# On the Potentials of Connected Array Technology for Wide Band, Wide Scanning, Dual Polarized Applications

D. Cavallo[(1)], A. Neto[(1)], G. Gerini[(1)], G. Toso[(2)]

(1) TNO - Defence, Security and Safety , Oude Waalsdorperweg 63, 2597 AK, The Hague, The Netherlands E-mail : andrea.neto, dave.bekers, giampiero.gerini@tno.nl
(2) ESA-ESTEC Nordwijk The Netherlands, E-mail: Giovanni.Toso@esa.int

The realization of wide band, wide scanning angle, phased arrays has been the object of many recent investigations and the most succesfull type or radiators are all from the extended Vivaldi antenna family [J. J. Lee et al *AWPL*, vol. 2, no. 1, pp. 46–49, 2003.] [Kasturi, S.; Schaubert, D.H. Trans A. P. Vol. 54, Issue 2, Feb. 2006 ]. However all these solutions typically compromise some performances aspects with high cross-polarization levels. A novel trend in this field is the use of planar long dipole or slot antennas periodically fed at Nyquist intervals to effectively achieve an amplitude and phase aperture distribution without necessarily using separate antenna elements. This trend was originally proposed by [R. Hansen AWPL, Vol. 3, pp.154-156, 2004.] and was then further developed theoretically [A. Neto et al. in *IEEE Trans. A.P.*, Vol. 54, no.2, February 2006]. The first practical demonstration of a planar connected array antenna was given in [Lee, J.J et al.; Trans. A.P. Vol. 54, Issue 7, July 2006]. Thanks to the planarity of the radiators, the low cross polarization level is among the most important features of such antenna solutions.

An important commercial application that requires further development of the connected array principles is the in flight entertainment. In this scope the use wide scanning angle arrays with extreme polarization requirements are necessary. In fact this application is required to support two orthogonal polarizations characterized by isolation between the channels better than -15 dB over an entire hemisphere. Moreover, if one wishes to adopt a unique antenna for both the uplink and the down link bands, a wide bandwidth (about 30%) could become necessary for the antenna. Similar requirements are often requested also in a number of different RADAR systems that are presently being investigated for both military and civil applications.
In this work some of the peculiar difficulties associated to the design of such arrays are discussed. These peculiarities are associated to the *connected* nature of the antennas which implies extreme mutual couplings ($S_{ij}$ in the order of 1) between different feed elements.
The connected nature dominates the:

1) active input impedance at each feed
2) cross-polarization radiation levels
3) impact of the finiteness of the array on the radiation patterns