Full Simulation of a Wireless Power Transfer System with Power Line Communication Integration

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Abstract — In this work the authors create a full model (containing the models of all the devices) of a Wireless Power Transfer (WPT) system which is specially designed to be interfaced to a Power Line Communication data transfer system.

Index Terms - Electric Vehicles; Power Line Communication; Wireless Power Transfer; Smart Grid.

I. INTRODUCTION
Power line communication (PLC) has recently gained widespread interest, from both industry and the scientific community, as a viable alternative technology for broadband communications. Commercial modems are nowadays capable of reaching theoretical speeds of 500 Mb/sec, by using advanced communication techniques.

The in-vehicles applications of PLC systems have been investigated in recent years, and the many results [1] – [3] reveal the interest in the topic.

On the other hand Wireless Power Transfer (WPT) technology for recharging devices is nowadays attracting research attention as an alternative to a wired connection. Amongst the many potential application of such technology, its use for EV recharging is promising ([4] – [7]). In most of the proposed implementations the frequency operating point is in the MHz range, inside the frequency range used by the Homeplug 2.0 standard for wide band PLC modems. This consideration would theoretically allow the implementation of a V2G communication channel allowing the continuity of the PLC communication between the vehicle and the grid when battery charging is performed by WPT. The authors have already performed a feasibility study, which only takes into account the coil systems (and not other equipment such as amplifiers, filters etc.) and evaluated the theoretical channel capacity [8]. In this contribution the simulation of the whole system is performed.

II. SYSTEM DESCRIPTION
In order to achieve a correct PLC signal transmission and reception through the WPT coils system, the scheme shown in Fig. 1 is proposed.

The scheme is characterized by the most common elements of a WPT system with the addition of a set of filters and coupling circuit. The rationale behind the proposed scheme is the following: the input signal is the mains power with the addition of the PLC signal; this input has to be properly processed in order to achieve a proper data transmission without corruption.

III. RESULTS
The system has been fully simulated with the ADS software package. In this short contribution the scattering parameters of the designed filters are shown in Figs. 2 and 3. A correct design of the filters is crucial for the proper operation of the proposed system.
**Fig. 1.** Scheme of the implementation of the PLC-WPT system.

**Fig. 2.** Pass-band filter (10%).

**Fig. 3.** Stop-band filter (10%).

**REFERENCES**


