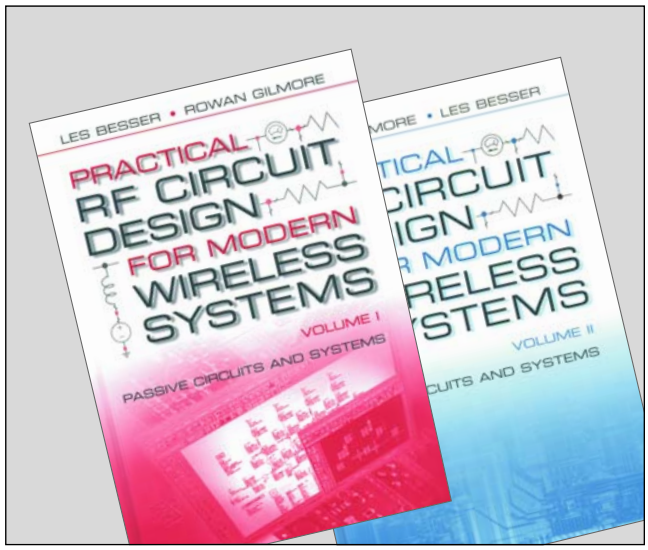
Practical RF Circuit Design for Modern Wireless Systems

Volume I—Passive Circuits and Systems, by Les Besser and Rowan Gilmore
Volume II—Active Circuits and Systems, by Rowan Gilmore and Les Besser

Reviewed by Guillermo Gonzalez
University of Miami, Dept. of Electrical and Computer Engineering

This two-volume set of books was written by two well-known lecturers in the RF and microwave field, who have many years of teaching experience. Their goal was to provide a practical exposition of RF/MW circuit design that appealed to students, academicians, and design engineers. They certainly succeeded. The reader will find that fundamental and advanced principles are properly explained with emphasis in CAD techniques. While the mathematical manipulations are kept to a minimum, the associated results are well-referenced and extensively discussed.



Practical RF Circuit Design for Modern Wireless Systems—Volume I, Passive Circuits and Systems
By Les Besser and Rowan Gilmore
Publisher: Artech House, 2003, 539 pages

Practical RF Circuit Design for Modern Wireless Systems—Volume II, Active Circuits and Systems
By Rowan Gilmore and Les Besser
Publisher: Artech House, 2003, 569 pages

Volume I—Passive Circuits and Systems

This volume focuses mainly on passive circuits and systems. The first two chapters provide a review of RF/MW circuit fundamentals. The emphasis is placed on topics related to RF/MW circuits, such a resonance, series and parallel conversions, quality factor, power transfer, transmission lines, reflection coefficients, and mismatch loss. Chapter 3 describes several radio systems and illustrates how the system's specifications relate to the various individual components. The receiver's characteristics are discussed, such as receiver noise and sensitivity, nonlinearities and dynamic range, and automatic control. The chapter includes the analysis of a CDMA handset from a system point of view. Chapters 4 and 5 describe the use of S parameters, the Smith chart, impedance matching networks, and bandwidth considerations. Many impedance matching design examples are provided with their associated frequency responses. Both lumped and microstrip matching circuits are considered. Chapter 6 shows the use of CAD programs for RF/MW circuit design. This chapter underlines the major key areas in CAD, such as linear circuit analysis, electromagnetic simulation, tuning, synthesis, optimization, non-linear simulations, and statistical techniques. Passive component models are discussed in Chapter 7, which include RLC components, distributed components, transformers, crystals, dielectric resonators, and surface acoustic wave resonators. The authors show how actual parts affect the behavior of a design, and how to account for them in the final product. Chapter 8 gives an overview of passive filters and the techniques used for their design in the RF/MW area. Such topics as the Richards' transformation, Norton transformations, and Kuroda identities are discussed. Chapter 9 is an overview of the major differences and similarities between RF and high-speed digital systems.

Volume II—Active Circuits and Systems

This volume focuses mainly on active circuits and systems. The volume begins with a discussion of linear RF/MW amplifier design techniques. The first two chapters deal with stability conditions, stability circles and the various design techniques for transducer gain, operating power gain, and associated gain. Material in low-noise amplifier design and broadband techniques is included, as well as DC considerations. Chapter 3 dis-

cusses the modeling of the actual devices (such as BJT, GaAs, HETM, etc.). Chapter 4 deals with nonlinear CAD simulations techniques, and their uses. Time and frequency domain methods are discussed and compared. A good discussion of the harmonic balance method is given, including a section on harmonic balance simulation of oscillators. Chapter 5 considers the topic of power transistor amplifiers. The categories of amplifiers are presented and the topics of bias considerations, distortion reduction and predistortion are included. The chapter includes a detailed power amplifier design. Oscillators are discussed in Chapter 6, with emphasis on the negative resistance design approach and CAD simulations. A section is devoted to the description of phase noise. Several design examples are included. An interesting example uses a ceramic resonator, another example involves a crystal resonator, and one example deals with a Colpitts VCO using a varactor diode. Chapter 7 deals with mixers and frequency multipliers. The authors discuss diodes and transistor mixers and their effect on the overall system. The final chapter gives an overview of several wireless systems.

The material covered in these two volumes extends from the basic to the advance. The texts are suitable for short courses in RF/MW circuits, since they provide a comprehensive description of the RF/MW circuit design field. They are also suitable for a course (or courses) at the senior/graduate level in the RF/MW field. The books strongly emphasize design and the use of CAD techniques. Enough information is provided in their CAD examples that the simulations can easily be implemented with one of the major CAD programs available for RF/MW circuits.

These texts contain a tremendous amount of information for RF/MW circuit designers. Especially, for those working in wireless communications. Discrete design is covered in detail-from the individual component specification to the overall system performance. The presentation is clear and well organized. It certainly makes for a good addition to the designer's library.

From February 2004 *High Frequency Electronics*