Wireless charging: An interview with the Alliance for Wireless Power

Chris Warner, Executive Editor

 Wireless power is slowly evolving to help make charging second-nature to the consumer. In Japan, for instance, several portable devices are available that support wireless charging.[1] As more portable devices that offer wireless charging capabilities enter the market, the need for standards naturally will follow. Organizations have emerged to help grow the market and provide standards for designers, which include the Alliance for Wireless Power (A4WP), and The Wireless Power Consortium's Qi (pronounced "chee") Specification. To find out more about wireless power, the new standards and what they mean for the designer, I posed some questions to Dr. Kamil Grajski, President of A4WP.

ECN: Can you describe the main benefits of the specification for designers?

KG: For the consumer electronics industry, the A4WP specification takes advantage of broadly adopted wireless technologies, such as Bluetooth LE, which will allow manufacturers to minimize hardware requirements. For industrial designers, the A4WP specification leverages a near-field magnetic resonance technology that provides more flexibility for charging applications to be installed into automobiles, furniture and other surfaces.

 **ECN**: Can you describe the main benefits of the specification for the consumer/end user?

KG: For consumers, the A4WP specification supports simultaneous charging of multiple devices with widely differing power requirements such as handsets, Bluetooth headsets, MP3 players, GPS devices and mobile tablets. Also for consumers, the A4WP delivers “spatial freedom” which means that users can “drop & go” multiple devices onto the charging surface without the hassle of individually lining-up or snapping into place the devices to be charged. Beyond immediate consumer electronics applications, such spatial freedom or drop & go capability may play very well into the design of next-generation home healthcare and outpatient monitoring devices where, for reasons of hygiene and ergonomics, completely sealed devices are preferred.

ECN: Can you describe the technology behind the specification and what makes it unique?

KG: The specification is based on non-radiative, near-field magnetic resonance, or loosely-coupled (LC) wireless power transfer (WPT) defined in a CEA-published glossary of terms as “… resonant wireless transfer of power… through magnetic induction between… coil(s) where the coupling factor (k) can be less than 0.1, though values up to 1 may also be supported, and where the system requires [coupled] magnetic resonance.” What makes the technology unique is that its application demands that the designer explicitly address impedance matching between the charger and device to be charged. In contrast, in the case of classic magnetic induction, or so-called tightly-coupled solutions, there is no need for impedance matching as the charger and device to be charged are held in extremely close proximity, where even the slightest rotational or translational shift causes power transfer and efficiency to drop significantly. Ultimately, this difference between tightly-coupled (a first-generation WPT technology) and loosely-coupled (a

second-generation WPT technology) is the above-described improvement in user experience owing to spatial freedom.

ECN: Given the wide variety of mobile devices – now and in the future – how is the amount of design requirements for the mobile device kept to a minimum?

KG: The amount of design requirements of for the mobile device are kept to a minimum by leveraging as much as practical existing antennas, RF circuitry and communications mangaement software stacks. For example, the A4WP specification leverages the Bluetooth LE (Generic Attribute Framework) for the WPT session and power management protocols. Similarly, the A4WP specification is a true interoperability specification in that the system reference model identifies a core set of interfaces and core set of parameters whose behavior (operating ranges) are specified in details. In such a case, details of the implementation on either side of these interfaces is left to the designer. This is to allow each OEM to uniquely leverage their existing and future implementations for the optimal embedded design.

ECN: What should the designer know about the communications interface between the base station and mobile device?

KG: The A4WP profile utilizes the Bluetooth 4.0 Generic Attribute (GATT) framework. At the level of user experience this means that the consumer is not required to implement manual “pairing” of PTU and PRU. Figure 5 indicates the respective roles of PTU as a GATT Client/Server and PRU as a GATT Server

ECN: What environmental considerations (ie., interference) should the designer be aware of when designing to your specifications?

KG: What the designer should be aware of is that there is a broad and well-defined applicable Regulatory framework. That framework includes issues of RF emissions (i.e., as regulated in the USA by FCC Part 15 and Part 18) and RF exposure (i.e., as regulated ICNIRP 1998 and ICNIRP 2010 which set limits on induced current, induced electric fields and specific absorption rate (SAR) in biological tissue. One direct impact to the designer is the operating frequency. A4WP has selected 6.78MHz (an internationally identified band for industrial, scientific and medical equipment (ISM)) as the WPT operating frequency specifically with regards to RF emissions and RF exposure compliance. Another direct impact to the designer is on the maximum output power delivered to the power transmitter (e.g., charger). Today, the A4WP has defined chargers with a maximum output power of 22W – sufficient to accommodate the simultaneous charging of several smartphones, cellphones and/or Bluetooth headsets. Though not yet fully and formally defined for WPT, the existing global Regulatory framework appears to have set an informal guideline that WPT for consumer electronics applications as below 50W.

ECN: Will wireless charging of low power devices already on the market be affected in any way?

KG: The A4WP specification gives integrators and manufacturers that clear path

forward to integrate wireless charging into almost any type of mobile device or surface.

ECN: Describe the certification process for new designs and what kind of help will your organization offer designers toward that end?

KG: As its first priority, the A4WP is focused on bringing the promise of spatial freedom based on non-radiative, magnetic resonance technology to the cellphone and smartphone industry. It is worthwhile to note that members of the A4WP comprise the vast majority of suppliers of power management components, circuits and modules to the mobile phone market. So, development of an interoperability specification was task #1. The A4WP is now focused on developing a technical and logo Certification program to the market. The A4WP has established a Certification Working Committee that recently approved a Framework document. This document is based on recognized international standards for Certification Programs. Among the key elements described are the independent Certification Authority, the process of Laboratory Authorization and the role of Test Equipment. The A4WP anticipates progress on the Certification program through 1HCY12 culminating in a set of plugfests for A4WP member companies' voluntary participation.

ECN: What will it take for wireless power to gain widespread adoption and how will your specification be a part of it?

KG: Wireless power is going through a process similar to that of othertechnologies such as Wi-Fi, Bluetooth and NFC. These technologies took many years before they became very widely adopted to the point where they are essentially ubiquitous. Based on recent Alliance for Wireless Power market surveys and data analysis, consumers appear to recognize a need for better device power management, to understand the need for and can assign value to the convenience and ease of charging offered by the next-generation experience of spatial freedom. The cellular industry took 20 years to reach its first 1B subscribers. The Alliance for Wireless Power believes that it will not take anywhere near as long to reach the first 1B wireless power charging users.

ECN: How will the specification adapt to future mobile devices and/or consumer preferences?

KG: The industry is in the early stages of adopting wireless power technology. The first-generation technology, or tightly-coupled magnetic induction requires precise positioning on a one-to-one basis between device and charger. While first-generation technologies can be configured to deliver spatial freedom-like performance, they are not presently seen as particularly commercially viable, because to deliver such a feature requires a large array of coils or other bulky coil configurations. One indicator of the early stages of the wireless charging market is the major leap in performance between first (tightly-coupled) and second-generation (Alliance for Wireless Power) technologies on delivering spatial freedom.

ECN: What kinds of accessories can we expect in the future?

KG: While the A4WP is currently focused on mobile applications, manufacturers from other electronic powered devices across industries are taking note of the specification.

[1] Jessica Leber, “Wireless Charging—Has Its Time Finally Arrived?”, MIT Technology Review, September 11, 2012.