-band antennas are suitable for such a balun.

An important note on Baluns within 'Self Balanced' Yagis

This is a subject I have covered in the 2016 ARRL Handbook in more detail but think it is important to note here as it highlights the functional importance of a balun and the varying effects installing or removing one can have.

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