بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

ANALYSIS AND DESIGN OF DIELECTRIC ROD MILLIMETRIC LEAKY-WAVE ANTENNAS

A Dissertation Submitted to the Electronics and Communications Department, Faculty 0f Engineering, Ain Shams University

For the Degree of Doctor of Philosophy

By

Eng. Mohammed Assem Mohammed El-Muslimany

Egyptian Air Force Research and Development Department

Under the Supervision of

Prof. Dr. Hadia M. S. El-Hennawy

Electronics and Communications Engineering Department, Faculty of Engineering, Ain Shams University

Dr. Essam Abdel-Fattah El-Diwany

Associate Professor, Microwave Engineering Laboratory, Electronics Research Institute

Dr. Hany Amin Ghali

Assistant Professor, Electronics and Communications Engineering Department, Faculty of Engineering, Ain Shams University

1998

«قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْحَكِيمُ »

صدق الله العظيم

«سورة البقرة -آية ٣٢»

EXAMINERS COMMITTEE

Thesis Title: **Analysis and design of dielectric rod millimetric leaky-wave antennas**

By : **Mohammed Assem Mohammed El-Muslimany**

Name, Title and Affiliation **Signature**

1- Prof. Dr. Safwat Mahrous Mahmoud

Professor, Electronics and communications Engineering Department

Faculty of Engineering

Ain Shams University

2- Prof. Dr. Ibrahim Ahmed Salem

Head of Military Technical Collage (previous)

Professor , Electronics and communications Engineering Department

Military Technical Collage

3- Prof. Dr. Hadia M. S. El-Hennawy

Professor , Electronics and communications Engineering Department,

Faculty of Engineering,

Ain Shams University

4- Ass. Prof. Essam Abdel-Fattah El-Diwany

Associate Professor, Microwave Engineering Laboratory

Electronics Research Institute

ACKNOWLEGEMENT

All gratitude is due to Allah. Thence the author wishes to express his deep thanks to the supervisors: Prof. Dr. Hadia El-Hennawy, Dr. Essam Abdel-Fattah El-Diwany, and Dr. Hany Ghali for invaluable assistance and continuous encouragement during the course of the research.

He also wishes to express his thanks to the colleagues of the Electronics Research Institute, and Dr. Safwat El-Nahas, his commander, for their help. Finally, he dedicates this thesis to sole of his father, Allah mercy him.

ABSTRACT

Mohammed Assem Mohammed El-Muslimany, Analysis and Design of Dielectric Rod Millimeteric Leaky-Wave Antennas, A Dissertation Submitted to the Electronics and Communications Department, Faculty Of Engineering, Ain Shams University For the Degree of Doctor of Philosophy, 1998.

Dielectric rod leaky-wave antennas may have applications in the millimeter wave band, for example as omni-directional antennas in the plane normal to the axis , as flush mounted antennas using its symmetry plane along the axis and as frequency scanning antennas with a cone shaped beam. TE, TM and hybrid leaky modes may provide radiation with $\phi-, \theta-$, linear, and circular polarization.

The present work is concerned with the analysis, design and measurement of the antenna consisting of a circular cylindrical dielectric rod covered with periodic circular conducting strips, for TE, TM and hybrid leaky modes. The method of analysis is based on expanding the mode fields in terms of Floquet's harmonics.

A moment method solution (Galerkin's method) is used to solve for the strip currents and/or the slot fields and the complex propagation constant. The choices of the unknown field or current components depends on the propagating mode to obtain numerical convergence. The radiated fields are obtained from fields on the rod surface using Kirchhoff-Huygens radiation formula.

The effects of the different parameters on the angle of the main beam and the attenuation constant are investigated. Such parameters include the frequency, the rod radius, the dielectric constant, the period length and the strip width.

At a certain frequency, the rod radius and the dielectric constant may be chosen such that the dielectric rod surface waves and the dielectric filled metal waveguide modes are above cut off. The period length may

be used mainly to control the beam direction while the strip width may be used to control the attenuation constant, which in turn may be used to control the beam width and the side-lobe level.

The conventional radiation stop band at broadside radiation may be overcome by using double strips or slots .

Verification of the results was made by comparison with published experimental results for the TE case and with laboratory measurements for the hybrid mode, and good agreement was found.