Designing wireless power supply systems

Michał Filipiak*

* Faculty of Electrical Engineering, Poznan University of Technology, Piotrowo 3A, Poland, michal.filipiak@put.poznan.pl

Abstract **The article presents information regarding the standard used for wireless power supply of equipment and the main problems connected with the design of such systems.**

Keywords **electromagnetic field, wireless power supply, Qi Wireless Charging Standard.**

I. INTRODUCTION

The present wireless power supply systems are used, among others, to charge the batteries, to power induction mouses, and in other low power equipment. They are constructed of two coils which are part of an air converter. The primary coil is usually placed in a pad with the size of the palm of a human hand. The secondary coil, that is – the secondary winding of the air converter, is placed in the receiving device. The transmitter is powered with alternating sinusoidal voltage. The alternating current flowing through the primary winding generates alternating magnetic flux which inducts voltage in the receiver in accordance with the law of electromagnetic induction.

II. WIRELESS POWER SUPPLY STANDARD

The standard called "Qi Wireless Charging Standard" specifies the parameters of the equipment in which wireless power supply is used to charge the batteries. It was developed by Wireless Power Consortium. The main constitutive elements of the system include a base station which is the transmitter and a device receiving power. In order to achieve the maximum efficiency of the device, the possibility to mechanically position the mobile device in relation to the base station was described. This means that the mobile device is placed in one specific position on the pad. Another method involves automatic adjustment of the device to the position of the mobile device. The pad consists of a greater number of induction coils connected to the controller which identifies the best configuration for energy transmission. The standard distinguishes two types of chargers:

- low power chargers with the capacity of up to 5W operating with the frequency range from 110 to 205kHz,
- medium power charges with the capacity of up to 120W operating with the frequency range from 80 to 300kHz.

The standard specifies the maximum distance between the base device and the receiver as up to 40mm. [2,3]

III. STRATEGIES FOR CONSTRUCTING DEVICES BASED ON ELECTROMAGNETIC INDUCTION

In the light of the continuing unreliability of the research on the influence of the EM field (electromagnetic field) on the human body, additional precautions which involve assessing the risk and the level of uncertainty of a given project are taken. If both the risk and its probability are low, no preventive actions are taken. If, however, the risk of uncertainty is high, even if the probability of its occurrence is low, preventive measures are introduced or the project is abandoned altogether in favor of searching for a different solution. Such an approach is both safe for humans, as well as economically beneficial. Further consequences could lead to financial claims, or even to blocking the project during the construction phase. The principle of exercising caution during the construction of devices that generate artificial EM field was included in the Maastricht treaty. Additionally, it includes also a cost recoverability analysis. [1]

IV. PROPOSALS FOR CONTROLLING WIRELESS POWER SUPPLY

The adjustment of the transmitter to a specific receiving device should be taken into consideration while designing devices powered by wireless power supply. Such a criterion will minimize EM field emission to the environment as there will be no power surplus. Another solution in the case of one wireless power supply transmitter used to power a few devices at a time is controlling the frequency of the resonance system. For this purpose, the controller would sample the frequency band in the specified range in order to obtain the resonance state. The introduction of an additional receiver (e.g. on a charging pad) would result in a change of the inductance of the system and drives the system away from the resonance state. In order to restore the most advantageous parameters, the controller should be able to search the frequency range again and to set the best frequency value.

V. CONCLUSION

The requirements set for devices powered by wireless power supply are very strict with respect to the EM field emission to the environment and electromagnetic compatibility with other devices. The research conducted by the World Health Organization broadens the knowledge both about the risks involved, as well as the beneficial influence of the EM field on the human health. The principle of caution and minimum negative influence on the environment should be observed while designing electric devices that use the phenomenon of electromagnetic induction. The standards specifying the parameters of wireless devices were developed for this purpose.

VI. REFERENCES

1. The World Health Organization (WHO): The effect of electromagnetic fields on human health Research Institute ZTUREK, Warsaw 2009.
2. http://www.wirelesspowerconsortium.com
3. http://www.radio-electronics.com (Power management) 2013.03.02