The Radio Hotel – 50 Ohm Direct Fed Yagi's

By Rick Hiller – W5RH

You can definitely teach an old dog new tricks….I know, cause this old dog learned a few new tricks about Yagi-Uda's and their feed impedances. I built a few Yagi's in the past and recently embarked on building a 12 meter, 3 element Yagi for QSO's with my friend in VK3. I was all set to cut metal, when I read, in a recently obtained book, **Array of Light** by N6BT, Tom Schiller, about 50 ohm direct fed Yagis. Why was this so enlightening? Because, in the many years of antenna designing and building I (and the books I was reading) focused on maximum gain and the highest front to back (F/B) ratio. The feed impedance was just accepted as what occurred in those two design conditions.

The feed Z in the "max gain and F/B configuration" was, typically, quite low… in the 10 to 15 ohm range. This low feed Z required some type of transformation from the 15 ohms to 50 ohms (the typical coaxial cable Z) in order to have a low system SWR. T matches, Gamma matches, Omega matches (all impedance step-up devices) were the norm and rather a pain in the butt to physically implement and tune (at least for me). But, N6BT and his designers found the direct match condition (and so had Mosley many years back), but no one said didly squat…well, until I re-read a few antenna books. Sure enough, in the 1955 (seventh edition) version of the ARRL Antenna Handbook, there it was plain as day. The chapter on multi-element arrays talked about Yagis, the varying element spacing and the associated gain and front to back curves. Although highlighting the max /low feed Z configuration, the graph's curves also showed that at a slight reduction in gain and F/B the feed Z could be 50 ohms.

With the use of EZNEC (or any other NEC based analysis) you can have a bit of fun and model a direct fed Yagi. You will notice a changes in gain, F/B and feed Z, etc. by varying the element lengths and element spacing. Notice that, as you vary the attributes, that the director location plays a large part in determining the feed impedance.

What is the benefit of a 50 ohm direct feed Yagi? As N6BT says in his book, VSWR bandwidth is wider and the higher Z decreases the element current, possibly creating a more predominant E field. Probably, in my opinion, the matching device elimination is the greatest benefit.

What is the difference in the classic Yagi design and the direct feed design? Gain and F/B suffer slightly according to the charts in the Bill Orr, W6SAI – Beam Antenna Handbook, however, Schiller touts the operational performance as being better than the lower feed Z Yagi's in his contest station situation. I have no anecdotal experience to challenge that claim, but looking at the performance of HC8A over the years, he just might be right.

If you are planning on building or even buying a Yagi, look at those with the direct 50 ohm feed. The SP7GXP multi-band Yagi's, that Pat (KJ5Y) is selling, have direct feed. The included feedpoint choke doesn't count as an impedance matching device, but does help to keep feedline radiation at a minimum to provide maximum symmetry in the radiation pattern.

References:

Array of Light – Third Edition, Tom Schiller – N6BT (self published)
ARRL Antenna Handbook – Seventh edition – but, any later edition has the applicable charts
Beam Antenna Handbook – William Orr – W6SAI -- Radio Publications/CQ Press

Enjoy your hobby. GL ES 73 DE W5RH

Next Time – VHF Antennas from Thumbtacks and Wires

The purpose of ***The Radio Hotel*** *is to give you a practical kick start into exploring the workings of antenna systems. Google the buzz words and find out what they mean. Read up on antenna system theory to see how it all works together. You will be glad you did.*