

# Proposed Regulatory Scheme for the Power Line Communication (PLC) TECHNICAL REPORT



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**ABSTRACT**

In this work on drafting a proposal for a Regulatory Scheme PLC (Power Line Communication), analyzes the situation in the country in the telecommunications sector, and how it has affected the market in recent years, in addition examines the technical aspects of the components necessary for the implementation of a PLC system in Ecuador. It has been observed with pilot projects in order to find an analogy to the national situation and obtain the appropriate parameters for the drafting of technical regulations.

## **INTRODUCTION**

The work on drafting a Proposal for a regulatory scheme PLC (Power Line Communication), is drafting a regulatory proposal PLC technique to Ecuador, or Power Line Communication, which will allow mass-production and dissemination of information technology and communication through technology. Internationally PLC is spreading more and more despite some drawbacks gradually being overcome with respect to interference with other systems, there are at present some standards and studies conducted by different organizations.

Few countries have increased exclusive technical legal framework, the vast majority refers to the international standards for the implementation of PLC systems, however the electrical characteristics and laws are different in each country

Ecuador has developed some pilot projects that have allowed providing services through the PLC, however there is no specific technical rules.

## **PURPOSE**

### **GENERAL PURPOSE**

Propose a regulatory scheme PLC in Ecuador through an examination of the situation in the country to ensure, promote and regulate competition and market access PLC.

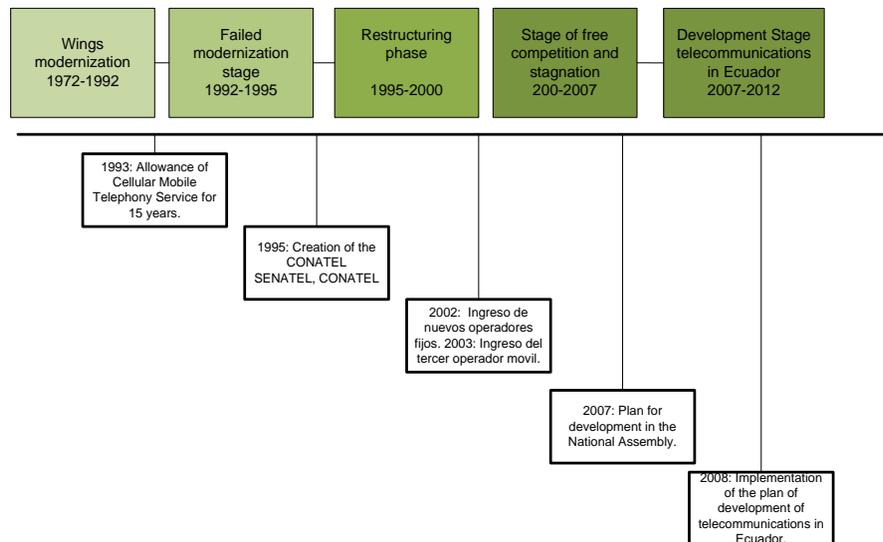
### **SPECIFIC PURPOSE**

1. Analyze and study the evolution of communication services in Ecuador to take a picture on the segment of users of these services
2. Differentiate the types of regulatory actions to PLC in accordance with the level of competition and market structure through the requirements for service delivery PLC
3. Analyze the guidelines used internationally for the regulation of PLC in order to compare with the reality of Ecuador.
4. Drafting a proposed technical standard for PLC in Ecuador, in order to collaborate in the dissemination of data transmission over power line.

## RESEARCH

We carried out a review in aspects, historical, commercial, technical and legal in national telecommunications to choose the parameters in the technical regulations PLC. The information collected and processed reported the next:

history of telecommunications in Ecuador has gone through a multistage process (see Figure 1), which in its early development, not allow free access to services, creating a technological stagnation, social and educational, for 2008, A proposal for a development plan, which is valid and still in the process of improvements, including access to information and communication technologies more and more number of people <sup>[1]</sup>



**Figure 1 Stages of telecommunications in Ecuador** <sup>[1]</sup>

Ecuador has a structure in regard to the telecommunications regulatory body, which are responsible for monitoring and controlling the sector, we include them in order of hierarchy:

- Ministry of Telecommunication and Information Society (MINTEL)
- National Telecommunications Council (CONATEL)
- National Telecommunications Secretariat (SENATEL)
- Superintendencia de Telecomunicaciones (SUPERTEL)

These organizations meet specific functions, looking for the country's development.

Services are mentioned below who have excelled in the country: End services in Ecuador, the most prominent are: Fixed Telephony, Mobile Telephony, within the value-added services have Internet access, and finally into Services Radio and Television highlights the subscription TV. The regulator CONATEL has issues standards for each of the services described and that are controlled by the SUPTERTEL. <sup>[2]</sup>

In Final services, mobile telephony has been the increased penetration of users with a 108% CONECEL where is the operator which dominates the market, while fixed telephony has a 57.83% with the operator at the head CNT EP. Due to the demand for mobility and new trends of mobile technologies has cornered the market of fixed telephony in the country. <sup>[2][3]</sup>

The value-added service (internet) is still not accessible to most of Ecuador's population, according to new figures given by the INEC (Ecuadorian Institute of Statistics and Censuses), which show that 29 out of 100 Ecuadorians have connectivity without But the penetration rate is really high compared to previous years. <sup>[2][3]</sup>

Bearer service, which provides the necessary capacity to third parties for the transmission of signs, signals, data, images and sound between network termination points defined; <sup>[4]</sup> representing 383,097 users in November 2010, distributed in more than 20 operators. Suratel is the company that dominates the market of users belonging to this service, one of the first to obtain the concession for over 10 years. CNT, state-run company won second place, companies like Stage Telconet, including not even reach 2% of users.

Power lines to global and national levels have increased coverage compared with other wire, reaching more users. By 2010 the user density is approximately 100% of the population. The Ecuadorian electricity sector is comprised of the following institutional structure:

- Ministry of Electricity and Renewable Energy (MEER)
  
- National Electricity Council (CONELEC)
  
- National Energy Control (CENACE)

Those agencies are in charge of leading, regulating and managing the generation, transmission, distribution and consumption of electricity nationwide. System should have a high quality of service before Implement PLC, through registration Ecuador 004/01 CONELEC can measure the quality levels of distribution..

Some countries have implemented pilot projects with great success using this technology have also been developed forums and working groups for over 10 years to implement and protect the transmission of data through the cable.

Among them are mentioned:

- Plcforum
- Universal Powerline Association of Power (UPA).
- Homeplug.
- Union Power Line Council (UPLC)
- PLC Utilities Association (PUA)
- PLC European Research Alliance (OPERA)
- PLC-J (PLC-Japan)
- Owners Association of Infrastructure and Private Telecommunications Systems (APTEL)

Among international regulators are:

- International Telecommunication Union (ITU)
- Institute of Electrical and Electronics Engineers (IEEE)
- International Special Committee on Radio Interference (CISPR)

Among the European standardization bodies are:

- European Technical Standards Institute (ETSI)
- European Committee for Electrotechnical Standardization (CENELEC).

Among the U.S. regulatory agencies are:

- Federal Communications Commission (FCC)

- National Telecommunications and Information Administration (NTIA)

In Latin America it is:

- Inter-American Telecommunication Commission (CITEL)

Those Agencies that have studied and promulgated regulations for the proper functioning of PLC systems

In Ecuador, as already mentioned, there are no technical rules for the use of PLC, but not limited implementation, the laws and regulations which examined whether there are impediments to the implementation of PLC are:

- Constitution of Ecuador

## **LAWS**

- Special Telecommunications Law
- Law Amending the Special Telecommunications Law
- Law for the Economic Transformation of Ecuador

## **REGULATIONS**

- General Regulations of the Special Telecommunications Law Act
- Regulation of concessions Telecommunications Services
- Regulation for the provision of telecommunications services through the end telecommunications terminal for public use.
- Regulation for the provision of Carrier Services

- Regulation for the provision of Value Added Services
- Regulations for Approval of Telecommunication Equipment
- Telecommunications Fund Regulation in Rural Areas

## **RULES**

- Technical Requirements and Specifications for the Provision of Quality Carriers Telecommunication Services
- Technical Standard of Value Added Services Internet Access.

Structure of the Ecuadorian State has its basis and foundation in the Constitution of the Republic of Ecuador, which is based on the legal structure of the country and that takes precedence over any other legislation, as mentioned in Article 424.

*“**Article 424.** - The Constitution is the supreme and prevails over any other legal system. The rules and acts of public authority shall maintain compliance with constitutional provisions, otherwise have no legal effect*

*The Constitution and international human rights treaties ratified by the State to recognize rights more favorable than those contained in the Constitution, prevail over any other rule of law or governmental action. ”*

After reviewing the legal instruments mentioned above, there is no impediment, it is noteworthy that the state regulates services rather than technologies, which means that while satisfying the legal requirements can provide services through a PLC system, but legislation is necessary technique enabling the identification of minimum requirements for access to quality services without affecting others.

## TECHNIQUES

PLC, is the generic name given to technology that transmits data via electrical line with a considerable bandwidth, PLC has allowed a form of alternative communication, wherein the data signal transmission is performed through existing power lines. <sup>[5]</sup>

To draft the local law is analyzed the necessary elements needed for PLC deployment. In addition, based on the experiences of power company Centrosur y Empresa Electrica Quito and, as in PLC telemetry studies in power distributors of Ecuador, have find a common factor, thanks to the projects implemented, and we proceed to study the minimum requirements to provide services through the PLC.

The components that are part of a PLC system are:

### ACTIVE COMPONENTS

Head End (HE)

Customer Premise Equipment (CPE)

Repeater (IR)

### PASSIVE COMPONENTS

Couplers.

Distribution Boxes.

Line filters.

Each of the elements are used in different applications namely internal and external. To better describe each of the components shown in Figure 2.

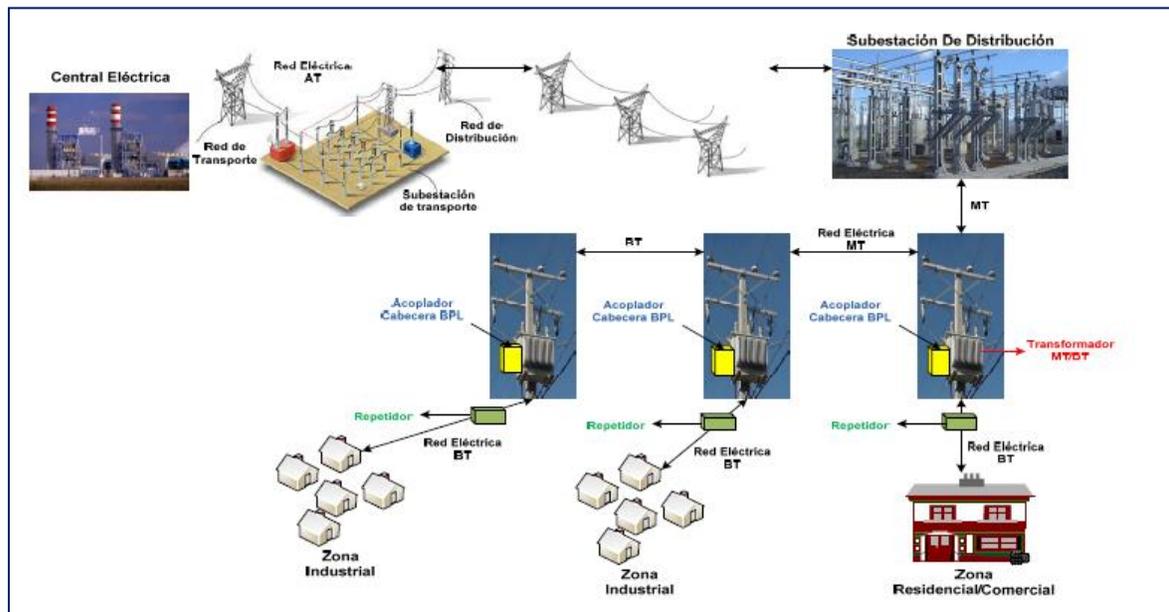


Figure 2. PLC Network topology<sup>[6]</sup>

**Head End (HE):** Depending on the system may be placed in the substation or transformer MV / LV (medium voltage / low voltage), serves as liaison with the external network and the PLC network and external network understood that network that provides Internet connection.

**Customer Premise Equipment (CPE):** Modulated digital signal to an analog carrier that can be transmitted by power lines and at the same time is responsible for putting the high frequency signal into the power grid.

**Repeater (IR):** Amplifies the coverage and scope of the PLC network.

**Couplings:** Those through which the devices are connected to the network of high or low voltage to inject and take IP signals.

**Distribution boxes:** distribution boxes are used when should fit in more than one cable for two capacitive or inductive mode.

**Line Filters:** Prevent noise injected into the line of motors, coils, etc., affecting the signal.

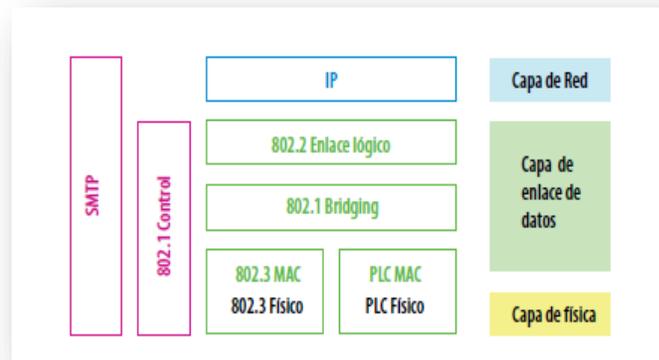


Figure 3 PLC Protocol Stack<sup>[5]</sup>

### PLC Protocol Stack

PLC protocol stack, shown in Figure 3, and then describes each layer of the PLC model.

**Physical layer:** Defines the specifications and procedures for data transmission:

**Transmission Speed:** 205 Mbps

**Modulation:** OFDM.

**Spectral Efficiency:** 8 bps. / Hz.

**Bandwidth:** 25.63 MHz

**Data link layer:** Defines the way in which the nodes have access to the channel grid. Also handles the transmission between nodes is free of errors.

**Network layer:** Mainly provides shipping services, routing and congestion control of packet data from one node to another in the network.

## COMPONENTS OF TECHNICAL STANDARDS FOR THE ECUADOR PLC

Before describing the components of the technical regulations for Ecuador, has show some actions to be taken into account previously.

## **ACTIONS PRIOR TO ESTABLISH A PROJECT OF OPERATION AND SERVICE PLC**

The utilities and the State must go through a process to manage a project PLC in good condition, they include:

1. Analysis of potential areas which would provide the service or market segment in order to classify potential customers as residential, and industrial.
2. Study of the quality of the components of the grid, so that the PLC network equipment work properly, in Ecuador the entity responsible for verifying the correct operation of electrical networks is the CONELEC, it measures the quality Electrical service considering the aspect CONELEC given in Regulation - 004/01 Power Quality Distribution
3. The electricity distribution company must study aspects of commercial viability before venturing into the PLC market, that is to say, by studying the strengths and weaknesses detailed, determine a business model.

Studies and given experiences in other countries suggests adopting one of three models:

Model A: BPL Global Operator.

Model B: Shared Society.

Model C: Bearer Independent.

4. If have choose the business model A, Have should analyze the feasibility of PLC complement to other technologies.
5. Ensure non-disruption of normal power supply.
6. Ensuring a fair price, whatever the business model

## COMPONENTS OF TECHNICAL REGULATIONS

### CHAPTER I

#### GENERAL PROVISIONS

##### OBJECT

This section presents the purpose for which the rule is written as follows:

- a) Establish technical criteria for the installation and operation using PLC technology
- b) Establish the characteristics of data transmission over electrical wire
- c) To prevent interference to other communication systems

##### SCOPE

Shows areas could be applied in the technical standards, such as:

- a) Planning SPLC networks,
- b) Preparation of technical projects for installation of a network of SPLC
- c) Development of projects to migrate to PLC technology.

##### LEGAL SYSTEM

In this part shows the different legal statuses through which govern the rules.

##### TERMS AND DEFINITIONS

Here have conceptualized the terms occurring in the rules, so that legislation can be understood better.

##### FREE COMPETITION

It mentions the competition for a PLC system

### CHAPTER II

#### CERTIFICATES

This section refers to the licensing requirement as a license depending on the chosen business model.

## **CHAPTER III**

### **TECHNICAL STANDARD**

#### **EQUIPMENT**

Showing the necessary equipment and its classification in a PLC system as follows: Class A and Class B

#### **EQUIPMENT CLASS A**

Among the equipment used in Class A teams will have passive and active

#### **CLASS EQUIPMENT B**

In this section uses only active teams

#### **CHARACTERISTICS OF TEAMS**

Shows the main characteristics and minimum equipment necessary to implement a SPLC

#### **BAUD**

For each system requires a minimum transmission speed for a PLC system is suggested:

MV = 135 Mbps

LT = 45 Mbps

CAPACITY / USER = 2.25 Mbps

#### **MEASUREMENT METHODS**

Be qualified according to Regulations for Approval of Telecommunication Equipment provided by CONATEL, taking into account the catalog of equipment.

## **CHAPTER V**

### **ADMINISTRATIVE FEATURES**

#### **DUTIES AND RESPONSIBILITIES**

This section notes the obligations of the supplier of the SPLC as conditions of service, style of treatment as well as provider responsibilities PLC has, as repair, quality of service. etc.

## **CHAPTER VI SAFETY AND WARRANTY**

### **SAFETY**

To ensure user privacy and make the necessary adjustments in the infrastructure necessary to fulfill the required assurance seeking the welfare of the user.

## **CHAPTER VII CONTROL**

### **CONTROL**

Lead agency is delegated to the SUPTEL to enhance the control of the SPLC and monitor compliance with the provisions of these standard and relevant regulations.

## **CONCLUSIONS**

- In Ecuador, despite efforts to make access to telecommunications services is crowded, there is still a high percentage of the population has no access to them, due to the low coverage of telecommunications services in the areas rural and marginal urban areas, which in turn hinders the economic development of regions and remote locations, making it less bearable the lives of its inhabitants.
- The electrical network is one of the largest network coverage in our country as in the rest of the world. What makes the PLC in an alternative technology implementation has the ability to meet the connectivity plans.
- Through various tests and PLC mounts in parts of the country, has obtained excellent results demonstrated that after a measurement process and quality control infrastructure of Ecuador's electricity network can provide the facilities for implementation and deployment of PLC technology.

- The regulatory framework in Ecuador since 2000 establishing a system of free competition to the generality of telecommunications services, adding to it, technological advances that encourages the development of a variety of services with other requirements and needs, so it is the duty of the regulator to observe the development of new technologies emerging in our country, the same as encourage the development and advancement of it.
- A service provider carriers using PLC technology in Ecuador, no impediment to get the certificate; because they are regulated more services rather than technologies. As well as in the Electricity Act that there are no arguments to prevent the use of electrical distribution networks with other end to the marketing of electric service. Consequently we see the need to issue a technical regulation that encourages competition and promotes the use of this emerging technology.
- According to the content of legal instruments regarding the telecommunications field is the need to submit the regulatory proposal to PLC by applying emerging technology from carrier and / or value-added services that will allow the regulatory body having an instrument approves the massification of PLC technology and the use of information and communication technologies.

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