DIVERSITY GAIN USING MEASURED ANTENNA PARAMETERS FOR MOBILE ARRAY DESIGN

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Abstract:

Wireless communications is undergoing the widespread uptake of multiport, or array antennas, for both diversity and full-MIMO operation. The multipath means that link analysis becomes statistical, similar to that of fading line-of-sight (LOS), point-to-point links. Not only is the path loss a random variable, but traditionally deterministic antenna parameters also take on a statistical nature. In particular, the directional gain in the line-of-sight link budget is replaced by the diversity gain, a statistical measure. The antenna design process requires a link performance measure. But a communications link parameter, for example a BER statistic, does not give much insight for improving the antenna design. A direct measure of the diversity gain is preferable. But statistical measures become time-consuming to estimate because large-sampling is required for accurate estimates for the correlation matrix. Such estimates are normally location-, or scenario-dependence as well, further complicating the interpretation of repeatability.It is desirable and often necessary to have compact arrays. In the antenna design process, the antenna performance estimate is required to manage the tradeoff between array compactness and performance degradation caused by mutual coupling. To this end, the diversity gain should include the degradation from the mutual coupling. For efficient antenna design iterations, as the designer works to fit several elements into a compact space, so a fast estimate of the diversity gain is required. Under conditions of wide angular spread, in particular for the incoming waves occupying the full field-of-view of the antenna elements, a good estimate for the diversity gain and mutual coupling loss can be obtained from the mutual impedances of the array. These deterministic antenna parameters are readily measured, for example using an S-parameter test set, and converted to an estimate of the correlation matrix [1]. These also provide an effective number of ideal (equal mean power, and uncorrelated) diversity branches, which serves as a figure of merit for a given array [2]. Techniques will be reviewed and results for the measurements of 12-port compact array antennas for wall mounted applications will be presented.

[1] R.G.Vaughan, J.Bach Andersen, “Antennas Diversity in Mobile Communications”, IEEE Transactions on Vehicular Technology, Vol.36, No.4, pp.149-172, November 1987.

[2] O.Noerklit, P.D.Teal, R.G.Vaughan, “Measurements and Evaluation of Multi-Antenna handsets in Indoor mobile Communication”, IEEE Transactions of Antennas and Propagation, Vol.49, No.3, pp.429-437, March 2001.