An Analytical Study of Modulation Technique to Check Feasibility of Power Line as a Communication Channel

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Abstract: **In Modern Era, communication with zero distortion or with minimum distortion has become crucial for better transmission over the network. Many researchers have used the different techniques likes clipper circuit, equalizer circuit to prevent the impulsive noise and attenuation in the communication using power line communication, they also use Modulation Techniques with different encoding and decoding technique. In This paper we discuss about the modulation technique which are already introduced like PSK, QPSK, 16-QAM, 64-QAM etc. Also analyse the power line communication as a channel with noise and a small analysis of convolution encoder for encoding and Viterbi Algorithm for decoding.**

Keywords: PSK, QPSK, QAM,Convolution encoder, Viterbi decoder

I. INTRODUCTION

Electrical power system is used only for power transmission but recently it uses for transmitting the energy, voice, data services and internet access. Jing Lin, Marcel Nassar et all suggest an analytic model describing complex transfer functions of typical powerline networks using only a small set of parameters [4]. As per his research PLC as a channel the power line network differs considerably in topology, structure, and physical properties from conventional media suchas twisted pair, coaxial, or fibber -optic cables. Only in the case of very simple topologies, such as a cable with a single branch, the physical reasons for the observed results (cable loss, reflection, and transmission factors) can be easily identified. In real network topologies—which are always more complicated—a back-tracing of measurement results to physical reasons will generally turn out to be impossible.

Opposite to the telephone copper loop, the power line “local loop access network” does not consist of point-to-point connections between substations and customer’s premises, but represents a line bus. A typical access link between a substation and a customer consists of the distributor cable, or a series connection of distributor cables, and the branching house connection cables, both with real valued characteristic impedance. Multipath Signal Propagation Signal propagation does not only take place along a direct line-of-sight path between transmitter and receiver, but additional paths (echoes) must also be considered. The result is a multipath scenario with frequency selective fading. Cable Losses As mentioned above, the propagating signals are affected by attenuation increasing with length and frequency .The presented model offers the possibility to carry out investigations for different network topologies and to study their impact on PLC-system performance by means of simulations.

In his paper a model discuss with frequency range from 500 KHz to 20 MHz with physical effect multi-path signal and typical cable loss by very few relevant parameter [4].Noise in the power line channel cannot be described by AWGN, it suffers from impulsive noise and other narrow band interference [11].Impulsive noise can degrade the performance of OFDM based power line channel. Clipping is used for supressing the impulsive noise .noise is categorised as acolor background noise, Narrow band noise, Periodic impulsive noise (asynchronous)etc. Impulsive noise is mainly due to power supply or via switching transients. OFDM is a major modulation technique for PLC system due to its robustness to multipath prorogation, selective fading and different types of interferences. OFDM is multi-carrier transmition technique that have been used in several digital modulation technique ex. DAB Tv,Wimax,LAN perform better than signal carrier in the presence of impulsive noise. OFDM supress impulsive noise due to DFT while adding cyclic prefix in OFDM symbol can mitigate the effect of multi-path. A simple method for mitigating impulsive noise is clipping circuit in this circuit any signal sample exceeding certain threshold is clip off. Bit error rate (BER) is proposed to future mitigate the performance of impulsive noise. Different scenarios of impulsive noise are as a below.

1. Heavily disturb
2. Medium disturb
3. Weakly disturb

Symbol model in OFDM; high speed serial data stream is split into a number of parallel slow data stream that are carried in multiple orthogonal sub carriers by means of IDFT [11].Analysis and compare the performance of

OFDM receivers with blanking, clipping and combined blanking-clipping nonlinear preprocessors in the presence of impulsive noise. Closed-form analytical expressions for the signal to-noise ratio at the output of three types of nonlinearity are derived [12].Orthogonal frequency division multiplexing (OFDM) systems are inherently robust to impulsive interference. The longer duration of OFDM symbols provide an advantage, since the impulsive noise energy is spread among simultaneously transmitted OFDM subcarriers. Nevertheless, this advantage may turn into a disadvantage if impulsive noise energy exceeds a certain threshold a simple method of reducing the adverse effect of impulsive. A simple method of reducing the adverse effect of impulsive noise is to precede a conventional OFDM demodulator with memory less nonlinearity it is shown that under a low signal-to-noise ratio (SNR) assumption the locally optimal detector for arbitrary signals in impulsive noise comprises of a conventional detector (optimal in Gaussian noise) preceded by a memory less nonlinearity.

II. LITERATURE SURVEY

Recently, the idea of using suboptimal clipping or blanking techniques for impulsive noise mitigation has been applied to modern OFDM. The aim of the study is proposed an analytical technique for performance assessment of OFDM with three types of memory less non linearity [12]:

1. Clipping
2. Blanking
3. Combine clipping blanking

The results of this comparative study show that the blanking nonlinearity asymptotically (i.e.in highly impulsive noise) performs better than the clipping nonlinearity. On the other hand, in a weakly impulsive environment, clipping nonlinearity may slightly outperform the blanking scheme. The best solution is, however, the clipping blanking nonlinearity that combines the advantages of both techniques. Asynchronous impulsive noise and periodic impulsive noises limit communication performance in OFDM power line communication systems. Conventional OFDM receivers that assume additive white Gaussian noise experience degradation in communication performance in impulsive noise. Alternate designs assume a statistical noise model and use the model parameters in mitigating impulsive noise [8].To mitigate asynchronous impulsive noise, we exploit itssparsely in the time domain, and apply sparse Bayesian learning methods to estimate and subtract the noise impulses. We propose three iterative algorithms with different complexity vs. performance trade-offs: (1) we utilize the noise projection onto null and pilot tones; (2) we add the information in the date tones to perform joint noise estimation and symbol detection; (3) we use decision feedback from the decoder to further enhance the accuracy of noise estimation. These algorithms are also embedded in a time-domain block interleaving OFDM system to mitigate periodic impulsive noise. Compared to conventional OFDM receivers, the proposed methods achieve SNR gains of up to 9 dB in coded and 10 dB in un-coded systems in asynchronous impulsive noise, and up to6 dB in coded systems in periodic impulsive noise.

Due to the high penetration of power line infrastructures and hence low deployment costs, power line communications (PLC) plays a prominent role in enabling a variety of smart grid applications. Categories Operating Bands Data Rates Standards Broadband 3–500 kHz up to 800 kbps PRIME, G3, IEEE P1901.2,ITU-T G.hnemNarrowband 1.8–250 MHz up to 200 Mbps IEEE P1901,ITU-T G.hn.One of the major challenges for PLC is to overcome additive powerline noise. Such noise is generated by electrical devices connected to the power lines, and by external noise and interference coupled to the power grids via radiation or conduction [3]. Recent field measurements have identified two types of impulsive noise that are dominant in the 1.8–250 MHz band for BB PLC and in the 3–500 kHz band for NB PLC. impulsive noise is the primary noise component in BB PLC [5], [6]. This type of noise consists of short duration, high power impulses (up to 50 dB above background noise power [5] with random arrivals. The impulses typically arise from switching transients caused by connection and disconnection of electrical devices. In addition, uncoordinated interference from non-interoperable neighbouring PLC modems. Periodic impulsive noise (also termed “cyclo stationary noise”) is observed to be dominant in NB PLC Compared to asynchronous impulsive noise, this type of noise contains longer noise bursts that occur periodically with half the AC cycle. Typical noise bursts cover 10% - 30% of a period, which amounts to 833 _s-2:5 ms in the US. A single noise burst may corrupt multiple consecutive OFDM symbols.In this paper we aim to mitigate asynchronous impulsive noise and periodic impulsive noise, respectively, at OFDM-based PLC receivers. Our work distinguishes from the above approaches in two perspectives: (1) we propose “nonparametric” algorithms that do not make any assumptions on statistical noise models and hence do not require extra training; and (2) our approach estimates and subtracts the impulsive noise from received signal and can be implemented as a de-noising block prepended to conventional receivers [5] including both asynchronous and periodic impulsive noise, our proposed algorithms achieve significant BER improvement over conventional OFDM systems without noise mitigation in various SNR regions.To mitigate asynchronous impulsive noise, we apply sparse Bayesian learning (SBL) techniques to estimate the impulsive noise from the received signal by observing information either on the null and pilot subcarriers or on all subcarriers. Under periodic impulsive noise, we adopt a time-domain interleaving OFDM transceiver structure to break long noise bursts that span multiple OFDM symbols into short bursts, and then apply the SBL techniques. Impulsive noise is one of the major challenge in power line communication and it causes serious problem in OFDM based PLC system [12].In this paper we proposed a time domain /frequency domain technique for impulsive noise reduction in OFDM based PLC [12].

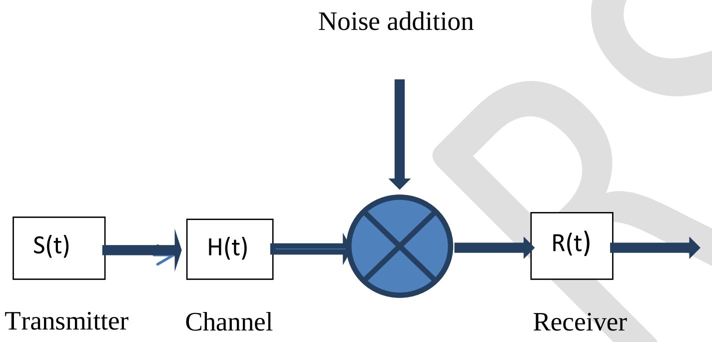
During the last decade, a great deal of attention has been directed towards the use of electric power lines for multimedia communications. Power Line Communications (PLC) offers the advantage of using the existing and widespread power distribution infrastructure to provide home networking as Well as broadband services. Due to the hostile channel characteristic of communication over power line faces serious problem including noise, attenuation, and multipath propagation. The first three types of noise usually remain stationary over long periods of time (seconds, minutes or hours) and can be summarised as background noise. The last two types are time-variant and can be summarised as impulsive noise. Impulsive noise is mainly caused by power supplies (synchronous to mains frequency) or by switching transients in the network (Asynchronous to the mains power).

Practical experiments in power line show that the PSD of impulsive noise exceeds the PSD of background noise by minimum of 10-15 dB and may sometimes reach 50dB. The harsh channel environment of power lines requires a transmission scheme that can effectively cope with hostile channel conditions. Due to its robustness to multipath, selective fading and different kinds of interference, Orthogonal Frequency Division Multiplexing (OFDM) is a major candidate for PLC systems. OFDM is a mature multicarrier transmission technique and have been adopted in several wideband digital communication systems. Examples of its applications include Digital Audio Broadcasting (DAB), Terrestrial digital TV (DVB-T), wireless LANs and Wi-Max. OFDM performs better than single carrier in the presence of impulsive noise [1]. This is due to the fact that OFDMspreads the effect of impulsive noise over multiple symbols due to Discrete Fourier Transform (DFT) algorithm. Moreover, the addition of Cyclic Prefix (CP) in OFDM symbols. A simple technique of impulsive noise mitigation is to precede OFDM receiver with a memoryless nonlinearity [10].As this paper, adopt a practically proven PLC channel model to compare the performance of three memories less nonlinearity methods (Clipping, Blanking and Clipping/Blanking) for mitigation of impulsive noise in OFDM systems over PLC channel. We also propose a combined time domain/frequency domain technique for impulsive noise reduction in OFDM based PLC systems [10].

MATLAB software was utilized to study the performance of the proposed combined Time Domain/Frequency-Domain impulsive noise mitigation technique. A random signal is mapped into QPSK symbols and modulated using OFDM with 128 subcarriers and passed through a PLC multipath channel with 15 paths. The arrival of impulsive noise is assumed to follow a Poisson distribution and is added to the signal as well as AWGN. The obtained simulation results show that the Combined TD/FD technique performs better than practically used nonlinearities and can reduce the adverse effect of impulsive noise significantly. Author details completely give all ideas about power line communication channel .Power lines were originally devised to transmit electric power from a small number of sources (the generators) to a large number of sinks (the consumers) in the frequency range of 50-60 Hz. It is a fact that power transmission towers and lines are some of the most robust structures ever built. Historically, the PLC technology has very limited applications but now we are witnessing the possibility of it being acclaimed universally as a prime mode of long-haul data communication.PLC Technology allows the use of the existing and widespread power distribution infrastructure to provide high speed networking capabilities along with many other benefits. Narrowband power line communications started soon after the beginning of wide-spread electrical power supply. Around the year 1922 the first carrier frequency systems began to operate over high-tension lines in the frequency range 15 to 500 kHz for telemetry purposes, and this continues to the present tim. Consumer products such as baby alarms have been available at least since 1940. A primary motivation for power line communications has been to do load management in future. The currently employed ripple control systems have the disadvantage of requiring several megawatts for information transmission. A second important motivation has been to facilitate meter reading from a distance. An English study has shown that a meter reader achieves an average information rate of only about 1 bit/s [3]. The Tokyo Electric Power Co was running experiments in the 1970's which reported successful bi-directional operation with several hundred units growth of the Internet and the gigantic leaps in VLSI (Very Large Integrated Circuits) and DSP (Digital Signal Processing) technology. Then was the telecommunications market deregulation, first in the US and then in Europe and Asia. All these events have made power line communications a viable technology.

Home automation Power line communications technology can use the household electrical power wiring as a transmission medium. This is a technique used in home automation for remote control of lighting and appliances and sensors for alarm systems etc. without installation of additional control wiring. Broadband over power lines (BPL), also known as power-line internet or Powerband, is the use of PLC technology to provide broadband Internet access through ordinary power lines. Issues in PLC i.e related to design First off, the power line carrier was not specifically designed for data transmission and provides a harsh environment for it. Varying impedance, considerable noise that is not white in nature and high levels of frequency-dependent attenuation are the main issues. Varying Channel Model for successful communication, the communication channel must be first modeled and analyzed accordingly. Power line networks are usually made of a variety of conductor types, joined almost at random, and terminating into loads of varying impedance. Over such a transmission medium, the amplitude and phase response may vary widely with frequency. High Dependence of Transmitter and Receiver

Location, the location of the transmitter or the receiver (in this case the power outlet) could also have a serious effect on transmission error rates. For example, a receiver close to a noise source would have a poor signal to noise ratio (SNR) compared to one further away from the noise source. Reflection, Multi-path Fading and Attenuation are Reflection of the signal often occurs due to the various impedance mismatches in the electric network. Each multi-path would have a certain weight factor attributed to it to account for the reflection and transmission losses. All reflection and transmission parameters in a power line channel may be assumed to be less than one. The number of dominant multi-paths to be considered (N) is often not more than five or six since additional multi-paths are usually too weak to be of any significance. This is because the more transitions and reflections that occur along a path, the smaller its weighting factor would be. It has been observed from channel measurements that at higher frequencies the channel attenuation increases. NOISE for data transmission. This is because it rarely has properties similar to the easily analyzed white Gaussian noise of the receiver with which we are much familiar with. Typical sources of noise are brush motors, fluorescent and halogen lamps, switching power supplies and dimmer switches. The noise in power lines can be impulsive or frequency selective in nature and, sometimes, both. Due to high attenuation over the power line, the noise is also location dependent.



General block diagram of PLC system

In this overview, we have seen the evolution and potential of PLC technology and have gained some idea of the structure of the standards involved with it.

High data rate communications on the medium voltage network has recently been added to the many fields of interest in power-line communications. This paper presents a comparison of OFDM and CDMA for data communications on the medium voltage network [1].

This paper evaluates the stability of CDMA &OFDM for high data rate communication on medium voltage power line cables. CDMA having robustness against interference .the possibility of multiuser access the availability of dedicated proceesor & inherent low power spectral density. Low PSD is advantage of cdma as low as PSD minimum emission of EM waves. OFDM include simple channel equalisation relatively easy implementation using DSP and enhance immunity to impulsive noise due to long symbol duration. Connecting PLC we use coupling limit between center conductor & screen through co-axial cable .these coupling unit include HPF to supress medium voltage & prevent it from damaging the transceiver unit, beside they provide a means for impedance matching.

This paper investigated the performance of a CDMA and an OFDM system for high data rate transmission on a medium voltage cable. The channel characteristics were obtained by measurements and were included in the simulation systems. In the simulations the CDMA system showed a substantial advantage over the OFDM system concerning the transmit power as well as the power spectral density which influences the radiated emissions. Future simulations have to evaluate the performance in the presence of impulsive noise. The choice for the CDMA or the OFDM system depends mainly on the future regulations on radiated emissions. Specially designated frequency bands for power-line communications would favour the OFDM system whereas a lower and constant limit for large parts of the frequency band of interest would recommend the CDMA system. This paper provides a fair comparison between DS-CDMA (Direct Sequence Code Division Multiple Access) and OFDM (Orthogonal Frequency Division Multiplexing) systems for broadband downstream Power Lines Communications (PLCs). Considered schemes seem particularly suitable for high bit rate broadcast flexible communications on low voltage grid in order to guarantee "last mile" access network.

As the number of Internet users increases and the request for multimedia communications grows, the demand forhigh-rate connections tends to become stronger and stronger, especially for the local access networks, the socalled last mile Between different Spread Spectrum Multiple Access (SSMA) techniques, Direct Sequence is known as anefficient scheme for communication systems due to its characteristics such as remarkable capacity, narrow-band interference suppression and anti-multipath capabilities: according to this technique, each bit of the signal to be transmitted is multiplied for a pseudo noise sequence whose fundamental element, called chip, is much shorter than the informative bit; as a result, signal bandwidth occupation is increased of a factor equal to the ratio between bit and chip duration, the so-called Spreading Factor (SF). Conventional DS-CDMA receivers consider other users as pure interference and the Multiple Access Interference (MAI) limits the number of active users inrelation to a specified bit error rate (BER).Proposed multiple access scheme is,based on joint utilization of Orthogonal Variable Spreading Factor (OVSF) [6] and random scrambling codes: firstly, each global bit stream is divided in N parallel sub-streams, orthogonally separated each others by a channel isation opention performed by multiplying them with an individual orthogonal OVSF code; in the second step all the substreams composing the data flow of each user are added together and scrambled by means of a pseudonoise user code to better protect it from multipath effectsand from interference of other possible users.

III. OFDM SYSTEM

Multi-carrier transmission techniques are based on the idea of partitioning the overall bandwidth in order tocreate many sub-channels, each characterized by its personal camer: this solution takes to obtain almost ideal condition of propagation for all the informative data flows even if the overall channel is characterized by colored noise and frequency selectivity; as a consequence, since Inter-Symbol Interference (ISI) impairments are negligible, channel equalizer block can be dramatically simplified or, ideally, slppressed. Moreover, this modulation technique permits to achieve data rate near to channel capacity if channel impulse response and noise power density spectrum are known.

IV. WORKING CONDITIONS AND COMPARISON CIUTERIA

In this paper the considered propagation environment is wired communication channel inside of buildings asdescribedin PL channel impedance is highly varying with frequency, ranging between a few Ohm and a fewkOhm. Moreover, load conditions changes and discontinuities in branch cables can cause reflection and echoes.Peaks in the impedance characteristics may occur at certain frequencies. As a result, PL channel can beconsidered as a multipath propagation environment with deep narrowband notches in the fre quency response. In performing our simulations the following conditions have been assumed:PLC channel ranging from 1 MHz to 21.480 MHz, i.e., bandwidth occupation equal to 20.480 MHz;overall maximum bit rate equal to 10.240 MHz;coherent phase modulation and rectangular pulse shaping for all the considered signals;perfect power matching, i.e. ideal power transfer. For what concerns DS-CDMA systems the following conditions have been supposed:considered substreams bit-rate equal to 40, 160,320,640 and 2560 kbit/s; spreading through a OVSF code, followed by a random scrambling code; the spreading factor of the OVSF.On the other hand, OFDM systems are based on the following assumptions:considered subchannels number equal to 64 and 256;bit loading technique based on the utilization of constellations formed by 2, 4 and 8 symbols; besides thepower is distributed between the subchannels so that each bit has the same energy.

In this paper, a fair comparison between DS-CDMA and OFDM systems for broadband downstream PLCs hasbeen provided under the same overall working conditions of bandwidth occupation, transmitted power andglobal data rate. BL technique introduction allows OFDM to achieve remarkable performance and highflexibility in resources management. On the contrary, CDMA guarantees good performance and satisfactoryallocation policies with low complexity receiver.

Power line noise is known to affect the performance of broadband power-line communications significantly. This paper presents a frequency-domain approach to characterize and model the statistical variation of power-line noise. The model considers both the background noise and the impulsive noise [5].

The amount of impulse noise reaching a power-line communications (PLC) receiver can then be determined with consideration of the channel transfer characteristics between the noise sources and the PLC receiver. Using these noise models, the performance of two major classes of digital modulation schemes, namely single-carrier modulation and multicarrier modulation, are analyzed and compared. It is found that the multicarrier scheme performs better than the single-carrier scheme when subjected to the observed power-line noise with non-Gaussian statistics uses the existing power cable infrastructure for communication purposes. The communication medium of this technology, the power lines, has been designed for transmitting electrical power without any thought on communications. In this paper, a frequency-domain power-line noise model is proposed for the typical broadband PLC bandwidth of 1–30 MHz. Using this proposed model, the effect of the power-line noise on the performance of several modulation schemes is evaluated. The evaluation is based on the bit error rate (BER) of the different schemes. Although the system BER is actually dependent on both channel transfer function and noise, in this paper, only noise is considered since. Background Noise To model the background noise, long-term measurements of noise spectrum from 1 to 30 MHz were conducted at two sites,a laboratory and a residential house. In each measurement, for every five minutes, one set of spectrum data was recorded andthe whole measurement lasted for one week. The results havegiven us sufficient information on how the background noisesvary with frequency and time. The Nakagami model is often used to represent wireless fading signals in multipath scattering environment with relatively large delay-time spreads, and with different clusters of reflected waves. The power lines, with many loops and joints, are likely to exhibit such multipath behavior with substantial reflections.

V. APPLIANCE NOISE

The noise spectrums from various appliances are also obtained through measurements. The procedure to determine the appliance noise can be divided into three steps. Step one is to measure the background noise spectrum without connecting the appliance. Then in step two, the appliance is connected to the network to measure the combined background and appliance noise. Finally, subtracting the spectrum of step two from that of step one gives the noise spectrum generated by the appliance. It should be noted that the noise spectrum used in this calculation is the power spectrum. This is because noises from different sources are noncoherent and hence they combine in term of power and not amplitude.This paper proposed a frequency-domain noise modeling approach for characterising the background noise and the impulsive noise encountered in broadband PLC systems. Based on two long-term measurements, the amplitude spectrum of the background noise at frequency 1–30 MHz is found to follow the Nakagami distribution.

In addition, the noise amplitude spectra from several typical household appliances were measured to construct a spectral density model for the impulsive noise. Together with the channel transfer function, the amount of appliance impulsive noise reaching the receiver can be determined. Summing the total appliance noise and the background noise gives the noise expected at the receiver. This receiver noise model has been verified through practical measurements.The Nakagami noise model was later used to compare the error performance of single-carrier modulation (PSK) versus multicarrier modulation (OFDM). It is found that due to the randomization effect inherent in the FFT operation in the OFDM receiver, the OFDM performance is not affected by Nakagami noise PDFs with different values, while the performance of single-carrier modulation schemes such as PSK and FSK degrades for channel noise having Nakagami distribution with smaller values. Since multicarrier modulation gives a more stable and predictable performance independent of the channel noise statistics. OFDM is a promising technique being used for bandwidth efficient communication over the power-line channel. It provides excellent possibilities to adapt to the frequency-selectivity of the channel [3].The influence of impulsive noise on the OFDM transmission is not well analyzed yet. We choose Middle tons Class A man-made noise model to statistically describe the impulsive interference and study the capacity of the additive impulsive noise channel. One promising modulation scheme for data transmission over power-lines is OFDM. It provides excellent possibilities to handle the colored noise, the narrowband interference and the fiequency selective attenuation of the channel. The goal of our paper is to give more insight into the influence of impulsive noise on OFDM. In the first section, we introduce the selected impulsive noise model and give a brief review of OFDM.

In order to analyze the performance of OFDM corrupted by impulsive noise a statistical model for the interference is required. In this paper we choose Middletons canonical man-made noise model [7]. It comprisesthe influence of impulsive noise and an additionally Gaussian component. The model is known to fit very well toa broad spectrum of measured data In this section the channel capacity of Middletons memory less additive Class A impulsive noise channel with anaverage energy constraint on the input is studied. The channel capacity gives a general performance bound forreliable communication over a noisy channel .We are interested in comparing the capacity of the Gaussian noise channel with the capacity of the Class A impulsive noise channel.In this paper we analysed the performance of the OFDM transmission scheme corrupted by impulsive noise.Using channel capacity arguments we showed, that using the conventional Gaussian noise OFDM receiver in animpulsive noise environment results in strong performance degradations. In the second part of our paper wedescribed a new iterative algorithm suited for mitigating the influence of the impulsive noise on the OFDM transmission. Urban optical wireless communication systems are considered a “last mile” technology. An optical wireless communication system uses the atmosphere as a propagation medium. In order to provide line-of-sight (LOS), the transceivers are placed on high-rise buildings. However, dynamic wind loads, thermal expansion, and weak earthquakes cause buildings to sway [6].

In this paper, we derive a mathematical model to minimize transmitter power and optimize transmitter gain (divergence angle) as a function of the building-sway statistics, the communication system parameters, and the required bit-error probability (BEP). Reduction in laser power could improve overall system performances and cost. For example, for BEP of 10 9, we can attain at least of a 4-dB reduction of the required transmitter power in comparison to a system with both half and twice the optimum beam divergence.In this paper, we derive a mathematical model to minimize transmitter power and optimize transmitter gain (divergence angle) as a function of the building-sway statistics, the communication system parameters, and the required bit-error probability (BEP). Reduction in laser power could improve overall system performances and cost. For example, for BEP of 10 9, we can attain at least of a 4-dB reduction of the required transmitter power in comparison to a system with both half and twice the optimum beam divergence. The building sway causes vibrations of the transmitter beam moving it from the line-of-sight (LOS) in the direction of the receiver. These vibrations decrease the average received signal, which in turn, increases the bit-error probability (BEP). Hence, the designer is required to increase the transmitter beam divergence angle and power so as to maintain LOS between the transmitter and the receiver.

In this paper, we develop a BEP model that takes into account building-sway statistics and communication system parameters. We assume that the receiver has knowledge about the marginal statistics of the signal fading and the instantaneous signal fading state. Then we derive a mathematical model to minimize transmitter power and optimize transmitter gain (the divergence angle) for a given BEP.One of the dominant factors for determining OWC system performance is building sway. It is easy to show that with our model we can reduce the required power by more than 4 dB by comparison with a system with both half and twice the optimum beam divergence angle for a BEP of 10. This result indicates that appropriate divergence angle design is essential for any practical system.

OFDM is a relatively new way to the field of digital communication but is finding more and more use due to its high spectral efficiency and robustness against interfering signal. Impulse noise is one of the major factors that can cause severe bit error performance degradation in OFDM systems. The impulse noise is usually of very short duration compared to symbol duration in parallel transmission. For both wired and wireless transmission, the frequency-selective fading is another significant source of disturbances for OFDM applications. The presence of these types of disturbances cause reliable communication difficult and also affects all the sub carriers in a symbol due to the Fast Fourier Transform operations at the receiver. For the better performance of the system interleaving is used before and after the IFFT operation. An OFDM system with 64 qam modulation is considered. Gated Gaussian model is considered as the impulse noise model and compared the performance of different equalizers.

Orthogonal Frequency Division Multiplexing (OFDM) is also called multi-carrier modulation scheme. OFDM used in various applications due to its high spectral efficiency, robustness -against interfering signal and to a great extends in avoiding multipath problems OFDM is alsoused for W-LAN, next generation mobile radio systems, Digital audio and video broadcast etc. The man-made noise created by power lines, heavy current switches and other sources cannot be assumed to be Gaussian, and must be represented by impulsive models. Noises in communications are summarized into two major types, Impulsive Noise and Background Noise. OFDM systems are inherently robust to impulsive interference. This interference becomes disadvantage when impulsive noise energy exceeds a certain threshold [4]. The impulse noise could occur due to several reasons such as circuit failure, power switching, and erasure channels.In this technique, total number of subcarriers is split into small blocks and spread the data symbols over these blocks by using unitary matrices in order to gain frequency diversity over each block. Unfortunately, this improvement comes at the cost of an increase in system computational complexity.

Different approaches for impulse noise suppression are proposed. A simple method of reducing the adverse effect of impulsive noise is to precede a conventional OFDM demodulator with memory less nonlinearity [8, 9]. But these traditional methods provide unsatisfactory system performance improvement. A completely different approach is considered here to remove impulse noise in OFDM system. A time domain interleaving (TDI) technique in conjunction with threshold based blanking scheme is utilized to improve the OFDM immunity over multipath fading channels impaired by impulsive noise without a sacrifice in bandwidth or an increase in the transmit power[1]. For the better performance of the system, interleaving is applied before and after IFFT at the transmitter. And this will reduce the bit error rate of OFDM system.

OFDM uses a subcarrier-based communication concept where the subcarriers are orthogonal toeach other over the sample period. This is possible when carriers are harmonic of each other. In thissystem, each of the subcarriers carries a part of the message and together they deliver the entiremessage. The mutual orthogonality of subcarriers help in achieving superior performance ofOFDM.64-qam is used for highest data rate. Normally, interleaver is used before the IFFToperation. For better performance of the system interleaver is used before and after the IFFToperation. Interleaver means it rearranges the order of the sequence and de-interleaver will reconstructthe same order. Hence this interleaver will reduce the error rate in the system and improve the system performance.

Technique used here is based on interleaving, in conjunction with a two-level threshold-based blanking scheme to combat the adverse effects of multipath propagation as well as IN for OFDMbased communications systems. Unlike traditional interleaved single carrier and OFDM systems where the information symbols are spread over a larger number of transmission blocks the TDI system interleaves the time domain samples after the IFFT which are composed of a mixture of all information symbols. This results in a significant improvement in uncoded BER that can never be achieved with conventional interleaving. Proposed blanking scheme in conjunction with TDI enables the proposed system to efficiently combat IN even in frequency-selective channels.

In standard OFDM system interleaving is used before IFFT in the transmitter part and deinterleaving is used after FFT block in the receiver part. By comparing these systems, standard OFDM system has high bit error rate. This is due to the presence of Impulse noise in the OFDM system. To improve the performance of the system, interleaving is used before and after IFFT.The biterror rate performance this system is shown in .The results clearly shows that the interleavingsurely outperforms the other considered systems Bit error rate performance of proposed systemThe performance of the OFDM system has been enhanced without sacrificing bandwidth or increasing transmits power. This enhancement was achieved by exploiting the time diversity which is ensured by the use of a block inter leaver of depth N samples positioned after the IFFT process at the transmitter and a block deinter leaver located after the equalization process at the receiver. A blanking process has been proposed to suppress the enhanced noise and improve the overall system performance. The use of the inter leaver breaks the correlated behaviour of the multipath fading channel, and spreads the impulsive noise samples over the impulse free OFDM symbols as well. The Interleaving-OFDM system used before and after.

VI. CONCLUSION AND FUTURE SCOPE:

As per our finding during the research of various paper and work done by different researchers they work on difference modulation technique with PLC and try to reduce noise by using different method but their main course of action to remove noise with the help of different hardware devices they didn’t focus on any simulated coded technique. In future we can develop coded modulation technique with the help of simulation framework like MATLAB and can analyse the performance of PLC system with noise using Plot like BER (bit error rate).

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