INVESTIGATION OF MEAN RADAR CROSS SECTION TROPOSPHERIC SCATTERING LOSS USING INTELLIGENTLY DISTRIBUTED ADHOC POLYMORPHIC ANTENNA ARRAYS

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This work examines the characteristic modes and measurement of a circular canonical family (CCF) of ad-hoc array topologies for their intended use in either beyond line of sight or over the horizon capacities with angle of arrival estimates. The element radiators of this are used independently and assumed to deliver both sum and difference beams under lossy apertures settings of tropospheric scattering settings. Monopulse detection estimates on spatial angle of arrival as well as topology identification of this can then be extrapolated using a tapered variance approximation of the linearity arising from the delta-sum ratios that arises from the CCF distribution. This is done as a consequence from an associated moment generating function of which is derived and shown to arise naturally from the roots of quadric topologies. For circular non-degenerate topology these roots are shown to deliver newly derived multidimensional distribution characteristics that encompass a variety of planar and volumetric topologies. This has significant impact for radar detection and also applies reciprocity in passive settings for RCS measurement and topology detection. This approach, however generalizes the Fourier probabilistic methods by using the Laplace transform to analyze statistical averages that cater to the degenerating effects of pattern behavior that is influenced from the environment. A certain justification for choosing the field to be of this form is since the mean signal on arrival will tend to fluctuate randomly in tropospheric propagation for over the horizon (OTH) and beyond line of sight (BLOS) communications. In addition the averaging of sky waves throughout short time intervals (on the order of a minute or so) tends to produce a expected probability distribution of lognormal behavior. This kind of random character of the field in the aperture leads to a diminished gain in the overall effective aperture, of which tends to spread and distort pattern behavior and into the noise floor for the most extreme of conditions. In addition, these small amounts of loss in the antenna aperture not only lead to increased beamwitdths, but could even result in difference beam patterns of which will be shown. Lastly, measured results of the CCF array topologies (constrained to 32 elements) are provided with the sum-difference patterns in both the E and H planes for lossless conditions with comparison to theoretical mean valued averages. Results of this are shown to have encouraging agreement for the circular canonical family investigated thus far.