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## EMC AND THE PRINTED CIRCUIT BOARD

*Design, Theory, and Layout  
Made Simple*

**Mark I. Montrose**  
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IEEE Press Series on Electronics Technology  
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The Institute of Electrical and Electronics Engineers, Inc., New York



A JOHN WILEY & SONS, INC., PUBLICATION  
New York • Chichester • Weinheim • Brisbane • Singapore • Toronto

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For ordering and customer service, call 1-800-CALL-WILEY.  
Wiley-Interscience-IEEE ISBN 0-7803-4703-X

Printed in the United States of America.  
10 9 8 7 6 5 4

#### Library of Congress Cataloging-in-Publication Data

Montrose, Mark I.

EMC and the printed circuit board : design, theory, and layout made simple / Mark

I. Montrose.

p. cm. — (IEEE Press series on electronics technology)

"IEEE Electromagnetic Compatibility Society, sponsor."

Includes bibliographical references and index.

ISBN 0-7803-4703-X (alk. paper)

1. Printed circuits—Design and construction. 2. Electromagnetic  
compatibility. I. IEEE Electromagnetic Compatibility Society.

II. Title. III. Series.

TK7868.P7M65 1998

621.3815'31—dc21

98-35408  
CIP

*To my family*

*Margaret,*

*Maralena,*

*and Matthew*

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## Preface

*EMC and the Printed Circuit Board: Design, Theory, and Layout Made Simple* is a companion book to *Printed Circuit Board Design Techniques for EMC Compliance*. When used together, these two books cover all aspects of a PCB design as it relates to both time and frequency domain issues. One must be cognizant that if a PCB does not work as intended in the time domain, frequency domain concerns become irrelevant, especially compliance to international EMC requirements. Time and frequency domain aspects must be considered together.

The intended audience for this book is the same as that for *Printed Circuit Board Design Techniques for EMC Compliance*: those involved in logic design and PCB layout; test engineers and technicians; those working in the areas of mechanical, manufacturing, production, and regulatory compliance; EMC consultants; and management responsible for overseeing a hardware engineering design team.

Regardless of the engineer's specialty, a design team must come up with a product that not only can be manufactured in a reasonable time period, but will also minimize cost during design, test, integration, and production. Frequently, more emphasis is placed on functionality to meet a marketing specification than on the need to meet legally mandated EMC and product safety requirements. If a product fails to meet compliance tests, re-design or rework may be required. This redesign significantly increases costs, which include, but are not limited to engineering manpower (along with administrative overhead), new PCB layout and artwork, prototyping material, system integration and testing, purchase of new components for quick delivery (very expensive), new in-circuit test fixtures, and documentation. These costs are in addition to loss of market share, delayed shipment, loss of customer faith in the company (goodwill), drop in stock price, anxiety attacks, and many other issues. Personal experience as a consultant has allowed me the opportunity to witness these events several times with small startup companies.

My main focus as a consultant is to assist and advise in the design of high-technology products at minimal cost. Implementing suppression techniques into the PCB design saves money, enhances performance, increases reliability, and achieves first-time compliance with emissions and immunity requirements, in addition to having the product function as desired.

Working in this industry has allowed me to participate in state-of-the-art designs as we move into the future. Although my focus is on technology of the future, one cannot