A STUDY OF SLOT AND DIPOLE ANTENNAS ON LAYERED ELECTRICALLY THICK DIELECTRIC SUBSTRATES FOR FAR INFRARED AND MILLIMETER WAVE IMAGING ARRAYS

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by

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An approach for designing imaging array antennas built on electrically thick substrates is presented. Calculations and measurements of the radiation properties and the input impedances of slot and dipole antennas on electrically thick, grounded, dielectric substrates are presented. These structures offer the possibility of simplifying the fabrication of imaging array antenna structures which operate at millimeter wave and far infrared freqeuncies. They also offer the possibility of good beam patterns which can be tailored to suit a specific need. We present an analysis of practical layered structures which have beam patterns that are suitable for millimeter wave and far-infrared imaging array applications. We discuss considerations of the choice of dielectric layers with regard to beam patterns, surface wave losses, and the type of element used. The effects of dielectric and ground plane losses in high-gain structures are also considered. Efficiencies and beam patterns for three and five layer structures are presented, although the analysis

techniques are extendable to an arbitrary number of layers. It is found that in combination with the use of a twin element configuration, both slot and dipole antennas can overcome the problems of losses to surface waves in the substrate. Consequently, they can be made to efficiently radiate to air on these layered dielectric structures. A microstrip feed structure for the twin slot antenna is also presented along with impedance calculations. It is found that the slot antenna has an input impedance that is compatible with existing detectors that operate at the millimeter wave and far infrared frequencies. Measurements of beam patterns and input impedance were made at X-band, and it was found that the models used here agreed reasonably well with the measurements.

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