

Diversity Gain Measurements for PIFAs on a Notebook Computer

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Diversity schemes for multiple antenna systems are widely used to enhance the performance of communication devices operating in a multipath propagation environment. In addition to base station applications, research activity is also focusing on the use of diversity schemes in mobile terminals like laptop computers (M. Karaboikis, C. Soras, G. Tsachtsiris, V. Makios, IEEE AWPL, Vol.3, pp. 9-13, 2004).

This paper describes a work in progress on performance evaluation of spatial/polarization diversity when applied to a multiple antenna system mounted on a commercial notebook. The diversity gain is the parameter that quantifies the improvement with respect to the single antenna case. In this activity, the antennas are two Planar Inverted-F Antennas (PIFAs) operating in the IEEE 802.11a (5150-5350 MHz, 5750-5850MHz), IEEE 802.11b,g (2400-2484 MHz) and HIPERLAN2 (5470- 5750MHz) frequency bands (P. Nepa, G. Manara, A.A. Serra, G. Nenna, IEEE AWPL, Vol. 4, pp.349-350, 2005). The PIFAs (the two branches of the diversity system) are installed within the housing of the notebook at different positions close to the display border. Space and polarization diversity will be analyzed and compared. Moreover, diversity gain variations with respect to both the distance between the two PIFAs and their reciprocal orientation are also addressed. Selection diversity is being applied to combine signals from the two branches.

Diversity gain measurements are being carried out in a reverberation chamber at C.I.S.A.M. (Centro Interforze Studi Applicazioni Militari) in the frequency ranges 2.4-2.484 GHz and 5.15-5.85 GHz, with a set-up similar to the one described by Kildal *et al.* (P.S. Kildal, K. Rosengren, J. Byun, J. Lee, MOTL, Vol.34, No.1, pp.56-59, 2002). The large reverberation chamber, rectangular in shape, has inner dimensions of 8.94 x 6 x 3.92 m³ (L x W x H). Walls and ceiling are made of 2mm thick solid aluminium panels bolted from outside, to leave a flat surface inside the chamber; the floor and the inner part of the door are also covered with 2mm thick aluminium sheets. A pair of three-dimensional “W-type” mechanical tuners, placed in vertical and horizontal position, guarantees a sequential mode stirring. An EMCO 3115 1-18GHz double-ridged horn has been used as transmitting antenna. By using an Anritsu 37317A vector network analyzer, the transmission between the horn antenna and each PIFA (S_{12}) is measured for a number of different positions of each stirrer and for several frequency points in each of the above frequency bands. Power transmission samples are collected and the cumulative probability density function is studied as a function of the relative position of the notebook and the transmitting antenna in the reverberation chamber. Measurement results will be shown at the conference.