# Signal Quality in a Multibeam Transmit Array

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Multibeam phased arrays in communications systems have the ability to transmit multiple signals in different directions. Ideally, the different signals in the different beams would be isolated and not interfere with each other. In reality, the main beams and sidelobes of the multi-beamed array interact and distort the desired signal in a given direction. Isolating the signals in the different beams is not feasible. As a result, a metric is needed to evaluate the signal quality transmitted in a beam and also the quality of the signal received in the far field.

This investigation uses a time domain MATLAB model of a 10x10 element multibeam communications array that transmits 8 different signals in 8 directions. The array scans a 45 degree cone over a frequency range of 8 to 12 GHz. It has a square grid with an element spacing of 1.46 cm. The signal modulation is assumed to be binary phase shift keying (BPSK). The signal in one desired direction is distorted by signals from the other beams. This distortion is highest when the main beams overlap and when the signals are at the same frequency.

We compute the correlation coefficient of the signals transmitted by the phased array and received in the far field. The degradation in correlation coefficient due to the number of beams, beam locations, and BPSK filtering will be considered.

In addition, the effects of power amplifier nonlinearity in an active phased array can also be incorporated into this model to evaluate the effect of the nonlinearity on the signal quality.