Aperture Coupled Strip-line Patch Transmitarray

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There is a growing interest for lens-type or reflector-type structures called transmit arrays and reflect arrays, respectively. The transmitarray is comprised of single-or multilayer elements which can locally compensate the phase delay associated with the different path lengths, is a promising substitution of conventional curved shaped dielectric lens antennas, with advantages of flat shape, low profile, easy fabrication and low loss, etc. The spatial feeding of transmitarray structure avoids using complicated feeding networks, especially in millimeter-wave (mmW) and sub-millimeterwave (smmW) bands, where the conductor loss is much severe. The major disadvantage of the transmitarray, similar to the reflectarray, is its limited bandwidth performance. This work aims to demonstrate a fully microwave transmitarray at X-band that is low-cost, easy to fabricate. In addition, the array element design is also low-profile, with a thickness of quarter wavelength. The transmitarray cell has constructed using aperture coupled strip-line patch technique. A 14 × 14 planar transmitarray prototype has been investigated and verified with good agreement between two simulated methods.

TRANSMITARRAY DESIGN:

The ACSP antenna provides a broadband matching with phase linearity charactersitcs within the certain desired band. The ACSP antenna have 4 layers. The transmitarray cell have been constructed by two sided ACSP antennas connected back to back. The array have 196 elements fed by linearly polarized horn as shown in Fig.1. The propagated wave across transmitarray axis is illustrated in Fig.2. Figure.3, the x-z plane field patterns calculated by FIT technique and verified by TLM method. The calculated gain is illustrated in Fig.4 with aperture efficiency 42.5 % at 11.7 GHz.

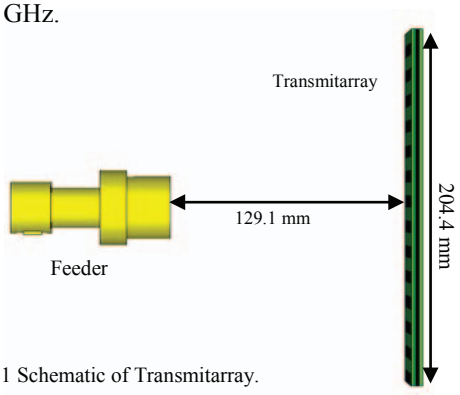

Fig.1 Schematic of Transmitarray.

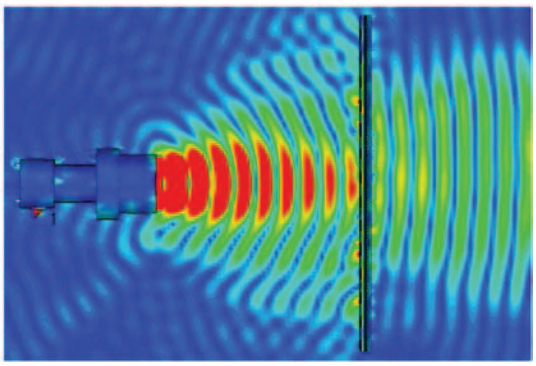

Fig.2 Propagated wave at 11.7 GHz.

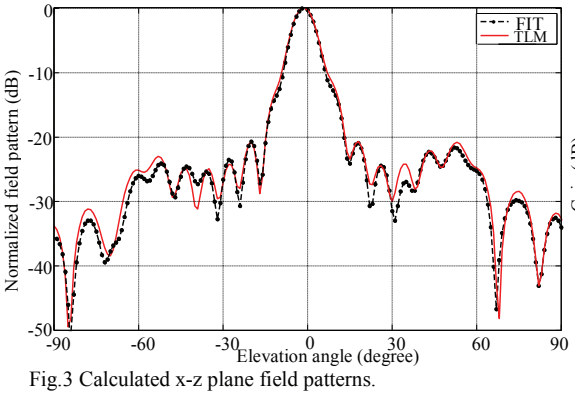

Fig.3 Calculated x-z plane field patterns.

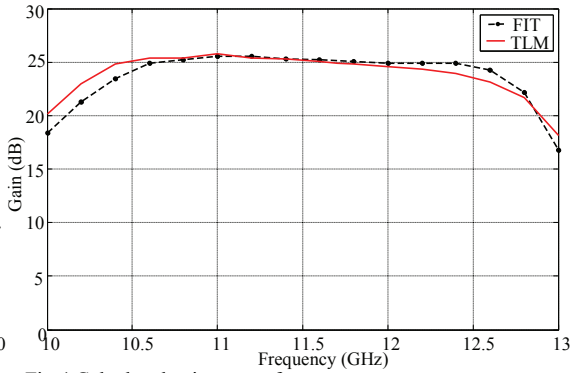

Fig.4 Calculated gain versus frequency.