

The Radio Hotel – Effective Aperture Ramblings

(And other semi-unimportant antenna design factors for HF)

by Rick Hiller – W5RH

Don't get me wrong. Antennas are my favorite aspect of Amateur Radio. From the theoretical, to the physical, from the performance to the benefits, etc. But sometimes in my casual research I run across attributes that seem to be worth little to us "shortwave" oriented hams and how we see, design, build and use antennas.

Effective aperture A_e is a basic antenna concept that is a measure of the power captured by an antenna from a radiated plane wave. Effective aperture (from Jasik $A_e = \lambda^2 G / 4 \pi$) is expressed as a function of the antenna gain G and the wavelength of interest λ , nothing else. Physical size does not enter the equation, nor does conductor surface area. Great! But does knowing this improve our HF capabilities? Only in the fact that more gain is better. But we know this inherently, as gain is what we ultimately strive for, right?

Other factors. For higher frequencies VHF, UHF, SHF you move into the world of the **Friis Transmission Formula, polarization loss and path loss.**(Google them). These are important factors, for sure, when you are designing an antenna system sending critical data across the country or to fellow astronauts cruising to another celestial body. Should we be concerned with HF polarization loss and path loss? Not really. Just know that they apply at some point. The higher the frequency, the higher the path loss, for example.

In the end, I'm not sure we need to know everything there is to know about antenna theory. Our concerns are mostly with the physical and modeling realms of antennas. Resonance, feed Z, gain, loading, SWR, return loss, front to back ratio, beam width, etc. My view is that we should stop there. Most amateur radio practical HF antenna books do stop there. But what is behind the curtain? Anything exciting? Not really.

Our concern is being able to communicate....CW, Voice and data on a hobbyist level. We are not passing G-bytes of data across the country enabling stock trading or telephone conversations, or the Internet. We are not commercial entities, so our calculations of antenna system performance do not include Effective Aperture measurement or Friis Transmission equation results or even path loss. But just like **The Radio Hotel** column "**AA0ST and Antennas Thru the Looking Glass**" in **April of 2017 BVARC Beacon** where I wrote of Non-Foster elements; it is all interesting to know. In the end though, this knowledge is not very beneficial to the common HF ham. We look at things differently. We will milk the b'geezus out of those 40 meter weak signals with special low noise receive antennas or 20 dB pre-amps in order to receive that CW signal from Reunion Island. However, if we don't get thru, then we will simply try the next night. TD Ameritrade does not rely on our FT-8 link performance for their daily business.

In summary, these extra antenna attributes are defining antenna system performance by putting it into equations that the antenna system design engineers can use in their daily work. But for us hams, we read what's best, design it and model it for the band we want, erect it, measure a few things (SWR etc.) to see that we are transmitting efficiently and we then chase shortwave DX. Nothing wrong with the fact that we ignore a lot of the deeper antenna design criteria.....because it matters little. Enjoy your hobby. W5RH