Increasing Efficiency or Bandwidth of Electrically Small Transmit Antennas by Impedance Matching with Non-foster Circuits

S. E. Sussman-Fort[1,2], and R. M. Rudish[1]

[1]EDO Corporation, USA
[2]State University of NY, USA

We have previously reported [1] the experimental realization of a stable, low-power high-Q VHF *non-Fostercapacitor*. This is an active one-port circuit element whose reactance-versus-frequency slope is *negative*. Our experimental verification showed that a non-Foster capacitor can reduce mismatch loss of electrically-small *receive* antennas over substantial bandwidths, thereby improving their sensitivity.

When used to cancel the reactance of an electrically-small *transmit* antenna, a non-Foster capacitor will be subjected to excessively high voltage in order to radiate even a moderate amount of power. We have previously reported [2] that we can mitigate this high voltage first by resonating the antenna with a conventional passive reactance, and then by canceling the reactance of this combination with a non-Foster tuned circuit. We also demonstrated the performance of stable non-Foster tuned-circuits. Initially, our tuned circuits were configured for operation in a simple, but relatively inefficient, class-A bias mode. Subsequently, we configured a composite device as a parallel connection of an NPN and a PNP transistor to operate in a more efficient class-B mode. Both class-A and class-B circuits were constructed with low-power devices.

Now, we report on our efforts to increase the power output capability and efficiency of these circuits to render them practical for realistic transmit antenna applications. We show that non-Foster transmit matching of electrically-small antennas is much more broadband than any passive matching circuit. The power efficiency of the antenna and its class-B biased non-Foster matching circuits is also better than that achievable for a passively matched transmit antenna.

REFERENCES

1. *IASTED International Conference on Antennas, Radar and Wave Propagation*, Banff, Canada, Arp. 2005.
2. *Twenty-Ninth Annual Antenna Applications Symposium*, Allerton Park IL, Sept. 21–23.