An Investigation of Millimetrewave Microstrip Patch Arrays with Uniplanar Waveguide Beamforming Networks

E.Lanoue*(1), D.A.McNamara(1), K.Hettak(2) & G.Delisle(1)
(1) University of Ottawa, Ontario, K1N6N5, Canada. (mcnamara@site.uottawa.ca)
(2) Communications Research Centre Canada, Ottawa, Ontario K2H 8S2, Canada.

Intelligent antennas combine the output of multiple antenna elements (*viz.* an antenna array) with a signal processing algorithmic capability to change the angular distribution of their radiation patterns in response to the signal environment. This can significantly improve the communication system capacity, something essential for future broadband wireless systems. The architecture of an intelligent antenna consists of several subsystems: the array radiating elements and RF feed network itself, the RF front end sections containing the active controllable devices, and the digital signal processing (DSP) sections which implement the signal processing that makes the antenna intelligent.

The authors are presently undertaking research needed to overcome the stumbling blocks that will make it feasible to realize complete intelligent antennas at millimetrewaves using fabrication methods that will permit future industry development of commercial products. The need for millemetre wave operation stems from the frequency assignments among which some international standards will emerge for broadband wireless in-door distribution.

Uniplanar waveguide technology (eg. combinations of coplanar waveguide and slotline) has shown promise of being able to significantly decrease the physical size (and hence the RF losses) of the typical components of a complete intelligent antenna. These include couplers, power dividers, filters and mixers (K.Hettak *et al.*, IEEE Trans. Microwave Theory Tech., Sept.1998, June 1999, Dec.1999, Jan.2000, Jan.2005, May 2005).

This paper will discuss the results from the first phase of the study, namely the performance (especially in terms of losses, bandwidth and dual-polarisation capability) of passive planar array antennas of various sizes that are fed using uniplanar feed networks. Experimental results will be compared to those predicted using electromagnetic simulation tools. This provides a firm idea as to the capabilities of such feed networks for planar arrays (along the lines of the very useful work on microstrip feed networks by E. Levine *et al*., IEEE Trans. Antennas Propagat., April 1989), as well as an indication of the effectiveness of the above-mentioned tools/models.