Preface

Access networks implement the inter-connection of the customers/subscribers to wide-area communication networks. They allow a large number of subscribers to use various telecommunications services. However, the costs of realization, installation, and maintenance of access networks are very high, very often representing more than 50% of the investment in the network. Therefore, network providers try to realize the access network at as low a cost as possible to increase their competitiveness in the deregulated telecommunications market. In most cases, access networks are still the property of incumbent network providers (e.g., the former monopolistic telephone companies). Because of that, new network providers try to find solutions to realize their own access networks. A promising possibility for the realization of access networks is offered by the PowerLine Communications (PLC) technology.

PowerLine Communications technology allows the usage of electrical power supply networks for communications purposes and, today, also broadband communication services. The main idea behind PLC is the reduction in operational costs and expenditure for realization of new telecommunications networks. Using electrical supply networks for telecommunications has also been known since the beginning of the twentieth century. Thus high-, medium- and low-voltage supply networks have been used for internal communications of electrical utilities and for the realization of remote measuring and control tasks. PLC is also used in internal electrical installations within buildings and homes (the so-called in-home PLC) for various communications applications. Generally, we can divide PLC systems into two groups: narrowband PLC allowing communications services with relatively low data rates (up to 100 kbps) and ensuring realization of various automation and control applications as well as a few voice channels, and broadband PLC systems allowing data rates beyond 2 Mbps and, accordingly, realization of a number of typical telecommunications services in parallel, such as telephony and internet access.

Broadband PLC in low-voltage supply networks seems to be a cost-effective solution for "last mile" communications networks, the so-called PLC access networks. Nowadays, there are many activities concerned with the development and application of PLC technology in the access area. Thus, we find a number of manufacturers offering PLC products that ensure data rates between 2 and 4 Mbps and announcing new PLC systems with data rates up to 45 Mbps or more. There are also numerous PLC field trials worldwide, as well as several PLC access networks in commercial use. The number of PLC subscribers is still growing. A similar development in medium-voltage and in-home PLC networks

is in progress as well. On the other hand, there are no existing standards for broadband PLC networks, which are supposed to use a frequency range up to 30 MHz. In particular, the problem of electromagnetic compatibility of PLC systems with reference to their coexistence with other telecommunications systems, such as various radio services, has not yet been completely solved. Therefore, PLC technology is now in a very important development phase that will determine its future, its application areas, and its penetration into telecommunications world in competition with other broadband technologies.

Because of the absence of standards and, understandable, detailed publication of sensitive research material by PLC manufacturers, there is very little information on broadband PLC systems and networks in the literature. We find a number of papers, several dissertations, and a few books covering different, mainly very specific, research areas, which are not suitable for the wider community of readers. On the other hand, there are many publications describing general PLC-related topics but without, or with very little, technical content. Therefore, it is necessary to provide complete information on broadband PLC networks that includes both general information on PLC technology and also offers technical details that are important for the realization of PLC systems. The book "Powerline Communications" by Klaus Dostert covers mainly narrowband PLC technology, and it focuses more on the transmission aspects of PLC.

This book contributes to the design aspects of broadband PLC access systems and their network components. The intention of this book is to explain how broadband PLC networks are realized; what the important characteristics, as well as environment, for the transmission through electrical power grids are; and what implementation solutions have been considered recently for the realization of broadband PLC systems.

The authors of this book, all of them from the Chair for Telecommunications at Dresden University of Technology – Germany, have been involved in the research and development of PLC networks and systems for several years. Our department has participated in several international industry and EU supported research projects on PLC and cooperated with a number of partners also involved in the actual development of this technology. The chair is a member of the PLC Forum. The authors have published more than 20 research publications on broadband PLC access networks, performance evaluation of PLC systems, modeling PLC networks, and development of PLC MAC layer and its protocols. In our department, we have developed a simulation tool called PAN-SIM (PLC Access Network Simulator), used for performance analysis of PLC networks, which has also been presented in several trade fairs and specialized conferences.

This book has been written for the following groups of readers:

- Lecturers (professors, PhD researchers), for research and educational purposes at universities
- Developers of PLC equipment, systems, interfaces, and so on.
- Network engineers at potential PLC network operators
- Business people, managers, or policy makers who need an overview of PLC technology and its possibilities, and of course
- Students with an interest in PLC and other telecommunications technologies.

During our work on this book, many people have supported us in different ways. Therefore, we would like to thank them. First, we would like to thank all our colleagues

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