Locating the Beam Pointing Direction Using a Few Probes

Sembiam R. Rengarajan
California State University
Northridge, CA 91330
srengarajan@csun.edu

This work was motivated by a need to determine the beam pointing direction accurately and rapidly by processing the received signals from a few probes from among an array of probes. The feasibility of this measurement scenario is demonstrated by simulated results in this presentation. The antenna under test (AUT) is mounted on a turntable in an anechoic chamber consisting of a planar array of probes with a spacing of 4 ft. located on the chamber wall facing the antenna. As the antenna beam is commanded to point towards a certain direction, it is tilted so as to point the beam peak nominally towards the center of the probe array. The antenna tilt is specified by the three Euler angles. The beam pointing direction differs from the command direction within $\pm 5^{o}$ in both the elevation and azimuth. The beam pointing direction is determined by minimizing the mean square error between the four largest normalized amplitudes of the received probe voltages and the corresponding normalized transmitted signals. It is assumed that the antenna size and the aperture amplitude distribution are known. At lower frequencies of interest the four probes used to determine the beam pointing direction are within the main beam region. However, at higher frequencies, the amplitude and phase information from as many as nine probes are used to determine the beam pointing direction. Based on the knowledge of the phase center of the antenna the nominal phase term exp (-jkr) is subtracted from the received signals. This allows the use of the received voltages from the main beam and the first sidelobe in each direction in our least mean square error technique. The simulated results for a wide range of parameters including different levels of noise added to the received voltages of the probes will be presented.