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Text Explains Standards And GaN-based Circuits For Wireless Power

Wireless Power Handbook: The eGaN FET Journey Continues, a supplement to *GaN Transistors for Efficient Power Conversion*, First Edition, Alex Lidow, *et. al.*, Michael A. de Rooij, Power Conversion Publications, El Segundo, CA, 2015, 126 pages in color, paperback, ISBN 978-0-692-37192-3.

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The emergence of (eGaN) MOSFETs led to publication of *GaN Transistors for Efficient Power Conversion*, which was reviewed previously in the June 2012 issue of How2Power Today. This supplement focuses on wireless power, which represents an emerging application area for GaN MOSFETs such as those made by the authors' company, EPC.

The preface begins, "Since Nikola Tesla first experimented with wireless power during the early years of the 20th century, there has been a quest to "cut the cord" of electrical power—and go wireless!" With the vast increase in mobile, battery-operated devices, the next logical step is to rid them of batteries and power them with magnetic fields. Although many current applications for wireless power revolve around wireless charging of batteries, this book did not address battery charging, leaving the impression that the discussion related to transmitting power for real-time use.

Three standards for such wireless systems have emerged and this book describes them with a GaN MOSFET-eye view. Consequently, transmitter amplifier (class D and E) topologies are given a chapter and FET selection is the topic of another. Practical design information continues in the chapter, "Experimental Verification" such as how to impedance-match pickup coils, which continues in the succeeding chapter. Because magnetic fields are in the near field, resonant coupling of inductances is the means of conveying power from transmitter to receiving unit. Near fields imply lower frequencies for a WiFi range, and the coupling usually involves a loosely-coupled resonant circuit of the transmitter loop antenna with the receiver loop coil.

Are magnetic fields safe? The author cites an *IEEE Transaction* paper telling us they are so. Yet the whole matter of electromagnetic radiation, even in the near-field, and health is an ongoing research topic about which there is still plenty of controversy.

The book includes discussion of EMI design problems (not issues) relative to regulatory constraints in the U.S. and EU. The limits are in two categories for both: radiated emission and human exposure. The A4WP standard uses 6.78 MHz (in the ISM band). The relative merits of the three standards (Qi, PMA and A4WP) are discussed. Qi and PMA operate at the lower frequency range of 100 kHz to 315 kHz, enabling a multi-mode scheme for complementary use of the three standards, though system cost is increased by it. The book ends with its central theme: power FET circuits, especially in a communications sense. For what is "communicated" in this case is not signals but power.

This little book contains its share of information on wireless power to be worth having a copy if you are a circuit designer that has any interest in the subject at all. It might not appeal to the cult followers of Tesla, but for engineers, it gives a detailed overview of the whole of what is involved nowadays in wireless power. The book is profusely illustrated, with many color illustrations, including thermal pictures of some of the circuits discussed in it. The book has a little math and mostly circuit diagrams, waveform plots, tables and charts, and photos of boards in both the human optical and thermal (IR) ranges.

About The Author

Dennis Feucht has been involved in power electronics for 25 years, designing motor-drives and power converters. He has an instrument background from Tektronix, where he designed test and measurement equipment and did research in Tek Labs. He has lately been doing current-loop converter modeling and converter optimization.

To read Dennis' reviews of other texts on power supply design, magnetics design and related topics, see How2Power's Power Electronics Book Reviews.