Dual Frequency & Dual- Linear Polarization Integrated Antenna Array for application in Synthetic Aperture Radar

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***Abstract*—This paper presents the design and realization of a dual frequency antenna array for application in Synthetic Aperture Radar. The array consists of 64 C-band elements interleaved with 4 L-band elements incorporated with feeding network in one integrated, multilayer, LTCC compatible structure. The Antenna has been designed to operate with dual-linear polarization in both frequency bands. The achieved bandwidths are 100 MHz in L-band and 400 MHz in C-band. Several techniques for suppressing orthogonal polarization has been implemented to achieve very low cross-polarization coefficient in both frequency bands. The beam forming network has been designed to provide modified cosec2 radiation pattern suitable for radar applications.**

I. Introduction

Synthetic aperture radars (SAR) are used for a wide variety of environmental, navigational, industry and military, applications. To provide proper imaging capabilities dual frequency operation and dual-linear polarization, with low cross-polarization capability are desired [1]. For antennas suitable for SAR systems additional requirements such as low side-lobes, cosec2 radiation pattern, wide-band operation and lightweight and compact structure have to be met [2]. All these requirements result in complex design of the antenna array and beam forming network (BFN). To provide dual-linear polarization capability with low cross-polarization coefficient special techniques for suppressing orthogonal polarization have to be implemented in the radiating element design as well as in BFN design. Also good isolation between the individual parts of the BFN must be ensured to avoid undesirable couplings. All these requirements suggest an application of multilayer structure where the radiating elements and different parts of BFN are placed on different layers and good isolation can be easily achieved, when stripline technology is applied. In the design of interconnections between adjacent layers the possibility of excitation of leaky modes that can significantly deteriorate properties of BFN must be taken into account [3]. In this paper we present the design and realization of the dual frequency & dual-linear polarization, integrated antenna array when several techniques and solutions to deal with the problems described above have been implemented.

II. Design of Radiating Elements

The presented antenna has been designed in the form of panels that can be put together and connected to obtain the desired radiation pattern directivity. A basic antenna panel consists of 64 C-band elements arranged in an 8x8 element array interleaved with four L-band elements arranged in the form presented earlier in [4] (Fig. 1). The full antenna array can be composed of four such panels.

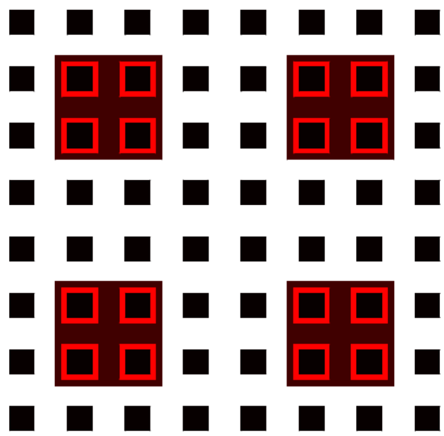

Fig. 1 The basic antenna panel composed of 64 C-band elements arranged in an 8x8 element array interleaved with four L-band elements.

A. C-band Antenna Elements

Each of the C-band antenna elements has been designed in a stripline technique. To achieve the required bandwidth (about 7.4% @ 5.45GHz) two square patches (driven and parasitic) are appropriately stacked. To minimize the number of via-holes within the entire antenna array, we have chosen aperture coupled feeding technique. In order to ensure high isolation between ports exciting vertical and horizontal