PUA
PLC Utilities Alliance

plcforum

PLC Current Situation
Overview

October 1st, 2003

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1 Executive Summary

During the last years, PLC industry landscape around the world has changed considerably. The number of PLC deployments in Europe is increasing and there are several regions where PLC initiatives are being carried out for the first time. Such is the case also in North America, Asia and Latin America countries, where a large number of PLC pilot trials have been launched during the past year.

Besides Europe, North America is showing an increasing interest in PLC technology (called BPL, "Broadband Power Line") with many Utilities initiating deployments and several Associations being launched. This significant change is mainly due to:

- Different topology designs and Business Models for PLC networks have been developed, solving the profitability issues initially raised due to the reduced number of electrical customers per transformer station
- A favourable regulatory environment has been established, based on FCC part 15, setting a reasonable and realistic limit for PLC radiated emissions in fixed telecommunication networks (including PLC)
- Positive public statements coming from FCC have supported BPL technology and initiatives
- Local Loop Unbundling has enjoyed limited success

This favourable environment is projecting its influence to Latin American countries where a large number of initiatives are being launched (Brazil, Chile, Peru, etc.) following the American standards.

Furthermore, the positive results obtained in the massive trial experiences around the world confirm the viability of this technology:

- PLC can provide competitive high quality broadband services (Internet access, voice IP, etc.)
- Up to now, considering a European customer base of around 200,000 PLC households passed (from the total households where PLC signal is available estimating a penetration of 10%), no real problems about interference have been raised. This is real evidence that the probability of interference, even in densely populated areas, is very low
- All Manufacturers now include a variety of management options with their modern systems that are capable of mitigating interference. This can be done at a local, regional or even international level and generates confidence that the probability of successfully dealing with the potential interference problems is very high

- The majority of the results of a large number of measurement campaigns prove that the level of non-intended emissions coming from PLC equipment is often below the existing noise floor. Furthermore, different types of telecommunication networks (such as ADSL, VDSL, LANs and others) are being deployed in much larger numbers without any special concerns even having emission levels similar to those coming from PLC

Unfortunately, Asian and American Manufacturers are day by day catching up Europe in terms of its initial PLC know-how leadership, taking advantage of the European development speed reduction. Some Manufacturers (such as M@in.net, Schneider or DS2) keep developing their PLC business, while others suffered from large reductions in their market share and manufacturing activities (Ascom). On the other hand, companies like Amperion and Ambient (USA) or Sumitomo, Mitsubishi and Toyocom (Asia) have already signed agreements with DS2 to use their chipset in their PLC equipment manufacturing and distribution activities around the world.

However, the discussion related to PLC standardisation issues remains open among the experts. As a consequence of this, after more than three years, a specific Harmonised Standard for this technology is still pending. The level of regulatory uncertainty becomes an important key issue considered by potential PLC investors, who under these circumstances cannot bear the risk to deploy PLC networks.

Electric Utilities, already operating PLC systems, therefore have to bear these risks. In this sense, an unjustified low emission limit would lead to an unprofitable PLC network scheme. In addition, the lack of a clear regulatory framework may generate additional barriers for PLC deployments reducing the window of opportunity and increasing legal uncertainty.

Different experiences around the world demonstrate that PLC technology is a viable solution to deploy alternative telecommunication networks (especially for the last mile and local loop) based on the already deployed electric grid. This will also help to boost competition and minimise the differences among the countries and areas regarding their existing telecom infrastructures.

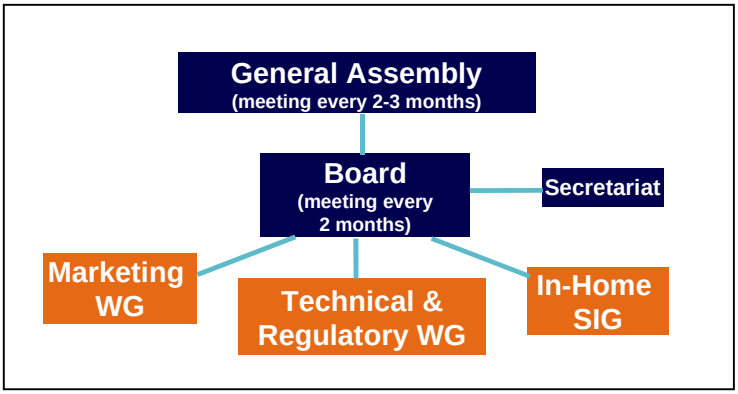
Therefore, the European PLC Community needs a clear commitment from the European and National Authorities on their interest to promote this new technology solving the lack of a regulatory framework, overcoming the existing conflict of interest and assuring a favourable and stable framework for PLC investors and successful roll-outs. It is necessary to come to a pragmatic approach on the acceptable emission limit that could definitely make PLC technology become an alternative to provide broadband services under non-discriminatory EMC conditions regarding other technologies.

2 Examples for Organisations dealing with PLC

2.1 PLC Forum

The “PLC Forum” is an international organisation created under the Swiss law in early 2000, through the merger of 2 existing Associations. It consists of 45 regular members and 12 permanent guests: 37% Utilities, 42% Manufacturers and 21% other PLC stakeholders.

These activities are carried out by the different Committees that are established in the organisational structure:



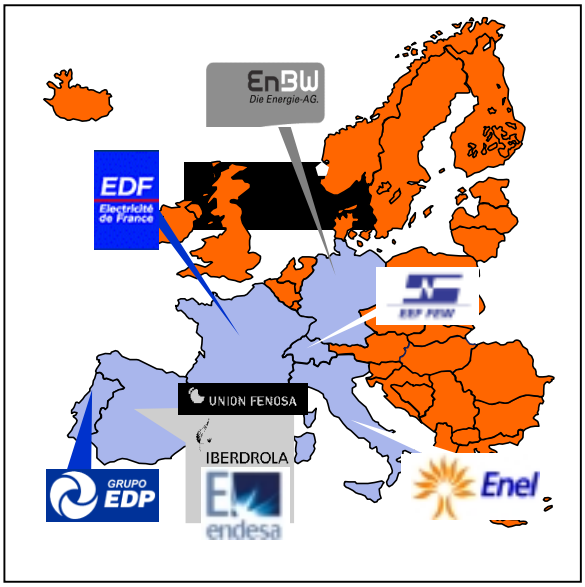
PLC Forum develops its activities in coordination with other different PLC organisations worldwide, given the importance of the cooperation among PLC Associations, which can be strengthened to the benefit of the PLC industry worldwide.

That is why PLC Forum has already signed 4 MoUs (with UPLC (through UTC), PLCA, PUA and ETSI PLT), and is willing to sign MoUs with other Associations.

2.2 PUA

The “PLC Utilities Alliance” (PUA) is an European organisation that was founded in January 2002 by Iberdrola, Enel, EDF, EnBW, and Endesa. Later on, some other Utilities such as EDP, EEF and Union Fenosa have joined the Alliance. PUA members have an electric customer base of over 100 million customers.

The aim of the PUA is to get a closer cooperation among Utilities to get a common position and to promote and influence the PLC industry development in Europe, mainly in terms of the promotion of PLC technology, and the development of an adequate regulatory framework and equipment standards. It also collaborates with the main PLC equipment providers in order to identify technical improvements and upgrades.



On November 2002, a White Paper on PLC Technology has been developed on behalf of the PUA in order to assess the development environment for PLC in the European telecom market. It also includes the analysis of PLC situation and the forecast of the Development of Broadband in Europe, evaluating the opportunity for the European industry that represent the European leadership in PLC. This White Paper is available to National Authorities and main PLC stakeholders (for further information, please refer to Chapter 7).

2.3 Eurelectric

The "Union of the Electricity Industry" (EURELECTRIC) is the sector association representing the common interests of the European electricity industry and its worldwide affiliates and associates.

It was formed as a result of a merger, in December 1999, of the twin Industry Associations:

- UNIPEDE (International Union of Producers and Distributors of Electrical Energy, founded in 1925) and
- EURELECTRIC (European Grouping of Electricity Undertakings, in existence since 1990)

Its mission is to contribute to the development and competitiveness of the Electricity Industry and to promote the role of electricity in the advancement of society.

As a centre of strategic expertise, EURELECTRIC identifies and represents the interests of its members and assists them in formulating and implementing common solutions on policy and strategic issues of concern. EURELECTRIC acts as a liaison body to promote the collective views of the electricity industry at EU and international level. Its main partners in dialogue are the institutions of the European Union, plus other European and International bodies.

Within EURELECTRIC a Network of Experts on Broadband PLC has been established under the Network of Experts on Standardisation.

2.4 Other PLC Organisations: USA and Asia

Other organisations around the world are oriented to the development and support of the PLC Technology in a similar way that the organisations already described for the European framework.

USA (UPLC, PLCA) and Japan (PLC-J) have the main organisations of this kind, which are briefly described below.

UPLC

The UPLC is an American alliance of Utilities and technology partners to develop business, technical and regulatory solutions for BPL in the Americas.

It is related to the United Telecom Council (well known as UTC).

Its activities are oriented to different PLC business and technical aspects, and are carried out regarding a Committee structure:

- Business Action: Promote market awareness through conferences, reports, and newsletters, newsletter, monthly email, etc.
- Regulatory Action: Become the premier advocate for industry w/Congress, FCC & States, Engage w/ FCC on Notice of Inquiry, Promote legislation that encourages PLC deployment, Advocate to state public Utility commissions/legislatures, upon request, etc.
- Technical Action: Develop common solutions to technical obstacles for deployments, Best practices for Power Line deployments, Coordinate w/ other organisations, Serve as resource for information on technical operations, etc.

PLCA

The "Power Line Communications Association" (PLCA) is an American alliance of Utilities or affiliates, PLC network Operators, Vendors of PLC technology and services, ISPs (Internet Service Providers) and CLECs (Competitive Local Exchange Carriers).

It was founded in December 2001 and incorporated in District of Columbia, USA.

It is a fully independent organisation focused on PLC issues in USA, mainly:

- Promoting PLC (as an access technology)
- Advocating favourable public policy for PLC
- Acting as catalyst for industry cooperation on tech R&D, standards, market research, capital formation and other objectives

PLC-J

The "High Speed Power Line Communication Promoters' Alliance" (PLC-J) is a Japanese organisation established as a PLC promotion group, and oriented to promote the deregulation about PLC in Japan. The board members are Japanese companies (mainly PLC Manufacturers and other developers).

This organisation basically performs activities oriented to achieve technology standards for the use of high speed Power Line communication (level of radiated emission, etc.). They develop specific radiated emission suppression solutions and methods to achieve coexistence with existing wireless communication systems. They also work on promotion and education about PLC and various different activities necessary for the achievement of the goals of PLC-J.

3 PLC Business Opportunity

3.1 PLC overview

PLC is a proven, competitive broadband access technology, supported by Utilities and Manufacturers worldwide.

In Europe, although Utilities and Manufacturers are ready for massive PLC deployments, a clear regulatory framework is still missing, delaying deployments, reducing the window of opportunity for European companies and jeopardizing the leading role that Europe plays today in the PLC arena.

Technology

Different experiences around the world demonstrate that PLC technology is a viable solution to deploy alternative telecommunication networks using already deployed infrastructure.

Low Voltage PLC

There are two main areas in which Low Voltage PLC technology may be used: Power Line access and In-house Power Line.

Power Line access provides, from the low voltage substation to the user's home, a broadband communication link using the low voltage grid. Its main applications are broadband Internet access and Voice services, positioning PLC as an alternative access network to incumbent Operators' infrastructure.

Additionally, Power Line access has other user applications, such as Digital TV, Video on Demand, and it also could enable applications such as remote Telecontrol of electric equipment and Automatic Meter Reading.

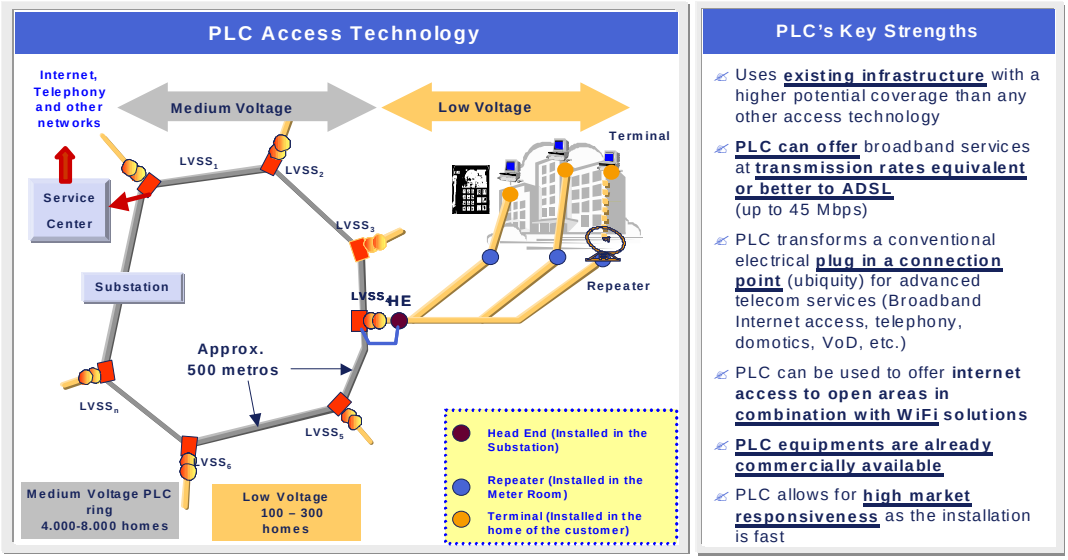


Figure 1: PLC Access Technology

In-house Power Line is a home-network system that provides a useful communications network inside houses using the existing electrical infrastructure. Its main application is the development of new 'Home Area Networks' which can deliver:

- Internet and voice access points all over the user's house
- 'Home automation' services

Both, access and in-house PLC, use the existing low voltage grid and provide an easy-plug-in solution to the development of broadband Internet and a solution to the present cabling problems.

Medium Voltage PLC

Besides Low Voltage PLC, Medium Voltage PLC communications have been developed during the last years. Through medium voltage PLC, Utilities can use their own existing medium voltage power grids to connect the different low voltage substations, setting up a backhaul network based on PLC or some PLC-fiber mixed solutions.

Developments

These different PLC technologies, developed by several technology providers, are currently achieving bandwidth capacities up to 45 Mbps (raw) range in both directions, obtaining speeds greater than ADSL's. Moreover, Manufacturers are currently working on commercial PLC chipsets that will be available in 2004 offering up to 200 Mbps (raw) in both directions.

Competitiveness

Power Line Communications is well positioned to compete in the European residential broadband market because of its commercial competitiveness and its favourable economics.

In terms of commercial competitiveness, PLC can be considered as one of the most competitive technologies. Thanks to the use of existing infrastructure, PLC technology presents an outstanding ability to roll out the network rapidly, and also provides a service quality and speeds in line with xDSL.

In terms of economics, PLC has a CAPEX per user of the same magnitude as CLEC's ADSL. PLC requires one of the lowest upfront and operating investments amongst access technologies (see Figure 2), since it is based on an infrastructure that is already in place (the electrical grid).

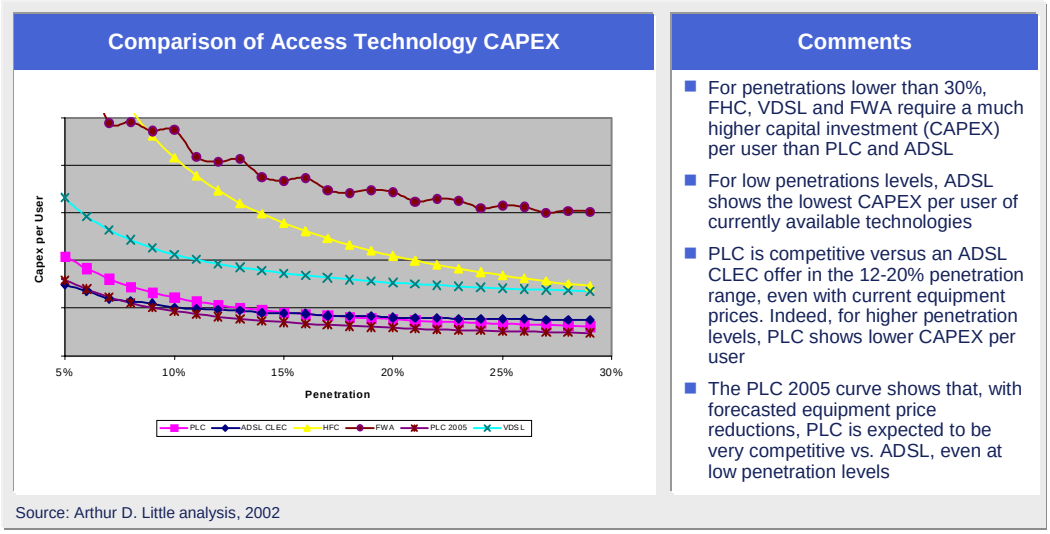


Figure 2: Comparison of Access Technology CAPEX

PLC and ADSL are by far the most competitive access technologies in the market. HFC and VDSL would need very high commercial penetrations to become closer to PLC CAPEX per user levels, and WLL seems to be CAPEX intensive to target the residential market.

Moreover, PLC economics will become even more competitive in the near future, as equipment costs decline up to a 50% by 2004 and the market progresses from its early development stage.

On top of that, the use of medium voltage PLC technology makes economics particularly attractive since it avoids the deployment of more expensive technologies (such as FWA or Fibre links) to link low voltage substations.

Manufacturers

Although some Manufacturers in Europe suffered from large reductions in their market share and manufacturing activities (Ascom), others (such as M@in.net, Schneider or DS2) keep developing their PLC business.

Asian and American Manufacturers are day by day catching up Europe in terms of its initial PLC know-how leadership, taking advantage of the European development speed reduction. Companies such as Amperion and Ambient (USA) or Sumitomo, Mitsubishi and Toyocom (Asia) have already signed agreements with DS2 to use their chipset in their PLC equipment manufacturing and distribution activities around the world.

3.2 *European Local Access Market Development*

Forecasts for broadband access development in Europe are quite optimistic, with impressive growth rates in every market in the next few years, in line with eEurope 2005 Policy.

However, although broadband demand is already high, broadband penetration is still low compared to other regions such as USA and Asia, one of the main reasons being the lack of infrastructure competition.

European Broadband Market

EU Broadband is still at an early stage of development, with a low average penetration of EU households.

The broadband market is expected to grow rapidly in Europe due to:

- The increasing demand for services that require broadband capabilities (e.g. multimedia entertainment, teleworking, corporate communications)
- The investments made by some Operators to develop high bandwidth networks
- The support given by European and national government to the development of the broadband market and the information society

Demand for broadband-enabled services in Europe will grow in the coming years since there are increasingly rich interactive content and corporate high data consumption applications coming online. The delivery of such content requires high-speed access to avoid long waits, which increase frustration and detract from the objective of providing more complex content.

There is already an important demand for more bandwidth from an increasing number of Internet users, who are facing usability problems with new media applications like audio and video streaming or when working at home. In fact, more than one third of European Internet users are not satisfied with the current speed of their Internet access.

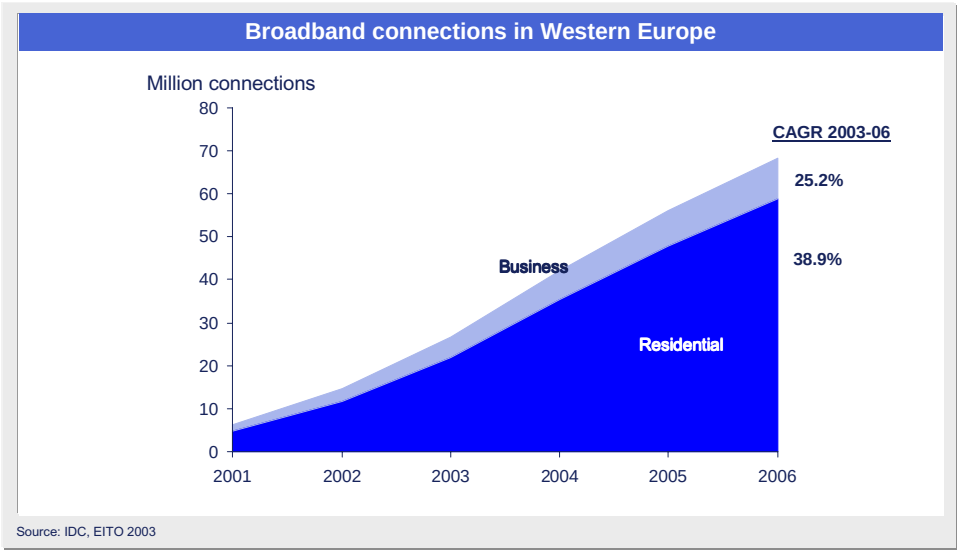


Figure 3: Broadband Connections in Western Europe

Infrastructure competition is a key driver for broadband penetration

Despite the existing demand, average broadband penetration in Europe is low compared to other regions such as the USA or Asia. The lack of infrastructure competition and the resulting absence of downward pressure on prices are among the main reasons for this low penetration.

As a matter of fact, broadband penetration is not homogeneous across the European Union, being directly correlated to the degree of network competition (Figure 4).

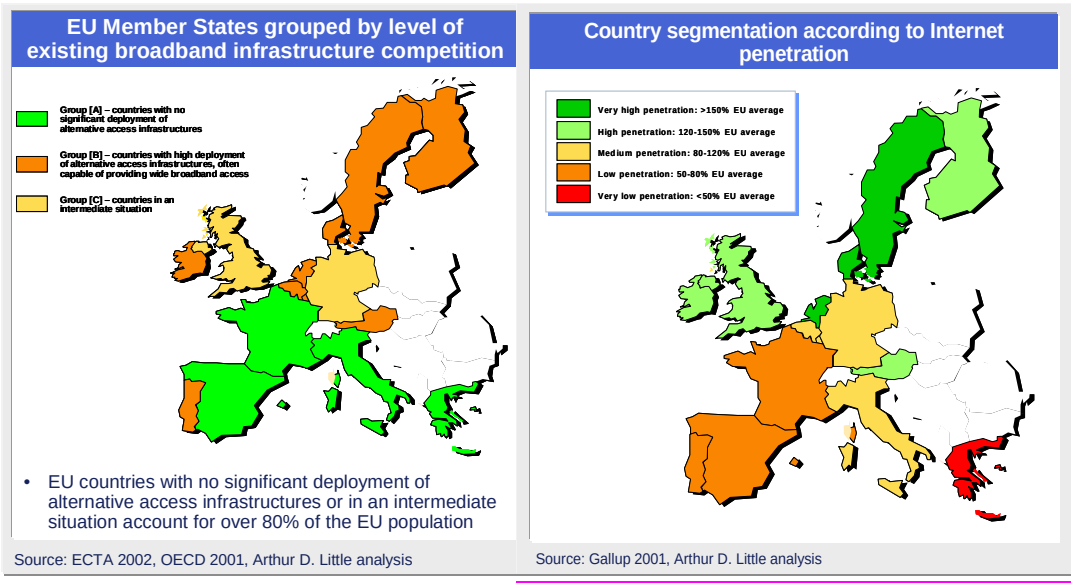


Figure 4: Country segmentation according to Infrastructure Competition and Internet Penetration

Consequently, the EU broadband market can be differentiated into two groups of Member States depending on their afore mentioned degree of development and penetration:

- Northern European countries: most of them have invested in the deployment of at least two different nationwide broadband networks (normally ADSL and Cable)
- Southern Europe and the UK: they have either only one network with high coverage (e.g. ADSL in Spain or Cable in Portugal) or two different networks but with poor nationwide coverage (e.g. UK or France)

Those countries that have invested in the roll-out of several alternative networks or technologies have a higher penetration of broadband connections as a consequence of the associated increase in competition[1].

The lack of competition from alternative networks in most EU Member States is one of the reasons why the USA and Asian countries are more advanced than the EU Member States in terms of penetration. Only EU countries with different competing networks or

[1] The main exception is Germany which is located among the countries with higher penetration in spite of having only one dominant network (Deutsche Telekom's ADSL). This is a result of DTAG making huge investments in marketing and network roll-out in order to capture most of the market before the sale of its majority stake in the German cable Operators. The cable Operators are likely to become DTAG's main competitors in the future since penetration of CATV in Germany is at 90%.

technologies have been able to reduce the gap with Asia and even exceed USA's penetration levels.

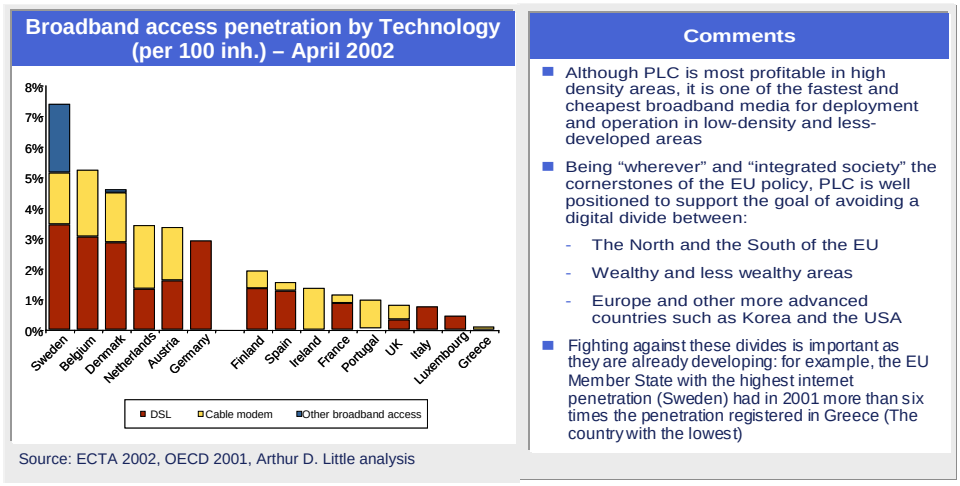


Figure 5: Broadband penetration gap

High prices hinder broadband penetration

The lack of alternative telecommunications infrastructure holds back competition from Operators reducing the downward pressure on prices and therefore hindering Internet broadband penetration.

Most Internet users in the EU still consider broadband expensive, with a clear correlation between countries with more users regarding broadband as affordable and higher broadband penetration. Therefore, countries with high broadband penetration have low broadband monthly fees:

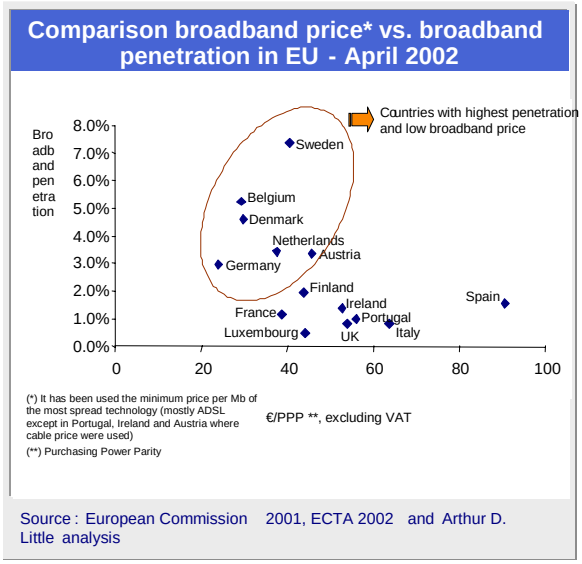


Figure 6: Broadband price – penetration correlation in EU (April 2002)

Nowadays, the European broadband market is characterised by the incumbent Operators' continued dominance of the local loop infrastructure. The countries with

established CATV networks are the exception, although even there, most of the network still needs to be upgraded in order to provide broadband Internet services. As a consequence, incumbents maintain broadband prices high, especially in countries where alternative networks have a low market penetration.

Local Loop Unbundling has enjoyed a limited success

Together with infrastructure competition, local loop unbundling was thought to be an alternative way to introduce competition in the broadband marketplace.

However, it is a fact that during the last years the unbundling process has enjoyed limited success. This, together with the restricted investments from Telecom Operator companies has been confirming the PLC opportunity.

The existence of alternative networks is the main factor promoting competition and broadband penetration. According to the EC: "Not surprisingly, it is those countries with extensive cable TV networks which lead in Internet via cable modem. These countries also benefit from the competition between cable and ADSL providers. Unbundling has only brought limited competition to ADSL supply and some incumbent Operators have opted for a positive marketing strategy for ADSL to establish market share in the face of competition from cable".

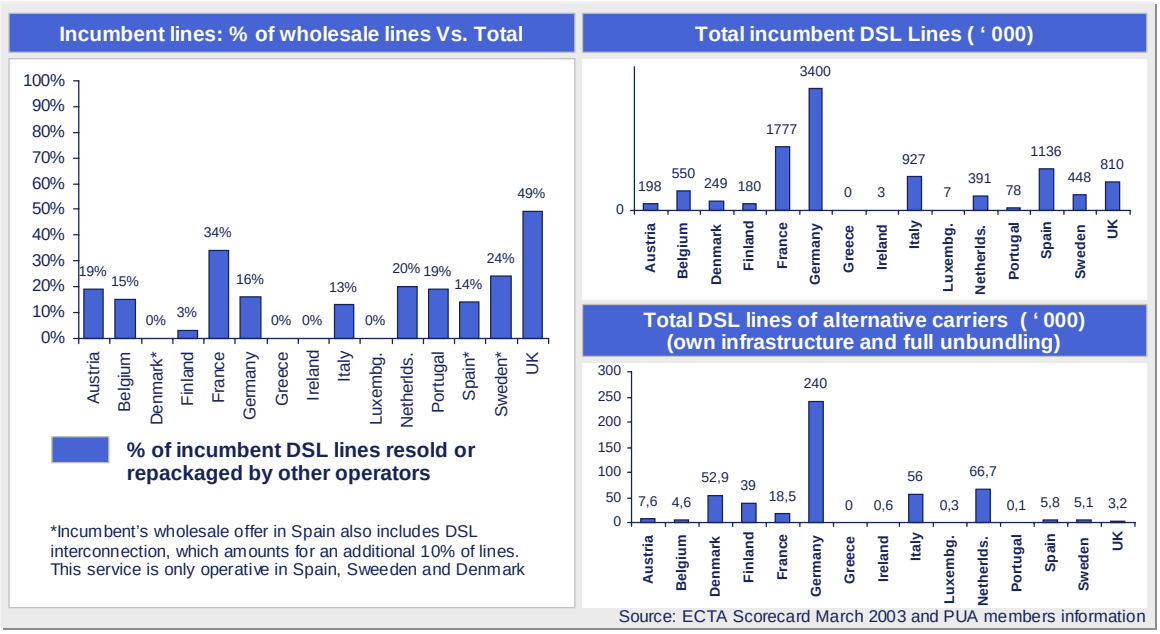


Figure 7: Analysis on incumbents

The Korean Case

South Korea was the great broadband success story of 2000 and 2001, with around 7.8 million broadband users at the end of 2001, in line with earlier predictions, and representing a penetration of up to 50% of households.

The success of broadband in Korea is based on three main factors:

- Competition among different ADSL and Cable networks, which has led to a broadband monthly subscription fee of around US$ 28.

- Financial support from the Korean government, who announced a series of loans to increase the number of homes passed by broadband from 55% to 70% by the end of 2002. It will lend a total of US$ 60 million to Operators for the roll-out of broadband networks. In addition, it plans to spend over US$ 10 billion to deliver VDSL or fibre to over 80% of the Korean population by the end of 2005.
- Development of broadband applications such as on-line games.

3.3 Contribution of PLC to attaining EU Objectives

The fixed telephony networks, with extensive (but smaller than electricity) coverage belong mostly to incumbent Operators, and local loop unbundling has proven not to be effective in the medium term.

The European Commission and eEurope 2005 Policy recognise that no single technology will be able to support total coverage of the EU area and, therefore, intend to put in place a level playing field between alternative technologies.

In this context, it is important to point out the opportunity that an efficient technology such as PLC represents and its undeniable advantages:

- The electricity distribution networks have the most extensive coverage and they are already deployed.
- As it is mainly based on existing infrastructure, PLC deployment is very fast compared with most of the competing technologies.
- PLC networks have competitive investment needs and operating costs if compared to other broadband technologies. Although PLC is profitable mainly when rolled out in urban highly populated areas, it is more cost effective than other technologies to reach areas with a lower population density.
- There are no primary spectrum limitation because PLC is not a radio service.
- The indoor ubiquity of power lines enables the provision of distributed services with lower investment. This has proved of special interest in public buildings like schools, universities, hospitals, community service centres, etc.
- At the current state of art, only wired technologies such as xDSL, HFC, FTTB or PLC could offer broadband services (>2 Mbps) to the residential market, but only xDSL and PLC can be profitable at significantly low penetration rates.

Power Line Communications is therefore capable of supporting effectively the EU's Information Society policies and goals and reducing the digital divide in Europe.

4 Business Models for PLC Deployments

4.1 Introduction

A large number of PLC initiatives around the world have proved that PLC is a viable technical solution to provide broadband access and services. Furthermore, PLC is currently commercially available and offers a great application potential.

In a first approach, PLC technology can be commercially applied to:

- Access Services: Broadband Internet, Telephony, Videoconference, etc.
- In-House Services: Tele-Surveillance, Home Automation, Home networking, Entertainment, etc.
- Energy Management solutions: Automatic Meter Reading, Increase operational efficiency, Increase efficiency in infrastructures and reduce investments, Provide value added services, etc.

Energy Utility companies, Manufacturers, Telecommunication Operators and other current investors have shown a serious commitment to PLC Technology as an alternative to other access technologies. It is necessary to provide a stable and favourable regulatory framework in order to encourage larger and faster deployments.

There are currently different Models being approached by Utilities according to their specific competitive environment and the role that the Utility is willing to play in the telecom market.

Although there are many shades on the different Business Models, the most important ones could be summarised as: ***Carrier*** and ***Retail***.

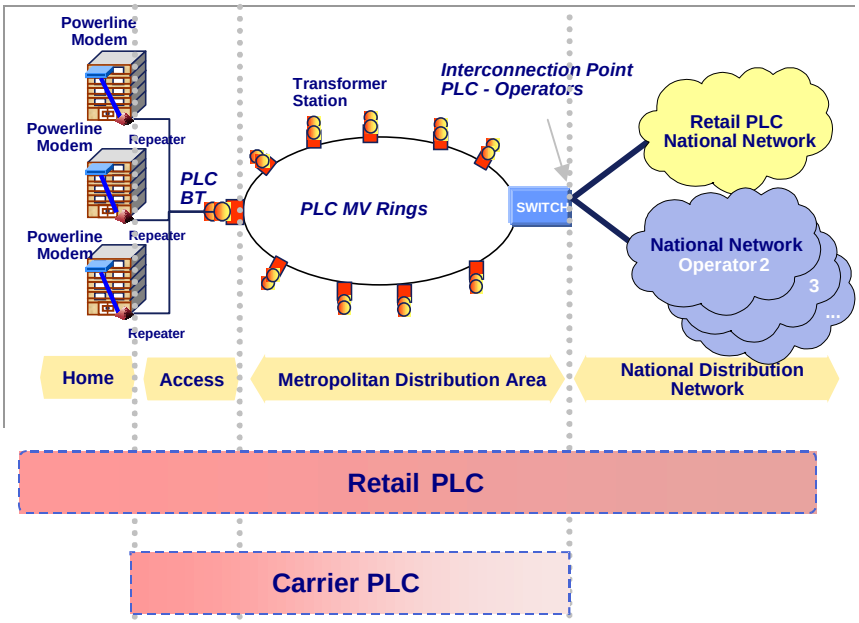


Figure 8: Business Models

4.2 Wholesaler Model: Utility as a Carrier

Under this Business Model, the Utility plays the role of an access carrier, exploiting its electric infrastructure (power lines and grid) by transforming it into a broadband-last-mile solution.

The electric grid is used to offer value added broadband services (like Internet and IP telephony). The PLC network would be open to Telecom Operators interested in the technology. Thus, the Utility final customers are the interested Telecom Operators, which will elaborate the commercial offer for the final customers.

The existing infrastructure is rented to them as a broadband access infrastructure. Therefore, the Utility can focus on its key strengths and core competence (such as infrastructure deployment, supervision, maintenance and technical aspects), leaving the Retail activities to specialised Telecom Operators.

The Telecom Operators, not owning last-mile access telecommunications infrastructure, would be able to launch their commercial broadband services in short time.

In this case, it will be under the responsibility of the Utility to:

- Deploy, supervise and maintain the metropolitan PLC network operation
- Sell local access services to a Telecom Operator
- Provide the Operators with the Internet and voice traffic in several PoPs (Points of Presence)

In some cases, the Utility could decide to deploy PLC networks in new distribution areas depending on the Operator marketing forecasts.

4.3 Retailer Model: Utility as an Operator

Whenever an Energy Utility decides to adopt a Retail Model for its commercial deployment, it will play the role of a Telecom Operator itself, both providing the broadband access services and building the commercial offer for the final customers.

Under this Business Model, the Utility could compete with the rest of local Operators, using its own electric infrastructure as a PLC network to provide the final customers with broadband services.

In this case, it will be under the responsibility of the Utility not only to perform all the technical activities (related to the deployment, supervision and maintenance of the network) but also carry out specialised marketing and commercial activities, such as:

- Building the commercial offer
- Launching Sales Forces
- Invoicing the usage of the services (traffic)

4.4 Conclusions

As a summary, the different alternatives in the Business Models definition can be clustered into various categories:

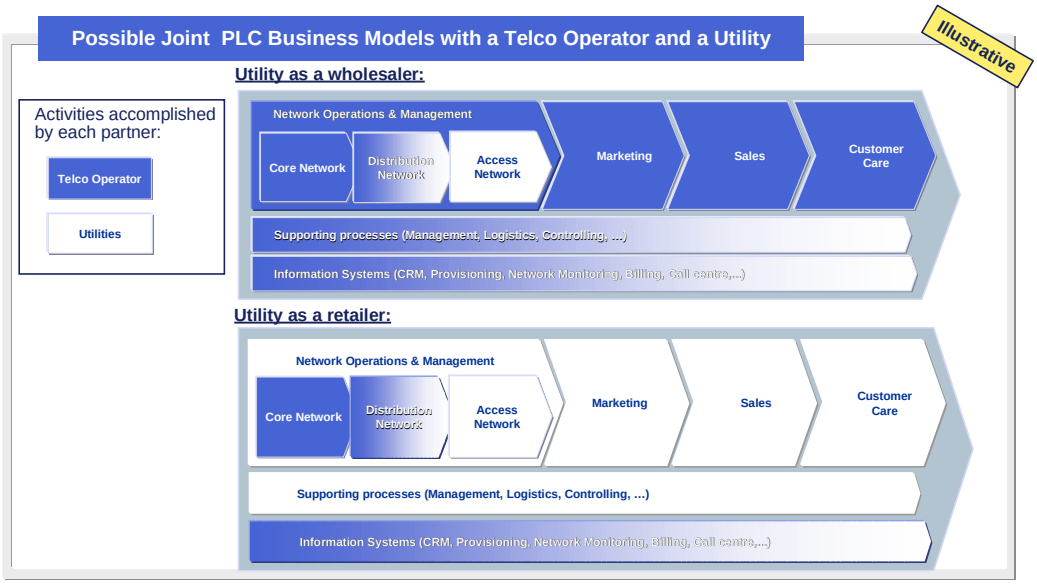


Figure 9: Utilities and Operators roles in Business Models

The benchmark of competitive offers and the current possibilities of PLC technology are the key drivers which guide the product definition process in order to meet customer needs.

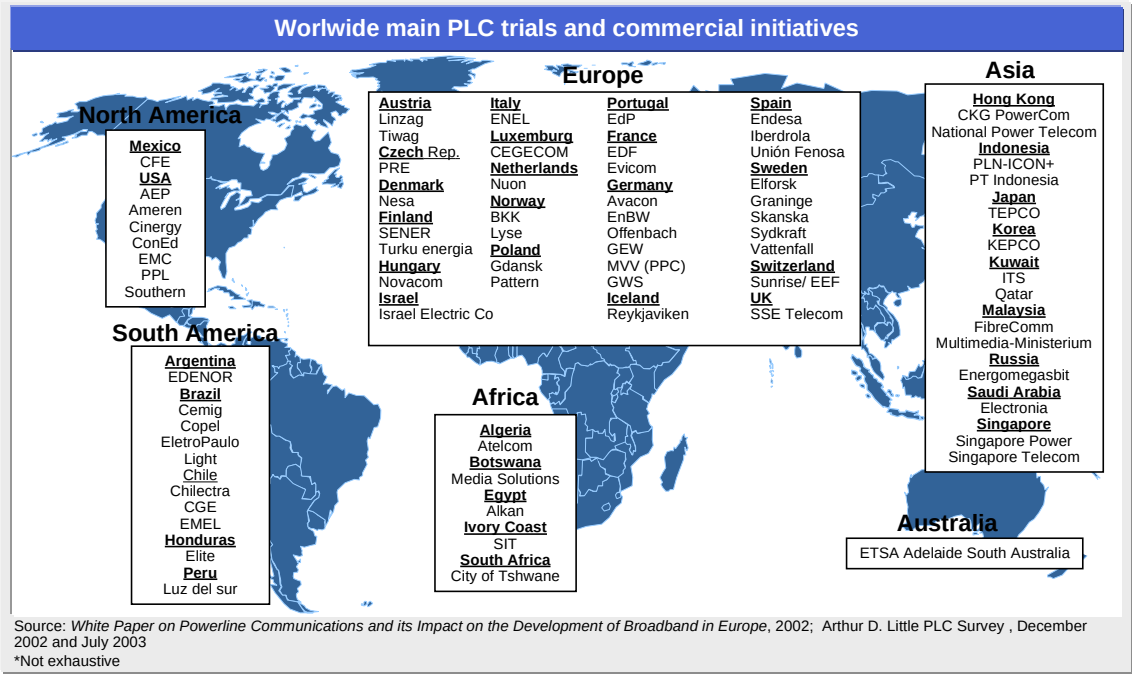
Profitability of PLC access services must be analysed on a case by case basis, as many factors have deep influence on it. In particular:

- Potential market
- Electrical grid topology
- Competing access infrastructures in the same market
- Internet & Broadband development
- Chosen Business Model: Retail, Wholesale, lease of use rights, etc.
- Equipment prices roadmap
- Etc.

Each organisation will choose the best fit considering market conditions and its own business strategy.

5 Current Status of PLC initiatives

During the past years, global interest in PLC technology has been growing considerably. In this sense, by mid 2003, more than 80 PLC initiatives in more than 40 countries, surpassing 20,000 users, have been detected among worldwide Utilities.



Source: *White Paper on Powerline Communications and its Impact on the Development of Broadband in Europe*, 2002; Arthur D. Little PLC Survey , December 2002 and July 2003
*Not exhaustive

Figure 10: Worldwide PLC experiences

By the end of December 2002, trials had been successfully completed, confirming the viability of a PLC networks and creating momentum to launch commercial initiatives. Today's landscape has evolved, transforming Power Line pilots and technology focused trials into commercial realities.

Once the technological barriers for deployment have been largely removed by the combined efforts of leading Manufacturers and Utilities, the PLC opportunity becomes clearer. Utilities are leveraging on their main assets to deliver the potential for massive efficiency gains enabling CLEC's Business Plans (as a competition driver in the local loop) and creating new business opportunities.

In fact, a large number of companies worldwide have started PLC controlled commercial initiatives, providing services as broadband Internet access, voice over IP and others to final users, as can be seen in the next scheme.

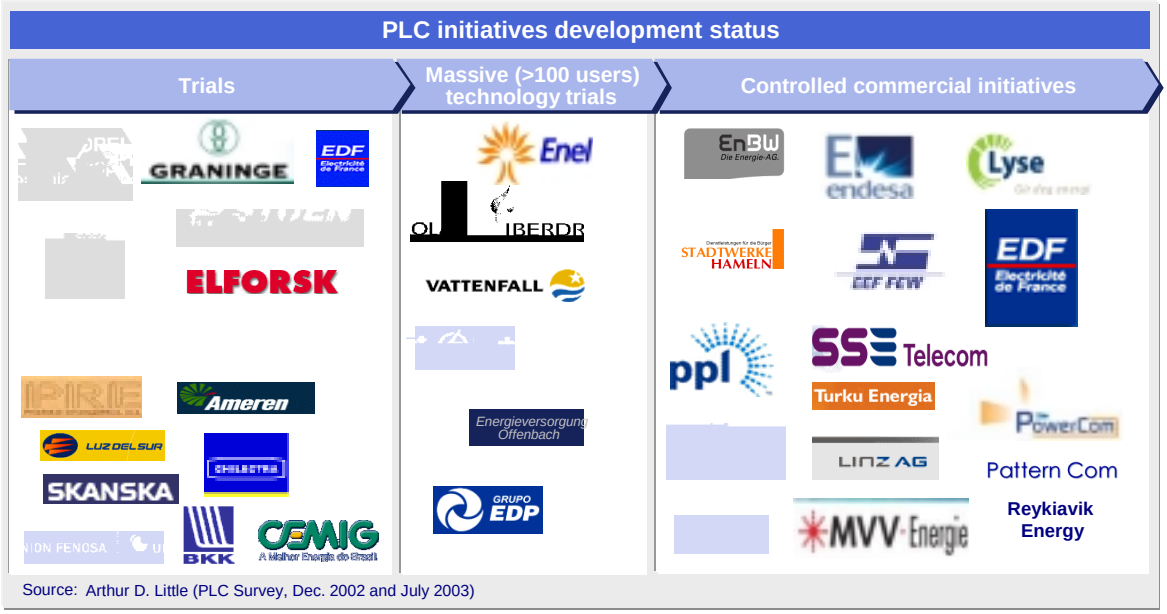


Figure 11: PLC initiatives Status

As an overview of the current situation of PLC deployments around the world, the following conclusions can be summarised:

- PLC Marketplace is poised for real and rapid growth provided a convenient legal framework
- Technology barriers to deployment are largely removed and currently solid Manufacturers are involved in supplying equipment
- World leading Utilities are moving on towards commercial initiatives and launches
- Not only Broadband, but Voice over IP (VoIP) has become a reality and is being tested in a high percentage of initiatives
- Low deployment costs enable profitable PLC Business Models
- Medium Voltage PLC is becoming one of the main backhaul network in commercial tests, although xDSL has gained market share due to the large number of small technology pilots
- Regulation remains an issue, delaying commercial launches in some cases, especially regarding EMC regulation

In particular, there is a strong development of PLC initiatives in USA, Latin America and Asia that are currently in place or being launched. European Utilities, despite last year's leading position, are now expecting for regulatory certainty to carry on major developments. This will imply a global approach by the Industry and European Regulators to overcome the main issues that have been pointed out as a critic barrier for massive deployments.

6 Standardisation issues – EMC

6.1 State of the Art

The regulatory initiatives already undertaken are the first step towards a clear regulatory and standardisation framework. The European Commission asked to stop the enforcement of limits standards defined by National Regulators and proposed the elaboration of European-wide wire-line emission standards.

Although no definitive conclusions or regulation have been still achieved within the European Framework, there are several initiatives coming from experts involved in the creation of related standards:

- Ongoing work at **CENELEC and ETSI,** through a Joint EMC Working Group, to establish a new harmonised emission standard for all kinds if wire-line networks under EU Mandate M/313
- Ongoing works to adapt CISPR22 (conducted emissions) related to PLC technology, by **CISPR/I/WG3**
- Concession of provisional licences by **National Authorities** to PLC Operators for PLC trials, if any needed, following a balanced approach in order to promote new broadband technologies while protecting radio services

6.2 Standardisation work

Related standardisation may be divided in two categories:

- As expressed above, the Working Group dedicated to the task of producing the amendment to the international publication IEC 22 will then edit a "**Product standard**" related to PLC technology.
- The Mandate M313 was given to CENELEC and ETSI in order to produce a European harmonised standard, to cover the "System" PLC as a whole, in other words " **Network standard"**.

Both categories cover EMC topics.

It is extremely important to keep in mind that the so–called Network Standard is to be applied only in case of interference, created by a PLC unit.

6.2.1 Product standard

This work is dealt with in the CISPR Committee, at the international level (IEC).

The expected output of the ongoing work is, as everyone knows, an amendment to the IEC publication CISPR 22.

The document is still at a low stage in the process of development of an international standard: the former draft ("CD", CIS/I/44/CD), after circulation to the National Committees and compilation of the received comments, was rejected by the Working Group in charge of the Work Item (WG3) and, for actual work, the Task Force LCL was disbanded.

Today, a new Task Force, Task Force ISN, was dedicated the work, with the objective to have a document ready for the next CISPR general meeting (end September 2003).

The impact of this future amendment is huge: the publication, after being adopted as a harmonised European standard (EN) by CENELEC, is a major part of the EMC requirements for the European "**CE marking**". It must be always in mind that the compliance with this product standard will imply presumption of conformity of the related product with the EMC Directive.

It is therefore extremely important to obtain the necessary consensus on a draft proposal and proceed the usual way in force within IEC from CD to CDV/FDIS.

6.2.2 Mandate M 313 and the Network standard

Establishing a harmonised standard, dealing with network, is quite an innovative idea, coming from an initiative of the European Commission: the Mandate given to the European Standardisation bodies was accepted by CENELEC and ETSI (Mandate M 313).

The expected outcome is a Harmonised European Standard. Due to many difficulties in reaching a consensus within the working group, a questionnaire is now circulating within the National Committees (CENELEC and ETSI, when applicable).

National Committees will provide answers to this questionnaire in the coming months. The option leading to **55,5 dBµV/m** is the extreme limit below which PLC industry will not survive.

An important clause is the applicability of the future standard: "Conformity assessment procedure for telecommunication networks" thanks to which there is deemed to be compliant to the present standard if all equipment connected to the network meets the emission requirements defined in the applicable EMC product standard.

6.3 Output from PUA Measurement Campaign

Beside other European Utilities, several network Operators within PUA have performed Measurement Campaigns over their Low and Medium Voltage PLC Networks and equipment. These PUA campaigns have been carried out in coordination with an independent and recognised laboratory, using the same equipment in all the cases.

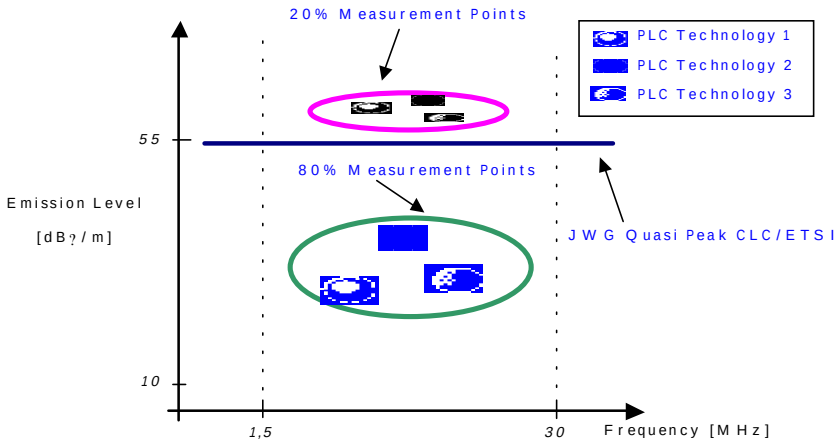
Among the measured parameters, the radiated emission measurements were performed following CISPR recommendations and instrumentation.

- Measured in 5 Utilities' PLC networks in 4 European countries (Spain, Portugal, Italy and France)
- 144 different measurement points: 56 outdoor and 88 indoor

- Measurement points were chosen at the locations where the highest emission could be expected
- The evaluated technologies were Ascom, DS2 and M@in.net

The Summary of the results of the different campaigns shows positive conclusions for PLC, proving that:

80% of the measured values are below 55dBµV/m (for both indoor and outdoor measurement points)
94% of the measured outdoor values are below the JWG CENELEC/ETSI currently proposed limit (55 dBµV/m)
60% of the outdoor measurements are lower than the surrounding noise



A deeper analysis of the results let us arrive to the following additional conclusions:

- The emissions are concentrated in the areas close to the injection points
- The surrounding noise floor was found to be between 30 - 60 dBµV/m
- The PLC Systems' contribution to the noise floor is negligible
- The results seem to be rather independent from the specific country where the measurement campaign was performed
- The electrical grids of the different countries show similar EMC behaviour

- Coexistence with many other technologies & applications (Ethernet, ADSL, WIFI, radio applications, etc.) is possible

It is also remarkable that no real problems have been registered until now, even knowing that most of PLC deployments are located in high density urban areas.

6.4 General Conclusions

A favourable regulatory environment and a supportive public policy are necessary in order to provide a regulatory framework and, therefore, sufficient certainty to boost massive deployments of PLC technology.

Due to the harsh contradictions among the interested Parties involved, the ongoing work being carried out by the different Standardisation bodies has very slowly advanced during the past three years, and a short-term solution for EMC standards for PLC technology is required.

In this sense, it would have a very important positive impact if a **permissive and pragmatic recommendation could be provided in the short term**. This would make it easier for key decision makers of the industry (Manufacturers and Utilities) to commit to important investments.

In this pragmatic approach the **EC should define and propose an acceptable emission level limit at least as a provisional value for its initial regulation.** This would help to reduce the deployment risk, providing some minimum legal certainty for Utilities.

In case of any interference or perturbation appears, technical solutions for mitigation can be applied effectively to those specific frequency ranges (non-intended emission suppression technology), whilst ensuring continuation of the service. These potential problems can be easily solved on a case by case basis.

7 Contact Information

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