Ultra-wideband Bandwidth-Reconfigurable Tightly Coupled Array

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There is already a growing need for bandwidth agile and reconfigurable apertures. Applications include suppressing the presence of a high power interferer, flexibility in multi-band operation, to facilitate filtering for dynamic systems and to aid in improving SNR for band-limited applications. Clearly more and more cases call for bandwidth reconfiguration.

Tightly coupled dipole arrays (TCDA) are conformal and low profile offering ultra-wide bandwidths with wide scanning capabilities. The opportunity for aperture reconfiguration is an extra advantage. It is of interest to reconfigure the wide-bandwidths of TCDA's for the applications described above. So far, reconfiguration has been attempted on the aperture with tunable capacitors or switching elements or between the feed and the transceiver as a separate filtering element. The same ideas can be applied to reconfigure the Balun. Previous arrays, (W. Moulder, IEEE Transactions on Ant. and Prop., 60, 4166-4172, 2012) and (J. Doane, IEEE Transactions on Ant. and Prop., 61, 4538-4548, 2013), exploit the current sheet concept introduced by Munk improving the bandwidth by integrating and co-designing a Marchand Balun together with the antenna. The Balun works not only as a mean of balanced output for the radiators but as a higher order matching network for wider impedance matching as well.

The innovation for this work is the reconfiguration of the Balun to achieve different band formations starting from a wide un-reconfigured response. Applications discussed earlier imply the need for narrower sub-bands of the initial wide bandwidth or bands with high rejection (stop-bands). This can be achieved by changing certain design parameters which have significant effect on the total performance of the array. Such parameters can be the lengths or the characteristic impedance of the open and shorted stubs of the Marchand Balun. A proposed solution is the utilization of MEM switches and switchable L-C circuits with external bias respectively. In conclusion, this attempt aims to facilitate filtering and offer a new degree of freedom in bandwidth tuning options with highly promising results.