A STANDARD FOR CONTACTLESS ENERGY

Lately, the interest in wireless power transmission has considerably increased. However, the range of different technologies used for its realization has led to uncertainly among manufacturers of these devices. This in turn, has delayed the swift, extensive expansion of a wireless charging infrastructure that is indispensable for a market breakthrough in the consumer sector.

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The use of mobile devices has steadily increased in the past years due to various technological advances. Today, making calls is not one of the primary functions of smart phones. In fact, additional functionalities such as navigation, music players or digital cameras are crucial factors in a consumer's decision to buy. However, the energy demand of these devices increases with the extended range of functions which, despite the constant advancements in battery technologies, involves more frequent charging. A solution to this problem is the use of wireless power transmission and the creation a widely available charging infrastructure comprised of highly frequented locations, such as for example, car interiors, public institutions and public transportation or cafés. This however implies a manufacturer-independent interoperability between the transmitters and the receivers.

In the past few years, the increase in publications and patent applications in the field of wireless power transmission demonstrate the great potential that this topic offers, scientific as well as economic. In 2020, the projected market for mobile devices is 15 billion US dollars of which 5 billion is for the smart phone and cell phone segment [1].

There are different approaches to the technical realization of achieving this interoperability. All of them aim at transmitting power without electrical contacts and with a maximum of efficiency and/or the greatest possible positioning tolerance between the transmitter and receiver. Currently, three industrial consortia are working on the creation of a specification that will form the basis for a subsequent standardization of wireless power transmission systems. However, each of them has different priorities with regard to positioning tolerance and energy efficiency.

Wireless Power Consortium

More than 140 companies now belong to the Wireless Power Consortium WPC that was founded in 2009. This makes the WPC the consortium with the most members. In 2010, the WPC published the first specification for wireless power transmission worldwide [2]. The transmitters and receivers described in it can be used to transmit power up to 5 W over distances of several millimeters and are recognizable by the Qi logo. The standard is also available to non-members free of charge. At present they are working on a "Medium Power Specification" for the transmission of up to 15 W. Parallel to this, the WPC is working on a specification for kitchen applications by which appliances with up to 2 kW can be provided with power wirelessly. A further team is dealing with the requirements of the automobile industry, in order to integrate Qi-compatible transmitters into automobiles. There are already about 40 models in the cell phone sector alone that are equipped with a Qi interface that allows the wireless charging of a Qi-compatible transmitter. Toyota and Jeep have already adopted the Qi technology and thus, helped it find its way into the interior of automobiles. In doing so, these companies have supported the development of a charging infrastructure for Qi-compatible devices.

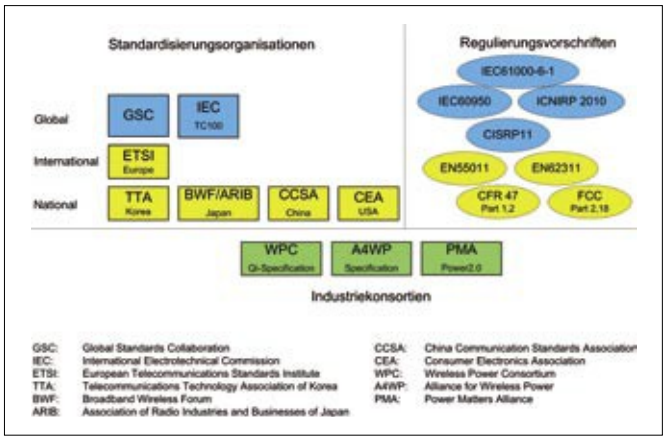

Figure 1: Global activities by organizations for the standardization of wireless power transmission

Power Matters Alliance

On the initiative of Powermat Technologies and Procter & Gamble a further consortium with the name Power Matters Alliance (PMA) was founded in 2012. Its goal is to establish its technology on the market in the form of a standard. In the Power 2.0 Standard, the PMA defines interfaces for power transmission and transceiver communication. With regard to circuits, only resonant circuits were specified in order to allow manufacturers the greatest possible freedom of design. The first transmitters that comply with the Power 2.0 Standard have already been installed in branches of the Starbucks chain in the USA. The Power 2.0 Standard is only available to members of the PMA, in contrast to the Qi specification by the WPC.

Alliance for Wireless Power

The Alliance for Wireless Power (A4WP) was also founded in 2012 by Samsung and Qualcomm. The aim of the consortium is to transmit power over larger distances, whereby the positioning tolerance is increased compared to systems with close coupling. The specified power classes indicate that the technology is predominantly targeted towards consumer products such as headsets, smartphones and laptops. Power receivers resp. power transmitters are arranged in five power classes. In Version 1.0 of the standard, receivers of the classes 2 and 3 with a maximum power of 3.5 resp. 6.5 W are specified. Power transmitters of the classes 2, 3 and 4 can transmit output ratings of up to 10, 16 resp. 22 W. Transmitters up from the power class 2 should be capable of supplying several power receivers simultaneously. Decoupled from the power transmission a bi-directional data channel is being realized between the receiver and transmitter via a Bluetooth connection. The A4WP vision is the most user-friendly of those discussed here due to the high positioning tolerance. However, loose magnetic coupling results in lower transmission efficiency. The greatest challenge remains the adherence to normative limits in all operating ranges of the systems, as well as convincing the end user with regard to EMF concerns.

Unsettled manufacturers

An ultimate market breakthrough is not in sight due to the differences in the different technologies. The appliance manufacturers who supply the consumer markets or contribute to the expansion of the of wireless charging infrastructure, for example in automobiles, are uncertain due to the partially competing technologies and are awaiting further developments. Thus, for example the CE4A – a consortium of leading automobile manufacturers – calls for a uniform solution for charging cell phones wirelessly in automobiles and in doing so, emphasizes the potential that lies in the wireless charging technology [3].

Creating interoperability

This dilemma can only be remedied by a manufacturer-independent interoperability between power transmitters and receivers. The first systems that fulfill the Qi as well as the PMA specification are already available, while others fulfill the requirements of the Qi specification with, at the same time, a much higher positioning tolerance. Nevertheless, the technical realization would be easier and the manufacturer's uncertainty could be reduced if it were possible to advance the development of a single, shared standard. All over the world many national and international standardization organizations are working on the development of guidelines and standards. During the 17th conference of the Global Standards Collaboration (GSC) in May of 2013, it was declared in a joint resolution that a cooperation between the standardization organizations and industrial consortia is being strived for in order to promote the global standardization of wireless power transmission [4].

The number of rules and regulations under which wireless power transmission systems must be classified are as different as the diverse specifications. National differences also exist here. In addition, the classification depends on the operating frequency. The adherence to standard and limit values is a challenge, especially with loosely coupled systems, by which power is to be transmitted over large distances.

It remains to be hoped that due to the differing interests of the industrial enterprises and consortia, further split-offs do not occur with regard to the development of mutual guidelines and standards. The huge economic potential of this technology can only establish itself in mass markets, such as the consumer market, when cross-manufacturer interoperability exists between devices by way of uniform interface definitions. Only then can the introduction of an extensive infrastructure that allows the inductive charging of mobile devices become feasible. When this goal has been achieved it will be easy to win over manufacturers and end customers for this promising technology.

Literature

[1] R. Martin, "Wireless Power for Mobile Devices Will Reach $5 Billion in Market Value by 2020." Press Release, Nov 16th 2012, Navigant Research.
[2] "System Description Wireless Power Transfer Volume I: Low Power Part 1: Interface Definition, Version 1.1.1." Wireless Power Consortium, July 2012.
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[4] "Resolution GSC-17/34: (Plenary) Wireless Power Transmission/ Transfer (WPT)." Global Standard Collaboration, 2013.

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