MedTech Unplugged: A Q&A on Wireless Charging

By Lee Goldberg, Editor

Wireless charging isn't just for cell phones anymore. Thanks to its convenience, reliability and ease of use, the technology is rapidly finding applications in everything from power tools to household appliances. Contact-free charging also holds great promise for medical applications. For example, wireless charging can eliminate the need for patients with pacemaker implants to periodically undergo the risk and expense of an operations to remove and replace the unit's battery. Designers are also discovering that inductively-charged care and treatment equipment eliminates failure-prone power connectors and can be sterilized more easily and thoroughly.

To help you get better acquainted with wireless charging, MDT invited George Gerwe, a director of business development at RRC power solutions Inc. (*www.rrc-wireless-power.com*), to give us a quick tutorial on the technology.

During his 28-year career, Mr. Gerwe has also held several positions with ICC, Think Outside, Iomega, Energizer Power Systems a Division of Eveready Battery Company, Gates Energy Products and Power-Sonic Corporation. He earned a B.A. degree from the University of Iowa.

MDT: *Are there any medical applications where wireless charging is especially useful?*

GG: Yes! In talking with a leading medical infusion pump manufacturer and a worldwide manufacturer of patient monitors, they both noted that the #1 reason for failure and/or service of their device is due to the connector. In these cases, either the connector has prematurely failed due to overuse and/or abuse OR the ingress of fluids into the unit. Having a completely sealed unit will allow these companies to eliminate a significant portion of repair and service downtime. This is just one simple example, and there are many more.

MDT: *Are there any types of applications where wireless charging technology is not recommended?*

GG: We are not working on medical implanted solutions. That requires a much different design and focus, and there are other firms working in this area. We are focusing on medical devices – equipment, handheld solutions, patient monitors, etc. All of those devices are an excellent fit for wireless power.

MDT: *What are the design issues which affect the efficiency of power transfer between the transmitter and receiver?*

GG: We believe the alignment of the coils to be a critical factor in a medical design. Not only must you be conscious of the vertical

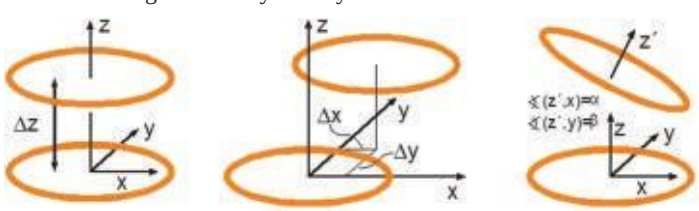

Fig. 1: From left to right: vertical alignment, lateral alignment, and angular alignment

alignment, but also the lateral and angular alignment as well. Ensuring consistent coil alignment is critical to coil pairing, efficiency and power delivery. (Fig. 1)

MDT: *What are the safety standards governing wireless charging in medical applications, and what design challenges do they impose?*
GG: The same safety standards that govern wired power solutions are also requirements for wireless systems. You will need to meet medical safety standards in regards to EMC, EMI, EMF, etc. There's a thick alphabet soup of EMC and safety standards governing these devices, but the ones you'll refer to most frequently include:

- FCC 47CFR part 15B and 18
- EN 61000-6-1, 6-3
- CISPR 11, 14, 16, 22
- IEC/EN/UL 60950-1
- IEC/EN/UL 60601-1

One of the many benefits of wireless power is that it inherently provides electrical isolation between the patient and the device. This completely eliminates an issue which can frequently be a problem for medical device designs.

MDT: *Is there a set of standards used to define wireless charging interfaces?*
GG: Yes, there are two main camps today:

- **Wireless Power Consortium** (Qi standard), which uses close proximity inductive coupling as well as magnetic resonance solutions. You can see more information at the following link: *www.wirelesspowerconsortium.com*
- **AirFuel Alliance**, which is a merg- er of the Alliance for Wireless Power (A4WP) and the Power Matters Alliance (PMA), comprised of technologies from magnetic resonance and inductive coupling. You can see more information on AirFuel Alliance at the following link: *http://airfuel.org/*
- Other things you should know:
  - o Inductive coupling has a higher overall efficiency and requires a tighter tolerance for the alignment of Tx and Rx coils (up to 7mm distance).
  - o Magnetic resonance has a greater alignment tolerance/distance, up to 5cm, but also has lower efficiency.

The power transmission frequency used by magnetic resonance solutions is 6.78MHz.

MDT: *If there is there more than one set of standards, how does one choose between them?*
GG: It depends on the application and requirements. We at RRC work with inductive coupling (close proximity) solutions.

Ask an Expert

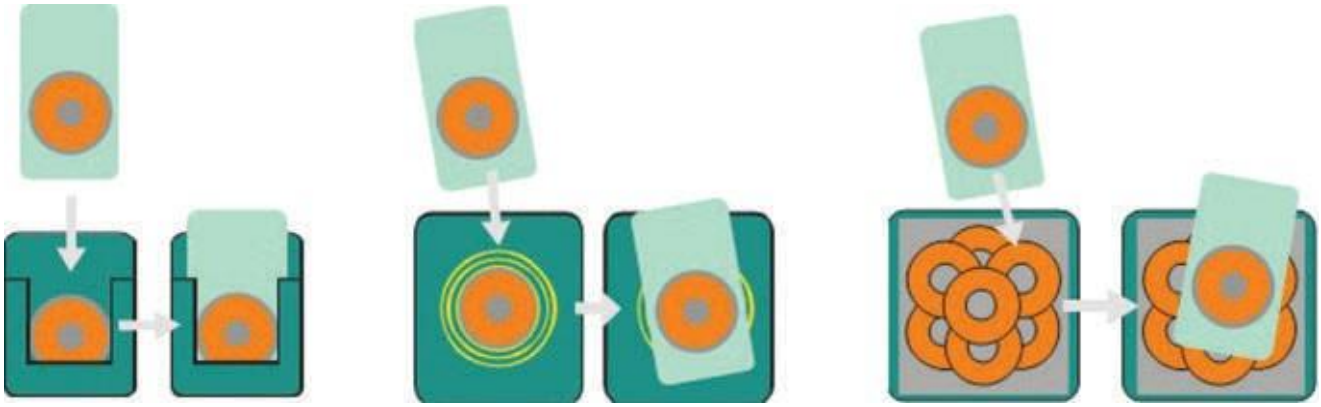

Fig. 2: From left to right: fixed positioning, guided positioning, and free positioning

Coils can be placed at a distance from 3 to 10mm. Ideally, for a highly efficient solution, 4-6m distance is best. For example, we have developed an 18W solution that is 87% efficient. There are other solutions, such as magnetic resonance, that allow a greater distance between the coils and for alignment. However, they will also offer lower efficiency. It just depends on your design requirements, power and specific needs. Can a distance of 4-6mm work? Do you need high efficiency? This will help guide your decisions.

MDT: *Are there any other important design issues that our readers should know about?*

GG: Yes, another important factor is to ensure that the coil docking and alignment can be controlled. We call this positioning, where to ensure high efficiency, we recommend that a designer continues to dock or "fix" a device into the charging station. Or you can guide the position into the proper location by using a mechanical method or even a magnet. (Fig. 2) Finally, you can

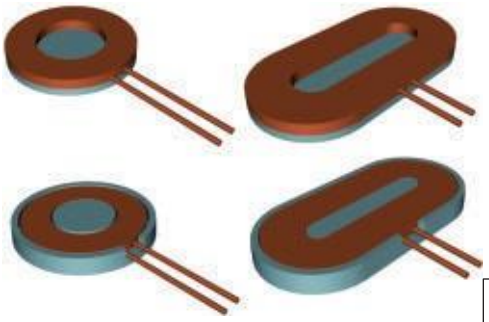

Fig. 3: Examples of cylinder and oval planar and potted coils

utilize free placement on a mat or surface for alignment and charging. The highest efficiency design is the fixed, with the lowest is free.

Another important factor is the coil shape, thickness, shielding, etc. to improve the coupling factor variation, and to shape the magnetic field. (Fig. 3)

Another benefit we provide at RRC is that we have also developed some standard battery solutions, which are off-the-shelf, high capacity smart batteries in a finished plastic enclosure. These simplify powering a portable device as they also have all of the worldwide certifications.

MDT: *Where can our readers go for more information on designing wireless charging systems for medical applications?*

GG: Yes, with semiconductor solutions from TI, Qualcomm and IDT, it is now easier than ever to develop a wireless power solution. The big challenge is finding the right partner who has the experience with modifying or customizing a solution to meet your requirements.

Here are a few websites where you can go for additional information:

- **The Wireless Power Consortium**: *www.wirelesspowerconsortium.com*
- **The AirFuel Alliance**: *www.airfuel.org*
- **RRC Wireless Power:**
- *www.rrc-wireless-power.com*
- **Texas Instruments' wireless power solutions home page**: *http://bit.ly/1SVCdJs* MDT

"Wireless charging enables the creation of a completely sealed unit that eliminates the repair and service downtime associated with connectors."