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Broadband over Power Line -Overview

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ABSTRACT : In this era of technology internet is playing a vital role in advancement of technology and development of nation , as it providing instant services like video calling , e-mail , source of information , internet banking act due to which it is widely used in Banks, Aviation systems, Hospitals , Universities and schools etc but in rural areas were the cable and digital subscriber lines could not be set up due to some economical reasons .so ,there internet could not be accessed to overcome this problem we have BPL although BPL is not new but recent developments in infrastructure is major advantage of this technology .

Keywords: Broadband over power line(BPL),orthogonal frequency division multiplexing(OFDM) , power line communication (PLC),Amperion .

I.INTRODUCTION

BPL is a method for sending high speed communication information over electrical power line . this could be accomplished by coupling RF energy with alternating Current onto existing power line. This could be done by using number of devices at the reception and transmission side . These systems are consist of Access BPL, In-house BPL, or a combination of both technologies. Further we are going to look into the various BPL techniques and various parameters and limitations related to this technology .

II.BACK GROUND

As our society is becoming more dependent on internet as critical medium of communication, And the bandwidth required to carry this information is also increasing rapidly because greater the bandwidth of signal more data could be send with that wide range of frequency . The shift from 56Kbps dial up to multi- mega bit connectivity termed as Broadband Revolution .Many new techniques are currently used to provide broadband access , including Digital subscriber line (DSL), cable modem , fixed wireless and broadcast satellite .However none of these access technologies have capability to reach every home .So to overcome this we have developed BPL system which utilizes the existing power lines for broadband communication .

III.TYPES OF BPL TECHNOLOGY

BPL is spited into two types –In-house BPL and Access BPL . these two differ on basis of there use and there radiation characteristics .

1 In House BPL: In house BPL system is most widely used application of BPL were the home networking on the voltage electricity lines within the household is done .Several years ago in house BPL was considered to be most optimum option for home broadband service as the wireless devices are quite expensive than this system but in past few years the prices of wireless systems (Wi-Fi) have dropped dramatically and have largely overtaken the in house wired alternatives .

2 Access BPL: This system is deployed of broad band internet access on the medium voltage power lines (Access BPL) , since these sinals are capable of being carried throughout the utility power distribution grid . In its early stage of devolopment this technique was termed as power line communication (PLC).PLC is being in use since , last 25 years but the advansment in modulation techniques and technolgy have led to significant increase in the throughput of power line carrier .

IV. BPL TECHNOLOGY

BPL is method for sending high speed communication information over electrical lines . since, the current is at 60Hz and BPL signal is at thousands of Hz. So both the signals clould be transmitted over same line .the modulation technique used is OFDM (orthogonal frequency division multiplexing) .

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The lifecycle of electricity from generation to household use can be split into little hopes

- I. Genration
- II. High voltage transmission line
- III. Substation for voltage step down
- IV. Medium voltage transmsion line
- V. Low voltage stepdown and transformer
- VI. Ddrop from transformer to customer primises
- VII. House meter
- VIII. Wall socket

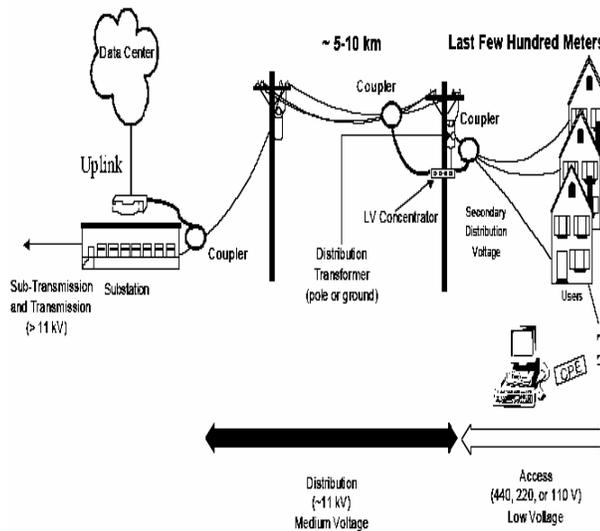


Fig1: Electricity lifecycle

The BPL signal can be injected into medium voltage distribution lines using a coupler between step 3 nad 4 . this is shown in fig . this signal than propogates untile it reaches the transformer for stepdown .At this point main difficulty arises because

Although the low frequency signal such as AC power at 60Hz , can easily pass through the transformer but higher frequency signal are impaired . for this we maily use two techniques *Amperion and current technologies* .In the first method(fig 2.) the signal is taken off the medium voltage line and is re-coupled onto the low voltage drop to home with a device called power bridge and in the later one(fig 3) the BPL signal is made to pass directly from medium onto a wireless device using Wi-fi

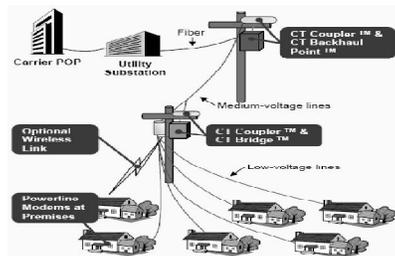


Fig 2: Power line distribution

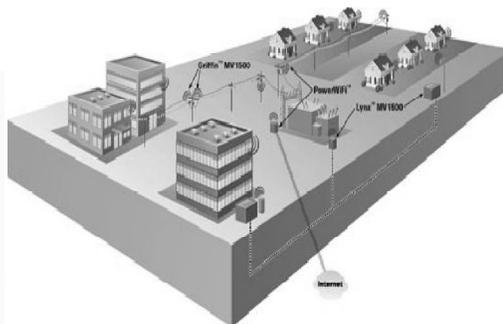


fig 3: Amperion Wi-fi distribution

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V. ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING

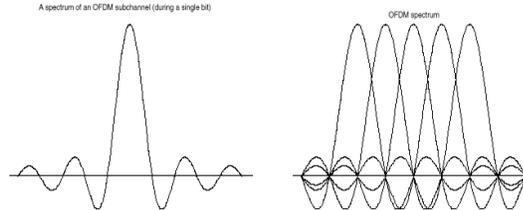


Fig 4: Orthogonal frequency division multiplexing

OFDM is frequency multiplexing is a digital modulation technique in which several narrowband channels at different frequency. In this technique, a large number of closely spaced orthogonal sub carriers are used to carry data. The data is further divided into several data channels one for each sub carriers. Each sub carrier is then Modulated with conventional modulation schemes.

VI. ADVANTAGES

BPL has the ability to provide internet service by means of transmission line control protocol/ Internet protocol (TCP/IP) which can support voice, Data and video services the advantages therefore are;

- I. **Wide Coverage:** BPL can provide wide coverage, since the power lines are already installed almost everywhere. This is advantageous especially for substations in rural areas where there is usually no communication infrastructure.
- II. **Cost:** The communication network can be established quickly and cost-effectively because it utilizes the existing wires to carry the communication signals. Thus, PLC can offer substations new cost-saving methods for remotely monitoring power uses and outages.

VII. DISADVANTAGES

1. High noise sources over power lines:

The power lines are noisy environments for data communications due to several noise sources such as electrical motors, power supplies, fluorescent lights and radio signal interferences. These noise sources over the power lines can result in high bit error rates during communication which severely reduces the performance of BPL.

2. Capacity:

Power line is a shared medium and therefore, the average data rate per end user will be lower than the total capacity depending on coincident utilization, i.e., the number of users on the network at the same time and the applications they are using. Thus, possible technical problems should be comprehensively addressed with various field tests before the BPL technology is widely deployed.

3. Open circuit problem:

Communication over the power lines is lost with devices on the side of an open circuit. This fact severely restricts the usefulness of PLC for applications especially involving switches.

4. Signal attenuation and distortion:

In power lines, the attenuation and distortion of signals are immense due to the reasons such as physical topology of the power network and load impedance fluctuation over the power lines. In addition, there is significant signal attenuation at specific frequency bands due to wave reflection at the terminal points. Therefore, there is loss in signal due to high signal attenuation and distortion.



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5.Security: There are some security concerns for BPL arising from the nature of power lines. Power cables are not twisted and use no shielding which means power lines produce a fair amount of Electro Magnetic Interference (EMI). Such EMI can be received via radio receivers easily. Therefore, the proper encryption techniques must be used to prevent the interception of critical data by an unauthorized person

6.Lack of regulations for Broadband Power line communication:

In addition to technical challenges, fundamental regulation issues of BPL should be addressed for substantial progress to be made. The limits of transmitted energy and frequencies employed for PLC should be determined in order to both provide broadband PLC and prevent the interference with already established radio signals such as mobile communications, broadcasting channels and military communications. In this respect, the Institute of Electrical and Electronics Engineers (IEEE) has develop a standard to support broadband communications over power lines.

VIII.COMPARISION WITH OTHER BROADBAND MEDIUM

Comparision	DSL	HFC	BPL
Channel medium	Twisted pair	Coaxial cables	Power line
Availability of physical medium	More available than cables	Less available	Most available media
Speed	1mbps	1 to 5mbps	Above 5mbps
Connection type	Not shared	Shared	shared
Security	More secur because uses dedicated path	Uses encryption	Can use encryption
Est.cost per month	\$27 to \$47	\$39 to \$60	\$28 to \$39

Table 1

IX.CONCLUSION

This technology has great aspect as future point of view providely the various issues concerned with security and other aspects could be removed . in devoloping countries like india were infrastructure of towns and villages are not so devoloped were DSL , coaxail cables could be used there this BPL could be used because as it uses existing power lines only therefore internet could made easily available in villages and town .

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