Powerline Publishing

2002 Update on the Powerline Industry

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FOREWORD

'2002 Update on the Powerline Industry' has been authored by Dr. Peter Krawarik, Systems Physics Consultant, Telecommunications & Business Development. It provides a fast track resource to vital information on the latest developments and trends in the rapidly changing Powerline arena, from a uniquely independent and global perspective. There have been significant developments over the past 18–months that existing players, new entrants and observers of the International Powerline Industry should be aware of to ensure that prudent and realistic technical and business decisions are made.

FOREWORD

Dr. Krawarik, formerly of Ericsson Austria AG, has over 34 years management experience in large and small companies. He has a strong track record directing major projects in state-of-art technology including fibre optics, video, office and factory automation, networks, telecommunications and systems integration.

Peter is an expert in strategy development. During his time at Ericsson he initiated extensive Powerline Communications programs in the company and is fully conversant with the difficult commercial and strategic issues facing the developing Powerline Communications industry.

FOREWORD

The Powerline Communications Industry is complex from a technical, regulatory, legal, commercial and strategic perspective. Entrants into this marketplace include the investor, manufacturer, power distributor or service provider, all of whom are presented with significant hurdles brought about by the dynamic nature of this growing and rapidly changing arena.

FOREWORD

Peter is able to provide refreshing clarity on this complex arena. He is well connected within this small but diverse industry, and attends the major conferences and technical and regulatory association meetings, worldwide. Having been involved with Powerline since its inception, Peter is able to provide an invaluable, in-depth insight into the developing Powerline industry. Such insight and independence allows Peter to provide technical and business development consultancy of real value to the diverse players in the Powerline arena. Peter can be contacted through MillenniaVision Ltd.:

www.millenniavision.com

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INDUSTRY OVERVIEW

Approximately 60 “trials” have been conducted worldwide in Access alone, mostly in European countries. The major Powerline vendors have come to call these “Introductory Systems” rather than trials. With the legalisation of Powerline most countries are now beyond the stage of trials.

Public acceptance has been slow. In the European market there is no primary need for Powerline as alternative competitive systems are already in place, or, else are becoming economically attractive. Powerline still has a lot of enemies.

The former forums, PTF and IPCF dissolved in the spring of 2000. The new PLCforum grew out of a combination of the two former organisations. It has today about 80 member companies and meets about 4 times a year.

www.plcforum.org

INDUSTRY OVERVIEW

While the principal purpose of founding the PLCforum had been to have only one worldwide organization, this did not in fact happen.

The interests of the in-house Powerline applications seemed underrepresented by the PLCforum, which continued to be dominated by electrical utilities and the established players in the Powerline industry.

Thus, the HomePlug Alliance was also founded in the US in 2000. It has also about 80 member companies and meets about two times a year.

www.homeplug.org

INDUSTRY OVERVIEW

In the PLCforum there is growing interest in the in-house applications and in business not confined to Europe. Conversely, in the HomePlug Alliance, there is continued interest in future access applications of the technology.

The realisation that in-house systems can only be marketed if they comply with the evolving European and International standards led HomePlug members to abandon their first idea to sell product, thereby establishing an ad-hoc standard and thus penetrate the markets quickly.

Representatives of HomePlug are found today in all major standards organisations, working alongside their European colleagues.

TECHNOLOGICAL DEVELOPMENTS

RF Spectrum - The same RF spectrum of 2 – 30 MHz used in the Manchester, UK trials by NOR.WEB still forms the basis for solutions in 2002.

Modulation techniques are now much better understood. Multi-frequency carrier technology, such as OFDM is in use, but some spread spectrum approaches have also been tried successfully. A number of vendors are still secretive about their favoured modulation scheme.

Design of a Powerline interface - The technology has differentiated the design of a Powerline interface in a layered fashion. The physical layer and the Media Access (MAC) layer are implemented in Powerline chip sets. The Powerline channel is a difficult and variable environment, so the MAC layer must implement the dynamic measurements necessary to adapt the transmission requirements of the communications channel to the Powerline channel. The actual communication services are then designed to live on top of the MAC layer.

TECHNOLOGICAL DEVELOPMENTS

Food chain - Powerline chipset vendors have emerged and Powerline system integrators package those chipsets into product. Few “monolith” companies still exist, such as Ascom who have their own chipsets and also do systems integration.

TECHNOLOGICAL DEVELOPMENTS

Access / Inhome

Initially, the applications split into in-house and access systems.

The HomePlug Alliance in the United States led efforts to come up with good, standardised in-house solutions. In July 2001, the HomePlug Specification 1.0 was ready and is endorsed by about 30 vendor companies.

Europe continued to concentrate on access systems, driven by the PLCforum. There is evidence however, that this split may become less meaningful as time goes on.

TECHNOLOGICAL DEVELOPMENTS

Access / Inhome

Early on, the two dominant access system vendors, Siemens and Ascom, had determined that they could not hope to sell access system solutions without also offering compatible in-house product.

Unexpectedly, Siemens withdrew from the Powerline market and ceased all Powerline activities just before the CeBIT 2001, the major fair for the Powerline industry.

Also unexpectedly, Oneline, Germany, announced the halting of the development of Powerline-Communications stating that - *"Altered environment renders operations economically unviable for foreseeable future". (www.oneline.de)*

Oneline states that "*government regulations on the emission of electromagnetic waves were an important factor in its decision. The mandated limits are extremely low. Moreover, the government intends to prohibit certain special frequencies. In this context, it would take at least two more years of development before Powerline Communications would be ready for the mass consumer market*"

TECHNOLOGICAL DEVELOPMENTS

Access / Inhome

Today, Main.net has developed such a powerful Powerline system product (based on Itran chipsets) that they claim their product can be used equally well for access as it can be used for in-house systems.

With adaptive modulation level mechanisms, transmission through electric meters and even transformers became feasible. By adjusting the modulation power, they can even “reuse” the frequency spectrum in some cases.

TECHNOLOGICAL DEVELOPMENTS

Access / Inhome

While HomePlug concentrated on the in-house market, their chip sets are designed to be also usable for access purposes later on. Using sophisticated modulation schemes a throughput of perhaps 15 Mb/s can be readily achieved using the frequency spectrum of 5 – 22 MHz with the modulation power still within the limits of FCC Part 15 rules, covering the majority of typical in-house applications in the US.

A weakness of this technology for access is that the limited information throughput of, currently, about 2 Mb/s is shared by all customers on a substation transformer, which will surely lead to inadequate bandwidth for some customers. Forrester Research has recently pointed that out as a severe weakness, markedly considering the competition of the emerging DSL services.

REGULATORY DEVELOPMENTS

COMPLEXITY

The regulatory field is complex. Regulation occurs on local, regional, national and worldwide levels. There are regulatory bodies such as the IEC or FCC, there are standards-making entities such as CENELEC, CISPR and ETSI and there are national and local authorities that control regulations on a political level.

Powerline is a product reusing existing networks that were not designed for such use, in dimensions that were neither foreseen nor intended for those networks. Regulation tries to cover the new issues resulting from the Powerline overlay over the existing networks.

REGULATORY DEVELOPMENTS

EMISSIONS

For the purposes of regulation, there are emissive (radiative) aspects that come into play because an RF modulation is used on the electric networks, and RF radiates as those networks are neither perfectly terminated and adapted coaxial conductors, nor perfectly matched antenna structures.

Here the argument is crucial if the resulting radiation is “unintentional” or “intentional”. If it is held to be unintentional, then it is subject to existing regulations as “RF frequency noise”. The regulator has set fairly stringent values that RF noise must not exceed (dependent on frequency). Those values are so low that for Powerline applications, given the “leaky” network structures, modulation levels that are permissible no longer give an adequate range of transmission on the networks.

REGULATORY DEVELOPMENTS

THE CHIMNEY APPROACH

During the past year, various attempts have been made to get some “exceptions” for certain frequency ranges, where higher power levels would be tolerated. One such attempt was called the “chimney” approach originally proposed by Siemens and Ascom.

Since each country has agreed those noise levels on an International basis, it is hard to see how such a country then could grant exceptions. But then, the rules specifying such noise levels have not been made considering the requirements of Powerline.

REGULATORY DEVELOPMENTS

INTERNATIONAL / COUNTRY SPECIFIC

Most countries take the values established internationally and then add their own “safety pillow” of extra restrictions just to be on the safe side. For that reason, the FCC Part 15 in the US can specify relatively lenient values (that the Powerline industry could live with) while a country like the UK can have much more stringent values that are absolutely prohibitive for Powerline applications.

In Europe we shall see “harmonised” standards eventually that apply to all EC members. During the past year, the EC has started to review this area of rule making.

REGULATORY DEVELOPMENTS

TEMPORARY LAWS

The not so good news (for the industry) is that regulatory activity, especially standard making, is a painfully slow process, it takes years before new regulation can be applied. Some countries have, either tacitly or by legal action, jumped the gun and have given the Powerline industry some temporary laws to operate until regulation kicks in.

Germany - The NB30 law in Germany was passed on March 30, 2001 and legalised Powerline applications in Germany allowing the Powerline industry to go forward. Ascom claims that all their current systems abide by NB30. This is the basis for the strong activity by RWE in Germany. Eventually NB30 will be superseded by an appropriate EC regulation, a harmonised standard.

REGULATORY DEVELOPMENTS

TEMPORARY LAWS

Sweden - Sweden took the tacit approach. Where there is no plaintiff there does not need to be a judge. If nobody complains about RF interference, then there is no reason to set up and enforce restrictions.

Austria - Yet other countries take a political “out” - Austria ruled in July 2001 that the Powerline industry could go ahead, as long as they would abide by all applicable regulation of the EC.

REGULATORY DEVELOPMENTS

EC / HARMONISED STANDARDS

So what applicable regulation, akin to the German NB30, does the EC have? None, so far, but a Joint EC Meeting took place in Brussels March 5, 2001. It resulted in a mandate for CENELEC to develop PLC standards. The Commission did not object to PLC, thus tacitly accepted it. Moreover, the European Parliament recognized PLC as an accepted legal way of electronic communications (wire based broadband systems).

A standard European operating framework is still missing. Harmonised standards may be expected by 2003, which will then override NB30 and NPT1517.

REGULATORY DEVELOPMENTS

EC / HARMONISED STANDARDS

But there is not just radiation, certain regulations pertaining to conductive modes of electricity can also be applied, particularly since we are dealing with electric networks that are based on conduction.

The standard EN50083 is for cable based systems and can be construed to apply to Powerline systems. The CENELEC standard EN55022 set limits for the voltage or current on a conductor, in a given frequency range. Network structures, that represent ill-matched antennas for RF frequencies, are then governed by another set of rules and restrictions.

REGULATORY DEVELOPMENTS

EC / HARMONISED STANDARDS

In the practical case, electromagnetic radiation as for instance permissible under NB30 cannot be actually generated on the network on the grounds of conductive electrical restrictions that come from EN55022. That impacts the permissible modulation voltage, which via the network impedance (that is variable in the frequency range of interest) gives us the modulation power. Thus, regulations coming from different regulatory areas are also not compatible.

EN55022 is a European standard. Complying with it in Powerline applications means that a reasonable business on that basis is all but impossible.

REGULATORY DEVELOPMENTS

EC / HARMONISED STANDARDS

The situation is even worse, because we are dealing not just with the two aspects of the radiative and conductive regulations, but several more that come from other areas that precede Powerline applications and now lead to conflicts in law, interpretation and interest.

Standards like the EN55022 are continually reworked, so there is an evolutionary process of massaging the existing regulatory framework to accommodate new needs.

REGULATORY DEVELOPMENTS

COEXISTENCE - ACCESS / INHOME

The standard making bodies have been working on the question of coexistence for more than a year now and this is the most important issue to be dealt with if we assume that Powerline applications are coming.

Coexistence means that in-house systems can coexist with access systems without mutual interference; that in-house systems can coexist with other in-house systems in the neighbourhood without interference…

REGULATORY DEVELOPMENTS

COEXISTENCE - ACCESS / INHOME

The method adopted for in-house to access coexistence is the frequency band split. The frequency spectrum is split into a lower area (below perhaps 10 – 12 MHz) for the use of access systems, and the rest above the split point for in-house systems. This method implies that a narrower frequency band is available for each of the two application areas, therefore less information throughput, perhaps 7 – 8 Mb/s may ultimately be expected for access, and even less for in-house. The modulation levels will have to be about 10 dB lower for the higher frequency band, as more radiation is expected there.

It takes a real effort by all of the Powerline protagonists to collectively influence and control the standards making activities such that regulation of a particular, pertinent aspect does not inadvertently go into a direction that may be adverse to the future viability of Powerline. For example, a recent session by a CISPR committee started to address definitions of “data port” parameters that, if passed as initially proposed, would have caused severe difficulties for Powerline applications.

MARKET DEVELOPMENTS

BUSINESS MODELS

We have Powerline technology, even third generation systems, we have a better understanding of the regulatory landscape, but how can we make a business with Powerline?.

A sort of “food chain” has established where Powerline technology chipset vendors deliver to system packagers or integrators, who market to a range of customers, utility network operator based ISPs, telecommunications companies, even private customers for in-house systems.

The combination of access and in-house applications with the diverse information applications provides a rich option space for business models. Business models are indeed the most important concept. If a company wants to enter the Powerline business, they need a business model first and foremost.

MARKET DEVELOPMENTS

THE POWER UTILITY

For companies who come from the electrical utility sector, this may represent a significant first hurdle. The companies do not have the necessary expertise inside their own organization. Their culture, their way of thinking is different from that of a Telecommunications Company or ISP. Commercial viability depends on the skill and dedication of the future operator to embrace the necessary change process.

A PLC operator business must be developed; that requires the application of BUSINESS DEVELOPMENT. Business Models will lead to a Business Plan, which in turn will lead to the Business. The uncertainty has actually increased for operator candidates, because of the lack of required skills.

MARKET DEVELOPMENTS

THE POWER UTILITY

The accepted practice is that a Business Consultant accompanies the Operator Candidate for analysis, goal formation, and establishment of a suitable business model and elaboration of business plan. Business Development is an essential tool to bring about the necessary adjustments. That process does take time, a year at least in our experience. There are only a few companies that managed that transition, over the past year.

Sydkraft - One example is Sydkraft, from Malmö, Sweden. It set out about two-years ago, built up an organisation that could deal with the issues, employed Business Development methods and are very successful in becoming a Powerline operator company.

MARKET DEVELOPMENTS

THE POWER UTILITY

The learning process should not be underestimated. It may be necessary to secure outside help, as a rule, because the professional expertise is rarely at hand. With the regulatory smoke clearing a bit, one large company after the other is entering the field.

RWE - In Germany, RWE wants to deploy 10,000 units in 2001.

EVN - In Austria, EVN is also talking about 10,000 end customers connected IN 2001.

2002 AND BEYOND

Soon it will be a question of market shares. Interest in and acceptance of the Powerline technology has been worldwide. Some big system vendors operate internationally already. The question is, are those few early adopters right or is it still not to be taken for granted that a good business can be made with Powerline?

While there is already healthy competition in the technology and Powerline has been accepted as a technology issue to be reckoned with by the regulators there is still relatively scarce information available on the business aspects of Powerline.

The few companies who are successful guard the business know-how as a secret of their success and are therefore reluctant to share it with others. That makes outside professional help even more important for any company that seriously considers entering the Powerline game. In a global context, there appears now to open a “window of opportunity” for Powerline applications. There have been some studies recently that come out less optimistic about the growth of Powerline deployment.

2002 AND BEYOND

Despite all euphoria, the rollout of Powerline services happens only slowly, with certain regional pockets served in the near future, but general availability still out in 2003 and beyond.

Compared with the speed that price competitive DSL services in those same regions are introduced, Powerline is running into severe problems. The price models for current offerings of Powerline service are data throughput sensitive, which makes Powerline too expensive, compared with DSL.

Due to the lead-time necessary for an aspiring Powerline operator company to manage the transition, companies who are thinking of entering the field must act fast not to miss the opportunity.

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

The following pages provide an overview and introduction to PLC Technology Developers, worldwide, with hyperlinks to their websites.

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Adaptive Networks' High-Speed Powerline Communications will soon be commercially available In low cost silicon for the Home Networking Market.

http://www.adaptivenetworks.com

As a world leader in the high speed access and optical transport market, Alcatel is a major player in the area of telecommunications and the Internet.

http://www.alcatel.de

Ambient Corporation focuses on Powerline Telecommunications (PLT) technology and a variety of exciting new Consumer and Utility applications.

http://www.ambientcorp.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Amperion, Inc., is the premier medium voltage powerline networking equipment company developing networking hardware and software that enables the delivery of high-speed

broadband data over medium-voltage power lines (MV-PLC).

http://www.amperion.com

The Powerline technology currently transmits data at 4.5 Megabits per second (Mbps) via the electricity supply grid, provides permanent high speed access to the Internet (always online) from every mains voltage supply socket in buildings and makes broadband capacity cost-efficiently available over the "last mile".

http://www.ascom.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Blue2Space is a wireless communications company founded in 2000 and situated in Stockholm, Sweden. Blue2Space develop and market hardware and software solutions for networking within the Bluetooth standard, providing a complete family of services and products.

http://www.blue2space.com

By joining Internet Home Alliance, Cisco will be able to build on the company's vision to provide consumers anywhere, anytime Internet access in the home. The Internet Home Alliance is the ecosystem enabler that will help to make the Internet lifestyle a reality. Cisco, along with other Alliance members, will benefit from the industry growth

fuelled by this initiative.

http://www.cisco.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Cogency's powerline integrated circuits are an inexpensive, scalable, robust, and high performance solution for creating products with home networking capabilities. The OFDM technology used by Cogency, addresses the challenges presented by using AC powerlines as a vehicle for data communications.

http://www.cogency.com

Use existing electrical outlets to create Local Area Network connectivity to share information between several computers, to share printers and to safely connect private network to the rest of the world over the Internet. With Corinex PowerNet devices, all of this is quickly and easily achieved.

http://www.corinex.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Cyan technology is developing a range of microcontrollers specifically intended for use in products that need to communicate with each other. Cyan Technology's unique devices are making consumer products possible at previously unachievable prices. Cyan is focussing on the high growth markets of gateways; Internet enabled devices and communications in the home/office.

http://www.cyantechnology.com

DATASOFT system GmbH presents POWERLINE - the communication network of the future!

http://www.datasoft.at

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Domosys Corporation

The PowerBus technology is a two-way, peer-to-peer communication protocol for control networks. It allows everyday devices to exchange information with each other over a shared medium for the purpose of performing control type applications, such as turning lights on off and monitoring the state of appliances. PowerBus™ technology supports communication over the AC power line, DC power line and twisted pair media. A PowerBus™ network is Internet-ready.

http://www.domosys.com

Home DS2

DS2 PLC technology opens up the power of the electricity networks to high-speed data services. DS2's proprietary technology can be adapted for use in the access or LAN segments of the PLC market.

http://www.ds2.es

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Using Powerline Technologies, Easyplug can provide solutions to people who want to enhance or renew their home with no new wire, simply using the existing electrical infrastructure, available in any home.

http://www.easyplug.com

Echelon's PLT-22 power line transceiver has been field proven in appliance, meter reading, home automation, lighting, and energy control applications worldwide. This technology employs advanced digital signal processing and error correction techniques to ensure reliable signalling.

http://www.echelon.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

ECI Telecom is a provider of integrated network solutions for digital communications and data transmission systems. The Company designs, develops, manufactures, markets and supports end-to-end digital telecommunications solutions for today's new services and converging networks.

http://www.ecitele.com

EICHHOFF

In order to support the success of PLC-technology, Eichhoff has developed a range of components to increase transmission performance of PLC-signals.

http://www.eichhoff.de

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Serving both network users and providers, ELCON Systemtechnik GmbH designs, manufactures and supplies telecommunication equipment.

http://www.elcon-system.de

endesa

Endesa is conducting tests with two different technologies (1.5 and 50 Mbytes/sec) for the transmission of voice and data through its electrical networks, which will enable the provision of services to domestic customers and small and medium enterprises, the installation of digital measuring systems, etc.

http://www.endesa.es

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Enikia's standards-based, highly integrated powerline solutions support audio, video, voice and data over the existing powerline infrastructure.

http://enikia.com

The PLC transmission technology from GÖRLITZ AG operates in the supply area of a utility's low-voltage island in exactly the same way with a passive (unfeeded) cable system.

http://www.goerlitz.ag

PLC TECHNOLOGYDEVELOPERS, WORLDWIDE

The HP and RCA Systemlink home networking kit -- a powerline system that enables home PC networking using existing electrical wires and outlets, thus eliminating the need to run new wiring.

http://www.hp.com

Inari's Powerline Networking Technology (PNT) is best suited to meet the unique requirements of a home network. Specifically, Inari's PNT is scalable from low speed to very high speeds allowing manufacturers to add the appropriate amount of networking functionality and cost to any device in the home. It also offers quality of service to ensure that devices containing voice, audio and video applications are able to operate without interruptions.

http://www.inari.com

PLC TECHNOLOGYDEVELOPERS, WORLDWIDE

Intellon Corp is now shipping the home networking industry's first standards-based powerline chipset. The immediate availability of the INT5130 chipset provides original equipment manufacturers (OEMs) of consumer products a faster, more reliable solution that is backed and supported by over 80 leading companies.

http://www.intellon.com

IntraCostal System Engineering Corporation

Utilizing *Spread Spectrum Technology*, IntraCoastal's proprietary PLC Technology allows reliable data transmission over existing power lines with low power consumption and high anti-interferance capability.

http://www.intracoastal.net

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

ITRAN offers a wide spectrum of broadband and narrowband solutions aimed at home networking, residential access and home automation markets. ITRAN delivers advanced, extremely reliable, low-cost, high-speed home networking components for the implementation of broadband and narrowband control networks over power lines. ITRAN also develops an advanced line of reliable long-distance components that enable transmission control, telemetry and low-speed data transmission.

http://www.itrancomm.com

JOOHONG Information & Communications Ltd. is a leading developer of technologies that enhance broadband systems and solutions over multiple network environments. Using the experience with the first-generation of high-speed data over cable products, JOOHONG is now designing and developing products based on Bluetooth, IMT, ATM NIC, and PLC.

http://www.joohong.co.kr

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

The purpose of the company is to offer general telecommunications services, emphasizing data transmission and permanent Internet connections in residential areas. The company is to utilize the resources of Reykjavik Energy and state-of-the-art technology for data transmission over the power grid.

http://www.lina.net

M@in.net has established itself as a world leader in providing fully integrated solutions for High Speed Power Line Communication (PLC) products which provide telecommunication services over the low-voltage power-line grid. The company has developed, and is currently producing, an innovative solution, that combines both the Home Network and the Access ("The Last Mile Solution") of Powerline communications into one system, compatible with the latest PLC standards.

http://www.mainnet-plc.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Corporation metricom

Metricom Corporation designs Application-Specific Integrated Circuits (ASICs). Metricom also provide customers with both Field-Programmable Gate Array (FPGA) and ASIC design services.

http://www.metricom-corp.com

MVV
Know-how provides answers

MVV has already successfully tested the technology to transmit data and voice mail via its electric power grid throughout its service area and has thus assumed market leadership. Today, 200 private customers in the Niederfelddistrict of Mannheim have already started using the power grid to access the Internet. As of the coming year, Powerline Service will be offered Mannheim-wide.

http:mvv.de

PLC TECNOLOGY DEVELOPERS, WORLDWIDE

nSine's robust high-speed solutions are extremely low cost, making it economic to embed internet connectivity into mass-market appliances as well as to network home PCs. By delivering reliable high bandwidth performance at a cost usually associated with low data rate technologies, nSine allows the rapid adoption of a single powerline solution for all applications.

http://www.nsine.com

NAMS is ranked as a technological leader in energy measurement, PLC applications, prepayment systems, and remote metering via a variety of interfaces.

http://www.nisko-metering.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

PhonexBroadband

Phonex is first in the USA market with voice and data technology over the power lines; Phonex was also first in Canada, Mexico, South America, Europe, Australia, and Asia. Phonex has announced the very first 14 Mbps Ethernet-compatible product over the powerline, with many more announcements to follow.

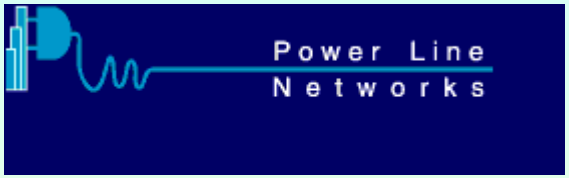
http://www.phonex.com

PolyTrax Information Technology

PolyTrax has developed a digital PLC solution which offers ISDN speed while complying with the CENELEC standard: the PolyTrax technology.

http://www.polytrax.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE



Power Line Networks has developed and patented a technology that enables the use of the AC power line for communications between electronic devices in homes and small offices. Using this technology, Power Line Networks is developing a family of power line adapters (PLA's). These PLA's will serve as power line network connectivity devices compatible with, and transparent to, standard and emerging network communications protocols.

http://www.plninc.com

PowerNet

PowerNet has advanced a unique approach for a standard networking system. The PC-Less Adapter provides interoperability of networking protocols and systems. The PC-Less Adapter integrates network adapters with stand-alone communication modules, which facilitate video, voice and data sources over the power-line at data rates of up to 10Mbps.

http://www.powernetsys.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

With more than 750.000 used products in the field Home Automation, Facility Management and Security the powertec AG benefits from its 10-year-lasting experience in the powerline-technology. Among the communication via the electricity lines other core activities are the development and use of systems for a remote meter reading, for a lighting system steering, for a facility management and for a tunnel security.

http://www.powertec-ag.de

ProSyst is a leading provider of Service Gateway software, offering the most complete solution for the delivery of network-based services, enabling a host of new control, information, measurement and entertainment services in any kind of networks.

http://www.prosyst.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

REDCOM LABORATORIES, INC.
Research and Development in Communications

Redcom engages in research and development of digital switching systems and related test equipment, along with software development.

http://www.redcom.com

RWE Power Net offers - High Speed Internet via a Plug & Play enabled modem - Transmission rate of up to 2 Mbps - Up to 30 times faster than ISDN - Internet access through any socket in the home - "Always on" - without inconvenient dial-ups - No need for complicated wiring and additional installations -Surf the World Wide Web while you make telephone calls over the fixed-lines network - 24-hour support at the telephone hotline.

http://www.rwe-powerline.de

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Aladn™ (Autonomous Local Area Distributed Network) is a revolutionary new networking technology that uses existing electrical wires to connect everyday devices and appliances to each other and the Internet. Via the Aladn Internet Gateway, Aladn-enabled devices can be remotely controlled and monitored and report energy consumption, usage patterns, status and health to maximize energy savings, comfort and security. The *Energy Management Suite* of Aladn smart products includes electric meter, thermostat, light switch, electric outlet, PC interface and Internet Gateway.

http://www.aladn.com

Schlumberger

The Multi-Energy Telemanagement System (ETS-ME) realizes the benefits of Power Line Carrier technology to allow multi-energy utilities and building administrators a flexible and cost-effective communication channel using the existing distribution network.

http://ask.slb.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Since 1972 SELTA has provided communication and automation solutions for business communication, corporate networks, TLC operators and Utilities.

tp://www.selta.com

Leveraging extensive PLC design experience, the E-Controls team can provide high performance, low cost designs supporting flexible industrial automation solutions.

http://www.tality.com

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

TEAMCOM ....a powerful connection

Traditionally, Power Line Carrier (PLC) on high voltage lines is extensively used, and

Teamcom AS is on the leading edge with their Digital PLC, A.C.E.32.

http://www.teamcom.no

UBICOM

Ubicom is the leading supplier of the Internet Processors and networking software that will connect billions of electronic devices to the Internet. Ubicom's silicon platform and the software modules create new opportunities for connectivity among devices and humans. By shifting connectivity and control functions from silicon to software, OEM

customers get to production faster, at lower cost.

http://www.ubicom.com/

PLC TECHNOLOGY DEVELOPERS, WORLDWIDE

Custom system and product design, engineering, production (hardware and software) and sales of power line communication, control and data acquisition in automation and installation, for power control in lightning (including hard to dim lamp versions), for heating, motion and actuation loads.

http://www.wsw-group.com

Powerline by Xeline

Xeline will create a new world of power line communication and brand new Internet access! Now Xeline is bringing powerline communication products to the market for the first time after successfully developing the modem for powerline communications.

http://www.xeline.com

THE PLC COMMUNITY

PowerlineWorld www.powerlineworld.com is a global online community facilitating the development and deployment of Powerline Communications (P.L.C.) products and services. It's aim is to stimulate the creation and development of the P.L.C. market through the exchange of information and to provide a global meeting point and signpost for the various organisations and individuals participating in this embryonic industry.

Powerline World provides facilities for the online exchange of views and ideas via its threaded discussions. The site is also regularly updated with news, information and free downloadable documents.