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Analysis of Channel Speed Power Line Communication Using OFDM (BPSK, QPSK, and QAM) Interfacing Between Remote Locations System

Arvind Singh**, **Prof. Ranjeet Prajapati and Prof. Bhaskar Singh

Department of Electronic and Communication Engineering,
RITS, Bhopal, (MP), India

(Corresponding author: Arvind Singh)

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ABSTRACT: Power line communication is basically meant for carrying not only the electric power but also the data over the conductors and as the application alters so do the need to change the technologies, like the requirement to alter the technology in case of home automation and for internet access and in order to create a sufficient level of separation between them, they are usually differentiated by means of frequency alteration. In general the transformer present at the substation usually prevents the propagation of signal. Data rates and the distance vary in accordance with power line communication standards. Power line communication has been emanated as one of the most enduring means of communication for smart grid applications therefore sending out the control information over the same network will add only a little cost and hence opens the door for a plethora of applications.

I. INTRODUCTION

Power Line Communications the target of home networking is to connect all digital electronic consumer devices within a home. The consumer should be able to access all services and data at any time and any place in the home, regardless of where the electronic devices are located. Wireless systems work well within a single room. However, their data throughput and reliability decrease dramatically if the wireless signal has to pass through walls or ceilings especially when made of concrete with metal reinforcements To enable real broadband throughput for “room-to-room” connectivity, an in-home backbone network that connects individual devices or clusters in the house with minimum installation effort is desirable. PLC fulfills these requirements. However, common place single-input single output (SISO) PLC systems as treated in detail in might lack in coverage, especially on long links in large homes. Here, the utilization of the third wire in conjunction with multiple input multiple-output (MIMO) signal processing is capable of boosting coverage and capacity of the PLC transmissions. MIMO systems have been heavily investigated since the mid nineties, targeting primarily wireless communications Nowadays, different MIMO processing options, with the aim of increasing data rates and communication reliability, are in operation in major wireless cellular systems such as UMTS, LTE, WiMAX, as well as wireless local area networks (WLANs) based on IEEE 802.11n Also, digital subscriber line (DSL) systems have to deal with near-end and far-end crosstalk between individual modems and recent developments treat the DSL cable binders as MIMO communication channels with the aim of applying multi-user coordination and interference mitigation techniques, also called vectoring Irrespectively, the power line channel has for a long time been regarded as dual conductor SISO channel. In reality, many in-home installations make use of three wires, and medium, and high voltage installations often have four or more conductors. Although the theoretical foundation of multi conductor transmission line theory was extensively laid out in the last century first large scale to make broadband power line communication (BB-PLC) systems economically viable on a world wide scale, internationally adopted standards became essential. The International Telecommunications Union Telecommunication Standardization as well as the Institute of Electrical and Electronics Engineers (IEEE) commenced work on such next generation standards, namely [12] ITU-T G.hn and IEEE. Before looking at channel and noise characteristics in particular it is important to have an idea of power line topologies and coupling methods. The very principle of power line communications implies that small-signal, high-frequency technologies are being deployed over power-carrying cables and grids that were designed for electricity transmission at low frequencies.

Couplers are used to connect the communications equipment to the power line. Besides, grid topologies are possibly the most important stage-setter for overall channel and noise properties Power lines are frequently characterized according to their voltage levels, as high voltage HV, 110 kV to 380 kV), medium voltage (MV, 10 kV to 30 kV) and low voltage (LV, 110 V to 400 V) lines Communication properties of HV and MV installations are assessed in respectively. However, deployment of MIMO signal processing to HV and MV lines has up to the present day been limited. This might be explained by the fact that coupling broadband MIMO signals into and out of these lines is costly, and in many cases alternatives such as fiber optical backbone links or wide area networks (WANs) are already in place posing a fierce competition Turning to LV topologies, they can further be subdivided into a distribution or access part, running from an MV-LV transformer up to individual buildings and an in-home part where the LV lines run in a tree or star topology up to the different power sockets in every room. For single phase in-home installations, three wires, namely live (L) (also called phase), neutral (N), and protective earth (PE), are common. Exactly how common on a worldwide scale was investigated by ETSI in It may be concluded that the PE wire is present at all outlets in China and the Commonwealth of Nations, at most outlets in Western countries, and only at very few outlets in Japan and Russia. Turning to power line couplers, one may generally distinguish between inductive and capacitive implementations. Inductive couplers guarantee a balance between the lines whereas capacitive couplers often introduce asymmetries due to component manufacturing tolerances. Couplers especially tailored to MV, and HV can be found in Further, details on low voltage inductive SISO couplers may, for example, be found in and The following will focus on LV inductive MIMO coupling options as presented in a delta-style coupler a T-style coupler and a star-style coupler

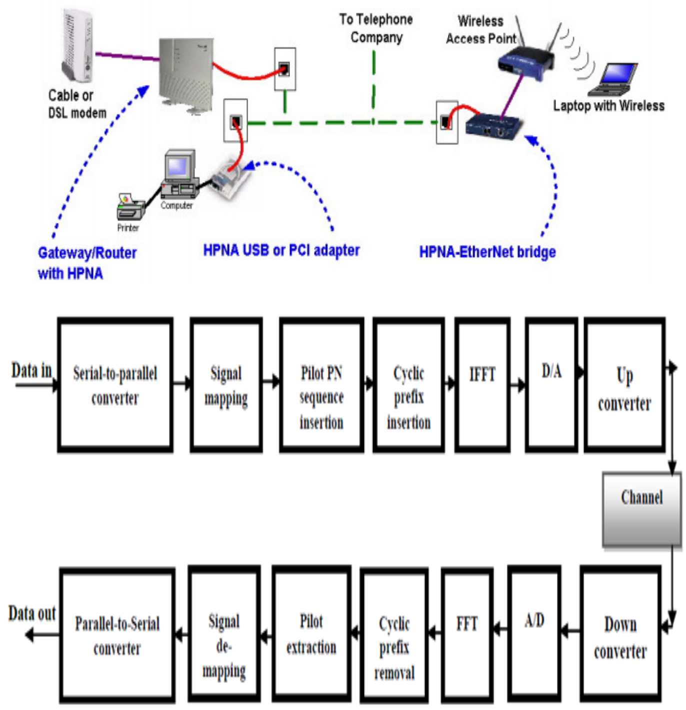

Fig. 1. Analog interface used to couple to power line.

Now an increasing demand to transmit digital video, internet data in an indoor environment. A solution to avoid the prohibitive cost of installing dedicated wires for this application is to transmit data on the same power lines which supply electric currents in the home/office environments. However this typical environment is unfavorable to ensure a good communication and this is essentially due to a frequency selective transmission channel in the presence of both an impulsive noise and a background noise.

Indeed, the branching structures of the network, the presence of many plugs connected or not to appliances, whose load impedances may vary in a large proportion, give rise to a multipath propagation. Results of both theoretical and experimental approaches on the feasibility of this kind of transmission have been published in the technical literature and are based on usual modulation orthogonal frequency division multiplexing (OFDM) is a robust technique in such environment.

Table 1: Phone line and power line data rate.

	Phone line	Power line
Current data rate	1-10 Mbps	1-14 Mbps
Future data rate	30-100 Mbps	30-250 Mbps
QuS support	yes	yes
Standardization	Stable	In flux Stable

OFDM is a subset of frequency division multiplexing technique in which each single channel utilizes multiple sub-carriers on adjacent frequencies. In addition the sub-carriers in an OFDM system are overlapping to maximize spectral efficiency. Ordinarily, overlapping adjacent channels can interfere with one another. However, sub-carriers in an OFDM system are precisely orthogonal to one another. Thus, they are able to overlap without interfering. As a result, OFDM systems are able to maximize spectral efficiency without causing adjacent channel interference OFDM scheme has a large number of sub channels or subcarriers used to transmit digital data. Each sub-channel is orthogonal to every other sub-channel. They are closely spaced and narrow band. The separation of the sub-channels is as minimal as possible to obtain high spectral efficiency. OFDM is being used because of its capability to handle with multipath interference at the receiver. These two are the main effects of multipropagation Frequency selective fading and Inter Symbolic Interference (ISI). In OFDM, the large number of narrow band sub-carriers provides sufficiently “flat” channels. Therefore the fading can be handled by simple equalizing techniques for each channel. Furthermore the large amount of carriers can provide same data rates of a single carrier modulation at a lower symbol rate. The symbol rate of each channel can be dropped to a point that makes each symbol longer than the channel’s impulse response. This eliminates ISI.

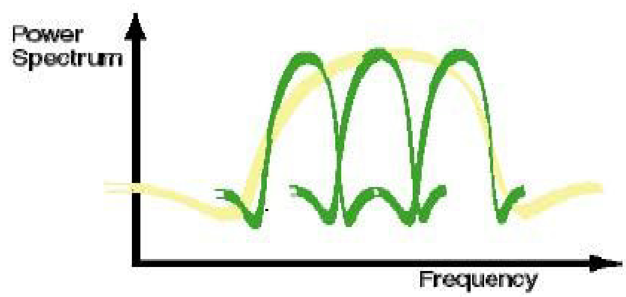

Fig. 2. Analog interface used to couple to power line.

II. POWER SPECTRUM

The OFDM Power Spectrum in which spectra overlap but signals are orthogonal. Different symbols are transmitted over different sub carriers. However, there are two main drawbacks of OFDM; large dynamic range of the signals being transmitted and the sensitivity to frequency errors Time synchronization errors originating from misalignment of symbols at demodulator is a serious OFDM design consideration. This is because they cause Inter Symbol Interference (ISI) and Inter Carrier Interference (ICI) which severely degrade the OFDM performance. Many research efforts have emerged to address this problem as presented in Quadrature Amplitude Modulation (QAM) is an attractive technique to achieve high transmission rate without increasing bandwidth. It has been implemented in xDSL systems as well as next generation wireless access and wireless LAN (WLAN). The BER and symbol error rate (SER) expressions for M-ary QAM for several applications and scenarios were derived by various authors. It is well known for M-QAM that the BER performance degrades for higher modulation levels i.e. for higher values of M, thus, 16-QAM has better BER performance than 64-QAM [4]. It has also been observed that orthogonal systems have the property that as you increase the number of orthogonal signals (channels), the performance graph shifts to the left (better performance). If you thus combine the effect of multilevel modulation (M-QAM) and orthogonal channels (OFDM), there should be a performance.

III. RESULTS

Increase visible overall. Quadrature Amplitude Modulation (QAM) modulation scheme has been very popular in OFDM system since it offers wider range of envelope fluctuations as explained in Besides, it provides higher spectral efficiency due to the usage of amplitude and phase modulation which effectively increase the channel capacity. OFDM has attracted many researchers due to higher demands for high-speed mobile communications. When using a guard interval and a frequency domain equalizer (FDE), OFDM is robust to the frequency selective fading channel, and has high frequency efficiency. Low complexity OFDM receivers can be implemented using Fast Fourier Transform (FFT).The proposed Analysis of Channel Speed Power Line Communication Using OFDM (BPSK, QPSK, and QAM) Interfacing between Remote Locations System is simulated by using MATLAB 7.8.0. MATLAB is a strong mathematical tool. It is standard engineering tool as it perform many different tasks using different tool box relevant to different particular cases e.g. Control systems, signal processing, image processing, communication systems, and support complex matrix manipulation, simulink etc. In different research field it provides platform for learning and comparison of theoretical hypothesis and simulated values. It even provides support to nonlinear system calculations and result. This chapter presents performance of the Power Line Communication Using OFDM (BPSK, QPSK, and QAM) Interfacing between Remote Locations System; simulation MATLAB.

Table 2: Parameters Power Line Communication.

Modulation scheme	BPSK, QPSK, and QAM
Number of sub carrier for OFDM	128
Symbol length	64 bit
Channel estimation	Perfect estimation
Signal estimation	Correlated
Channel	PLCC
Scrambling code	Random code of length 63

Table 3: System parameters Power Line Communication.

Bandwidth	14Mbps
Number of sub carrier for OFDM	128
Information length	242.5
OFDM Symbol Length	312.5ns
Data Transmission rate	55,200,and 480 Mbps
Pilot Carrier	500
FFT size	128
No of data tone	100
No of pilot tone	12
No of guard tone	10
Constellation	BPSK, QPSK, and QAM

In the process, the goal was to reach. A new closed-loop Analysis of Channel Speed Power Line Communication Using OFDM (BPSK, QPSK, and QAM) Interfacing between Remote Locations System The receiver of the scheme checks the output signal-to-noise ratio (SNR) of the Power Line Communication against an output threshold and requests the transmitter to plcc channel resulting in the poorest path with an used power cable if the output SNR is below the threshold. We provide some interesting statistical analysis and obtain closed-form expressions for the cumulative distribution function the probability density function and the moment-generating function of the received SNR. We show through scheme offers a significant gain plcc OFDM BPSK, QPSK, and QAM transmit system.

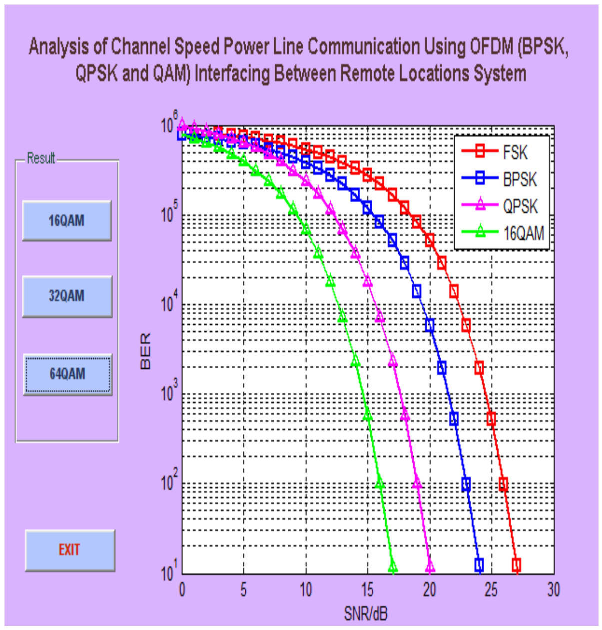

Fig. 3. Analysis of PLCC- FSK 26 SNR/db, BPSK, 24 SNR/db and QPSK 20 SNR/dB with 16QAM 16 SNR/db proposed.

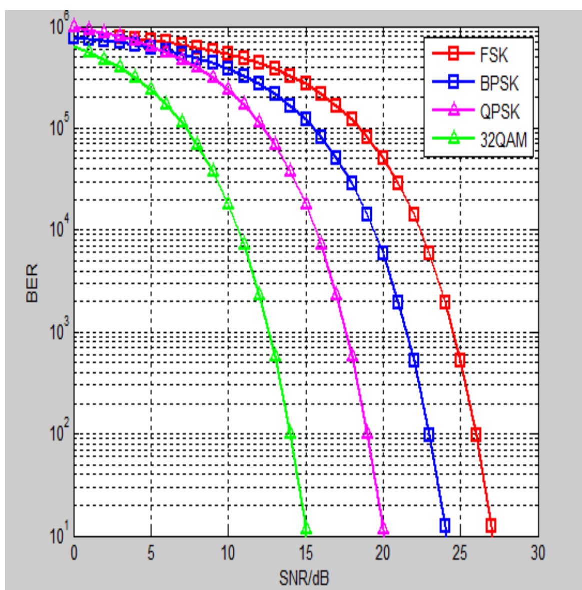

Fig. 4. Analysis of PLCC- FSK 26 SNR/db, BPSK, 24 SNR/db and QPSK 20 SNR/dB with 32QAM 15 SNR/db proposed.

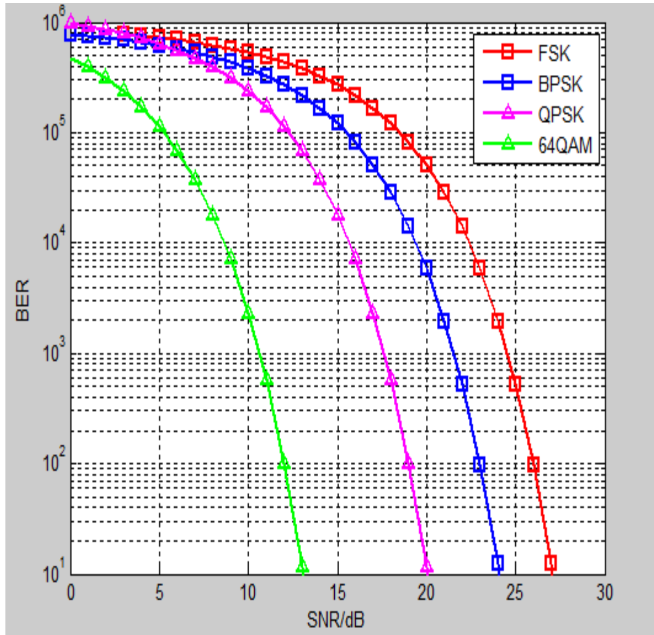

Fig. 5. Analysis of PLCC- FSK 26 SNR/db, BPSK, 24 SNR/db and QPSK 20 SNR/dB with 64QAM 15 SNR/db proposed.

Power line communication provides a new and exciting opportunity for high-bandwidth data communications. We discuss about a Analysis of Channel Speed Power Line Communication Using OFDM (BPSK, QPSK, and QAM) Interfacing between Remote Locations System show we can improve the performance of system with such a simple system. Using power line at the transmitter and receiver can decrease BER of the system and increase data rate of it. Also we discuss about the channel capacity of the OFDM (BPSK, QPSK, and QAM) We use 64 QAM in the receiver and show it's equation for estimation of channel and symbol Also we discuss about plcc link budget and the importance of it in designation. Finally we show the results of our simulations and we show that according to our simulation, we can improve the performance of the PLCC system.

V. CONCLUSION

It is obvious that the application of broadband, cable TV, smart monitoring system PLC will be a useful completion of future communication systems the channel capacity of PLC channels is promising. our measurements for PLC channels found in an apartments or in an office.PLC can enhance the capacity of wireless networks cost effectively using transmitting power Perhaps PLC as suitable for outdoor networking as for indoor networking. Because the power line is a shared medium and for outdoor PLC the capacity is frequencies can be used for the longer distances in the outdoor application.

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