

**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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DISSERTATION

Presented to the Faculty of the Graduate School of
The University of Texas at Austin
in Partial Fulfillment
of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS

May 1989

Acknowledgements

During my time at UT as a graduate student, I have been very fortunate to have had the opportunity to work with people, both in Team Neikirk and Team Itoh, who are outstanding individuals both personally and professionally, and I would like to thank them for their help during my time here at UT. I would like to thank Chi Yang, and Philip "Ninja" Cheung for their help in showing me how to use the 8510B network analyzer. I would like to thank Doug "Can I borrow this plotter?" Miller for teaching me a great deal about computers and computer programming as well as for the many valuable "Bob and Doug" discussions. I would also like to thank Stu "StuZak" Wentworth for his careful reading and very helpful comments of much of the material in Chapters 3 and 4. Special thanks go to Dr. Francis Bostick for sharing with me his understanding and insights on the subject of wave propagation in a stratified medium (either the earth or a layered substrate). I would like to thank Dr. Edward J. Powers, Dr. Ben G. Streetman, and Dr. Mark F. Hamilton for their help and support, as well as for serving on my supervising committee. I would especially like to thank Dr. Hao Ling and Dr. Tatsuo Itoh for their helpful discussions about many of the aspects of the analysis and the antenna design as well as serving on my supervising committee. I would like to thank my supervising professor, Dr. Dean P. Neikirk, to whom I am deeply indebted, and whose creative insights and suggestions contributed immeasurably to this work. I would like to thank my parents and grandparents for their continued enthusiastic support of my education. I would finally like to thank my fiance Kim Grahm whose support, love, and help made much of this work possible.

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Publication No. _____

Robert Lowell Rogers, PhD

The University of Texas at Austin, 1989

Supervising Professor: Dr. Dean P. Neikirk

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 frequencies. 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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