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SUMMARY

of doctoral thesis by Marek Wąsowski

"Influence of conductive disturbances up to 150kHz occurring in power grids on PLC transmission efficiency"

The work concerns conductive disturbances occurring in low voltage power networks in the frequency range of 2-150kHz and their impact on the efficiency of PLC transmission in power metering infrastructure.

The work contains a review of PLC communication technology and the assessment of the existing status of standardization and the literature in terms of permissible levels of intentional and nonintentional emissions in power grids in the considered 2-150kHz band. On this basis a general direction of the investigations are formulated, which are concentrated on elements that may affect the efficiency of transmission including the spectral parameters of disturbances and the technical parameters of power networks. Recognizing these factors and their interaction is one of the key objectives of the work and serves, among other things, to propose potential solution to prevent distortion of PLC communication.

An important element of the work is the analysis of the results of tests carried out both in the simulation model, in a model similar to real conditions, in laboratory conditions, as well as during field studies. Based on the low voltage network model created in Matlab environment in which PLC transmissions were implemented, simulation studies of the line attenuation impact on PLC signal transmission were performed involving disturbances generated by load and white noise source. In the real model of the low voltage line, the influence of line attenuation on the transmission of PLC transmission signal was examined with the participation of selected loads causing PLC transmission disturbances. Thanks to cooperation with TAURON Dystrybucja S.A. and TAURON Dystrybucja Pomiary Ltd. a field tests were carried out, as well as analysis of measurement documentation of 260 cases of transmission disturbances in PLC OSGP technology in the real low voltage network. Cross-sectional analyzes were carried out in order to identify characteristic categories of loads that affect the transmission including the spectral analysis of these disturbances. An attempt was made to analyze the relations of identified disturbances with selected available information of the technical parameters of the power network, such as the length or type of cable. The work includes a series of spectral analysis of conductive disturbances accompanying the PLC transmission both at the place of the concentrator installation and in the point of the connection of the identified load that caused transmission disturbances. The analysis of spectral parameters were used to assess the impact of cable length on the attenuation of the transmission signal under real conditions of power networks as well as become the basis for a discussion regarding the maximum permissible level of disturbances in the power grid (noise) as well as the maximum transmission level that would ensure the improvement of transmission efficiency. The work also contains the results of research on the impact of voltage supply distortion in 0-2kHz band on load's emission disturbances in the 2-150kHz band. These tests were carried out in laboratory conditions and referred to the transmission efficiency of the selected PLC PRIME technology.

The results of the research allowed to develop a classification and validity of factors that may affect the efficiency of PLC transmissions as well as to propose a number of potential solution to prevent distortion of PLC communication.

Keywords: power line communication, low voltage network, conductive disturbances 2-150kHz, electromagnetic compatibility, power quality

Marek Wąsowski