

Michel Mardiguian  
*Contributions by*  
Donald L. Sweeney  
Roger Swanberg

# Controlling Radiated Emissions by Design

*Third Edition*



Springer

# Controlling Radiated Emissions By Design

**John Scott, Clinton Van Zyl**



## **Controlling Radiated Emissions By Design:**

**Controlling Radiated Emissions by Design** Michel Mardiguian, 2001 In all possible industrial military and household personal applications the number of digital devices operating with data rates of hundreds of Megabits using processor chips with Gigahertz clocks has increased astronomically At the same time a myriad of popular RF receivers like portable telephones laptop PCs with integrated wireless modems wireless Internet and other electronic devices are becoming ubiquitous such that the number of sensitive licit receivers operating within a square kilometer of an urban area can be counted in tens of thousands In the crowded space that they share the conjunction of both events is increasing the number of potential interference situations especially in the upper VHF and UHF regions where spurious radiations are most difficult to contain There is in addition a growing although controversial concern about the possible health hazard caused by long exposure to near fields of low power radio transmitters All these aspects result in a continuous effort for lowering RF radiations This new edition of *Controlling Radiated Emissions by Design* retains the step by step approach for incorporating EMC into every new design from the ground up Quite different from other classical EMC books it approaches the problem from a development engineer's viewpoint starting with the selection of quieter IC technologies their implementation into a noise free printed circuit layout and the gathering of all these into a low radiation packaging including I/O filtering connectors and cables considerations Equally far from a cookbook of recipes all guidelines are supported by thorough but relatively easy and comprehensive calculated examples allowing a quantitative design instead of purely qualitative New to this edition is material on surface mount techniques IC's ground bounce random versus periodic frequency spectra and recent progress in low cost ferrite and filter components Also included is detailed information on radiation from high speed chips e.g. Pentium 200 MHz and the efforts by some manufacturers to reduce it The book has numerous tables all of which have been updated to reflect the latest changes in the field including a brief overview of the U.S. and worldwide emission tests *Controlling Radiated Emissions by Design* is an invaluable tool for helping design engineers EMC specialists and technicians develop more efficient and economical control of emissions

**Controlling Radiated Emissions by Design** Michel Mardiguian, 2014-05-28 The 3rd edition of *Controlling Radiated Emissions by Design* has been updated to reflect the latest changes in the field New to this edition is material on aspects of technical advance specifically long term energy efficiency energy saving RF pollution control etc This book retains the step by step approach for incorporating EMC into every new design from the ground up It describes the selection of quieter IC technologies their implementation into a noise free printed circuit layout and the gathering of all these into low radiation packaging including I/O filtering connectors and cables considerations All guidelines are supported by thorough and comprehensive calculated examples Design engineers EMC specialists and technicians will benefit from learning about the development of more efficient and economical control of emissions

**Controlling Conducted Emissions by Design** John C. Fluke, 1991-01-17 This book presents a useful way to

design in electromagnetic compatibility EM C EMC design considerations are often an addendum to the design These Band Aid fixes are not the best approach most of the time but are all that is possible at a late stage in the design and development process This book is not the classic EMI fix cookbook it is intended for all electronics design engineers The analytical tools presented enable the designer to address EMC considerations early in the design process Power conversion engineers will find the enclosed information especially important because of the inherent conducted emissions problems in power conversion equipment Switching power supplies are commonly the most significant noise generators in electronic systems In most design work if the conducted emission problem is addressed good layout and packaging will ensure that the conducted and radiated electromagnetic interference EM requirements are met The EMI process involves three components source path and victim These elements are easily modeled on the computer The methods of modeling and analysis on the computer are the essence of this book The EMI source is analyzed using the FFr and the results are applied to a computer model of the path and victim test setup The resulting currents are measured and compared to a standard

Electromagnetic Compatibility (EMC) Design and Test Case Analysis Junqi Zheng, 2019-02-11 A practical introduction to techniques for the design of electronic products from the Electromagnetic compatibility EMC perspective Introduces techniques for the design of electronic products from the EMC aspects Covers normalized EMC requirements and design principles to assure product compatibility Describes the main topics for the control of electromagnetic interferences and recommends design improvements to meet international standards requirements FCC EU EMC directive Radio acts etc Well organized in a logical sequence which starts from basic knowledge and continues through the various aspects required for compliance with EMC requirements Includes practical examples and case studies to illustrate design features and troubleshooting Author is the founder of the EMC design risk evaluation approach and this book presents many years experience in teaching and researching the topic

The Electronic Packaging Handbook Glenn R. Blackwell, 2017-12-19 The packaging of electronic devices and systems represents a significant challenge for product designers and managers Performance efficiency cost considerations dealing with the newer IC packaging technologies and EMI RFI issues all come into play Thermal considerations at both the device and the systems level are also necessary The Electronic Packaging Handbook a new volume in the Electrical Engineering Handbook Series provides essential factual information on the design manufacturing and testing of electronic devices and systems Co published with the IEEE this is an ideal resource for engineers and technicians involved in any aspect of design production testing or packaging of electronic products regardless of whether they are commercial or industrial in nature Topics addressed include design automation new IC packaging technologies materials testing and safety Electronics packaging continues to include expanding and evolving topics and technologies as the demand for smaller faster and lighter products continues without signs of abatement These demands mean that individuals in each of the specialty areas involved in electronics packaging such as electronic mechanical and thermal designers and

manufacturing and test engineers are all interdependent on each others knowledge The Electronic Packaging Handbook elucidates these specialty areas and helps individuals broaden their knowledge base in this ever growing field *The Electronics Handbook* Jerry C. Whitaker, 2018-10-03 During the ten years since the appearance of the groundbreaking bestselling first edition of The Electronics Handbook the field has grown and changed tremendously With a focus on fundamental theory and practical applications the first edition guided novice and veteran engineers along the cutting edge in the design production installation operation and maintenance of electronic devices and systems Completely updated and expanded to reflect recent advances this second edition continues the tradition The Electronics Handbook Second Edition provides a comprehensive reference to the key concepts models and equations necessary to analyze design and predict the behavior of complex electrical devices circuits instruments and systems With 23 sections that encompass the entire electronics field from classical devices and circuits to emerging technologies and applications The Electronics Handbook Second Edition not only covers the engineering aspects but also includes sections on reliability safety and engineering management The book features an individual table of contents at the beginning of each chapter which enables engineers from industry government and academia to navigate easily to the vital information they need This is truly the most comprehensive easy to use reference on electronics available *Testing for EMC Compliance* Mark I. Montrose, Edward M. Nakauchi, 2004-04-08 The Keep It Simple KISS philosophy is the primary focus of this book It is written in very simple language with minimal math as a compilation of helpful EMI troubleshooting hints Its light hearted tone is at odds with the extreme seriousness of most engineering reference works that become boring after a few pages This text tells engineers what to do and how to do it Only a basic knowledge of math electronics and a basic understanding of EMI EMC are necessary to understand the concepts and circuits described Once EMC troubleshooting is demystified readers learn there are quick and simple techniques to solve complicated problems a key aspect of this book Simple and inexpensive methods to resolve EMI issues are discussed to help generate unique ideas and methods for developing additional diagnostic tools and measurement procedures An appendix on how to build probes is included It can be a fun activity even humorous at times with bizarre techniques i e the sticky finger probe *EMC at Component and PCB Level* Martin O 'Hara, 1998-04-08 This book provides the knowledge and good design practice for the design or test engineer to take the necessary measures to improve EMC performance and therefore the chance of achieving compliance early on in the design process There are many advantages for both the component supplier and consumer of looking at EMC at component and PCB level For the suppliers not only will their products have the competitive edge because they have known EMC performance but they will be prepared should EMC compliance become mandatory in the future For consumers it is a distinct advantage to know how a component will behave within a system with regard to EMC Shows how to achieve EMC compliance early on in the design process Provides the knowledge to trace system EMC performance problems Follows best design practices **Electronic**

**Enclosures, Housings and Packages** Frank Suli, 2018-11-01 Electronic Enclosures Housings and Packages considers the problem of heat management for electronics from an encasement perspective It addresses enclosures and their applications for industrial electronics as well as LED lighting solutions for stationary and mobile markets The book introduces fundamental concepts and defines dimensions of success in electrical enclosures Other chapters discuss environmental considerations shielding standardization materials selection thermal management product design principles manufacturing techniques and sustainability Final chapters focus on business fundamentals by outlining successful technical propositions and potential future directions

**Electromagnetic Compatibility Handbook** Kenneth L. Kaiser, 2004-09-29 As the number of electrical devices in use continues to grow so do the challenges of ensuring the electromagnetic compatibility EMC of products and systems Fortunately engineers have at their disposal an array of approximations models and rules of thumb to help them meet those challenges Unfortunately the number of these tools and guidelines is overwhelming and worse still is the thought of investigating their origins and confirming their results The Electromagnetic Compatibility Handbook is an unprecedented compilation of the many approximations guidelines models and rules of thumb used in EMC analyses complete with their sources and their limitations The book presents these in an efficient question and answer format and incorporates an extremely comprehensive set of tables and figures The author has either derived from basic principles or obtained and verified from their original sources all of the expressions in the tables Mathcad was used to generate most of the plots and solve many of the equations and the author includes the Mathcad programs for many of these so users can clearly see the variable assignments assumptions and equations Designed to be of long lasting value to engineers researchers and students the Electromagnetic Compatibility Handbook is ideal both for quick reference and as a textbook for upper level and graduate electrical engineering courses

Electromagnetic Shielding Kenneth L. Kaiser, 2005-09-13 In chapters culled from popular and critically acclaimed Electromagnetic Compatibility Handbook Electromagnetic Shielding provides a tightly focused convenient and affordable reference for those interested primarily in this subset of topics Author Kenneth L Kaiser demystifies shielding and explains the source and limitations of the approximations guidelines models and rules of thumb used in this field The material is presented in a unique question and answer format that gets straight to the heart of each topic The book includes numerous examples and uses Mathcad to generate all of the figures and many solutions to equations In many cases the entire Mathcad program is provided

*Electromagnetic Compatibility* Yang Zhao, Wei Yan, Jun Sun, Mengxia Zhou, Zhaojuan Meng, 2022-01-01 This book highlights principles and applications of electromagnetic compatibility EMC After introducing the basic concepts research progress standardizations and limitations of EMC the book puts emphasis on presenting the generation mechanisms and suppression principles of conducted electromagnetic interference EMI noise radiated EMI noise and electromagnetic susceptibility EMS problems such as electrostatic discharge ESD electric fast transient EFT and surge By showing EMC case studies and solved examples the book provides effective

solutions to practical engineering problems Students and researchers will be able to use the book as practical reference for EMC related measurements and problem solution      *Transmission Lines, Matching, and Crosstalk* Kenneth L.

Kaiser,2005-09-20 In chapters culled from the popular and critically acclaimed Electromagnetic Compatibility Handbook *Transmission Lines Matching and Crosstalk* provides a tightly focused convenient and affordable reference for those interested primarily in this subset of topics Author Kenneth L Kaiser demystifies transmission lines matching and crosstalk and explains the source and limitations of the approximations guidelines models and rules of thumb used in this field The material is presented in a unique question and answer format that gets straight to the heart of each topic The book includes numerous examples and uses Mathcad to generate all of the figures and many solutions to equations In many cases the entire Mathcad program is provided      Signal and Power Integrity--simplified Eric Bogatin,2010 With the inclusion of the two new hot topics in signal integrity power integrity and high speed serial links this book will be the most up to date complete guide to understanding and designing for signal integrity      *Introduction to EMC* John Scott,Clinton Van Zyl,1997-09-04 This is the clear guide for non specialists to electromagnetic compatibility EMC the effects of electromagnetic radiation and the European EMC Directive which is now in force This book helps by explaining the basic principles of EMC how it may be controlled in practice through filtering shielding appropriate printed circuit board design and other means Electrostatic discharge ESD and surge protection are discussed The growing concern about the effects of electromagnetic waves and fields on health are examined in detail This introduction provides beginners technical and non technical alike with a basic guide to the principles of EMC This will prove essential reading for the thousands of people close to despair giving them the underlying insight in clear words that is needed to comply with the EMC Directive and therefore opens the door to continued trading in Europe and the World Beginner s guide to EMC ideal for non technical staff Vital for all businesses who export to either Europe or the rest of the world      Review of Radio Science W. Ross Stone,2002-08-12 A triennial summation of the state of the art in radio science This book is the fourth in the modern series of triennial reviews prepared by the International Union of Radio Science to further communication and understanding of the status and future of radio science both for those working in the field and for those who want to know what is of current importance in this area The International Union of Radio Science URSI Union Radio Scientifique Internationale has divided the subject of Radio Science according to the ten topics of the Scientific Commissions that make up URSI This volume consists of thirty eight original peer reviewed papers Each paper provides a critical in depth review of and in many cases tutorial on advances and research that have been of significant importance within the area of interest of the Commissions during the past three to four years Among the topics covered are Electromagnetic metrology Fields and waves Signals and systems Electronics and photonics Electromagnetic noise and interference Wave propagation and remote sensing Ionospheric radio and propagation Waves in plasmas Radio astronomy Electromagnetics in biology and medicine With an included CD ROM of the full book text allowing the user to do

full text searching of all the papers the Review of Radio Science 1999 2002 is a resource of vital importance to anyone working in or with an interest in radio science

**Platform Interference in Wireless Systems** Kevin Slattery, Harry Skinner, 2011-04-08 Intra system EMC problems are becoming increasingly common in mobile devices ranging from notebook PCs to cell phones with RF wireless capabilities These issues range from minor annoyances to serious glitches which impede the functioning of the device This book gives a thorough review of electromagnetic theory including Maxwell's equations discusses possible sources and causes of intra system interference shows to use models and analysis to discover potential sources of intra system EMC in a design how to use appropriate tests and measurements to detect intra system EMC problems and finally extensively discusses measures to mitigate or totally eliminate intra system EMC problems With more and more mobile devices incorporating wireless capability often with multiple wireless systems such as Bluetooth and WiFi this book should be part of the reference shelf of every RF wireless engineer and mobile device designer Addresses a growing problem in RF wireless devices interference created inside the devices which impair their operation Covers devices ranging from laptop PCs to mobile phones to Bluetooth headsets Explains the sources of such intra system interference how to detect and measure such interference design techniques for mitigating the interference and proven techniques for eliminating the interference

**Electro Static Discharge** Michel Mardiguian, 2011-09-20 A thorough and concise treatment of ESD Recognizing its methodic step by step attack of the electrostatic discharge ESD problem the initial release of this book was quoted by specialists as the most thorough and concise treatment of the broad ESD continuum that is available Now in its Third Edition this book delivers the same trusted coverage of the topic while also incorporating recent technological advances that have taken place in the engineering community The book begins with the basics of ESD for humans and objects and goes on to cover Effects of ESD coupled to electronics Principal ESD specifications ESD diagnostics and testing Design for ESD immunity To help with troubleshooting many ESD case histories are given along with their successful fixes Electrostatic Discharge is essential reading for all designers who want to avoid component failures no trouble found incidents and random errors

**Switching Power Supplies A - Z** Sanjaya Maniktala, 2006-06-22 The design of Switching Power Supplies has become one of the most crucial aspects of power electronics particularly in the explosive market for portable devices Unfortunately this seemingly simple mechanism is actually one of the most complex and under estimated processes in Power Electronics Switching power conversion involves several engineering disciplines Semiconductor Physics Thermal Management Control Loop theory Magnetics etc and all these come into play eventually in ways hard for non experts to grasp This book grows out of decades of the author's experience designing commercial power supplies Although his formal education was in physics he learned the hard way what it took to succeed in designing power supplies for companies like Siemens and National Semiconductor His passion for power supplies and his empathy for the practicing or aspiring power conversion engineer is evident on every page The most comprehensive study available of the



theoretical and practical aspects of controlling and measuring Electromagnetic Interference in switching power supplies including input filter instability considerations Step by step and iterative approach for calculating high frequency losses in forward converter transformers including Proximity losses based on Dowell s equations Thorough yet uniquely simple design flow chart for building DC DC converters and their magnetic components under typical wide input supply conditions Step by step solved examples for stabilizing control loops of all three major topologies using either transconductance or conventional operational amplifiers and either current mode or voltage mode control      **Applied Embedded Electronics** Jerry Twomey,2023-11-14 And Conclusions Further Reading Chapter 3 Robust Digital Communication Digital Signals Physical Considerations and Connections Limitations of Ground Referenced Digital Signals Low Voltage Differential Signaling Organizing Interconnects for Speed and Signal Integrity Lumped Versus Distributed Networks Clock Distribution Digital Communication Parallel Versus Serial Ports Clocking Methods for Serial Ports Starting Edge Synchronization Parallel Clock Manchester Code Self Clocking Embedded Clock and Run Length Limited Codes

## The Enigmatic Realm of **Controlling Radiated Emissions By Design**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing lacking extraordinary. Within the captivating pages of **Controlling Radiated Emissions By Design** a literary masterpiece penned by way of a renowned author, readers attempt a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book's core themes, assess its distinct writing style, and delve into its lasting affect the hearts and minds of people who partake in its reading experience.

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