# Mitigating the Port Isolation Degradation due to Feed Network Routing in Dual-Polarized Microstrip Antenna Arrays

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A dual-polarized patch antenna is a 2-port device capable of radiating orthogonal polarisations at the same frequency. One advantage of a dual-polarized antenna is the possibility of simultaneous transmit/receive operation, but to exploit this the isolation between the orthogonally-polarized ports must be maximized. Dual-polarised aperture-fed patches, with the access lines to the two ports situated at 90° to each other, have been investigated (eg. S.C.Gao *et al.*, Electron. Lett., 37, 1213-1214, 2001) and isolations of 36dB have been achieved. However, such patches present difficulties when they are to be the radiating elements of a planar array. The reason is that the individual element port access lines can no longer be entirely perpendicular to each other, and that the feed networks for the two polarisations lie on the same physical level, both these aspects having deleterious effects on the isolation between the array ports. In the *first part* of this paper we discuss the port isolation of a dual-polarised patch that is aperture-fed for one polarization and edge-fed for the other. Measured isolation values of better than 36dB will be shown (even with non-perpendicular access lines), along with remarkably close theoretical predictions from electromagnetic simulations. The feed network geometry that provides this good isolation for the individual radiating patch element also allows the patch to be integrated into a dual-polarised planar array employing exclusively corporate feed networks. In the *second part* of the paper we address the unwanted effects that feed network lines in the immediate vicinity of the radiating elements have on the port isolation levels of an array. We discuss two approaches to improving the isolation performance of the overall array : (a).minimizing the individual unwanted cross-polarization-coupling contributions between radiating elements and surrounding feed lines by careful feed network routing, and (b).cancellation of the cross-coupling contributions by means of appropriate radiating element grouping within the feed network. We have devised a 2×4 element array (the sub-array building block) that incorporates all these feed network "design rules" to achieve excellent isolation between sub-array ports, and which can be replicated to form larger arrays with little degradation to the isolation as array size increases. This will be demonstrated through a description of, and experimental results for, a 4×4 array (consisting of two such sub-arrays) with isolation better than 40dB across the entire impedance bandwidth, and better than 50dB at the centre frequency (where the return loss is best). Dual-polarized planar arrays that achieve isolations of 40dB have previously been reported (S.Zhong *et al*., IEEE Trans., AP-50, Oct.2002). However, the feed network arrangement used there makes the routing difficult since both feed networks are on the same physical level, so the array size is restricted, and amplitude taper is difficult to implement (due to inherent use of a corporate-series network). The feed network here does not have these restrictions.