

A Review Paper on Performance Improvement for Various Parameters for Radio over Fiber Communications

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Abstract

As it is well known that combination of Radio Frequency and Optical Fiber has resulted high capacity transmission at lower costs components and makes Radio over Fiber as a current trend of large broadband communication. Radio over fiber (RoF) is an essential technology whereby light is modulated with radio frequency signals and transmitted over the optical fiber to accomplish wireless access. RoF stands for Radio over Fiber technology. As today's era is the era of networks. Therefore whole data travels over the internet. So there is a chance of data traffic over the network due to excess of data to be transmitted. There are many advantages of RoF like it provides the facility of low attenuation [1-2]. It is easy to install and cheap which leads to the less maintenance cost. Wireless communication was one of the paramount ways in term of high bandwidth data communication. Technology like microwave, wireless, optical communication & their combination are used and have improved the performance of the communication. Radio over Fiber technology (RoF), an integration of microwave and optical communication, is an essential technology for the provision of unmetered access to broadband wireless communications [5-7].

Keywords: Radio over Fiber (RoF), BER, Radio Frequency, Communication, Subcarrier Multiplexing

1. Introduction

The services that are provided by internet play an important role in today's life, and are considered as one of the most important communication platforms. As communication demands are increasing day by day, it is very important that must there be a system which would satisfy the increasing demands. Radio over fiber technology provides solution to this. Radio over fiber refers to a technology in which light is modulated with radio

signal and then transmitted over an optical fiber to facilitate wireless access, such as 3G. Nowadays due to the various demands of system and mobile users with data capacity for wireless communication have been adequately provided by voice and data services. The wireless system as suffered many losses in the transmission as well as atmospheric attenuation, to overcome these problem use of Radio over Fiber system, it has low attenuation, electromagnetic interface, and large bandwidth. Wireless coverage of the user domain has various essential part of fixed and mobile broadband communication network. In order to offer integrated with many of demand into mobile broadband and fixed services.

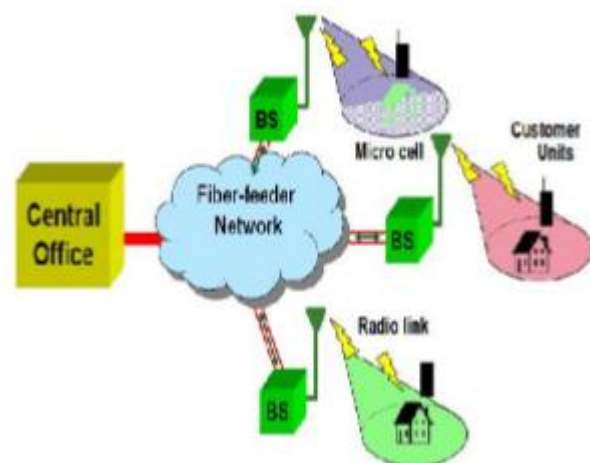


Fig. 1 Radio over Fiber

The wireless LAN offering up to 54 Mbps in 2.4 to 5 GHz carrier frequencies, 3G mobile networks offering up to 2Mbps in 2GHz, and 4G offering up to 40 Mbps in 2-8 GHz carrier frequencies. Orthogonal Frequency Division Multiplexing

(OFDM) is an emerging technology for high data rates. This technique transforms a frequency selective with wide band channel into a group of non-selective narrowband channels, which make large orthogonality in frequency domain. Radio over Fiber (RoF) system could be the answer to many demands of the wireless network. It is suitable technology for wireless network and provides a low cost configuration, because the optical modulated signals are transmitted to the base station carrying to the fiber without significant loss and reach the mobile user via RF transmission. The organization of paper includes an overview of OFDM system, RoF technique and combination of RoF-OFDM. And to analyze the implementation of RoF-OFDM system and proposed method has been taken from various methodologies [12-14].

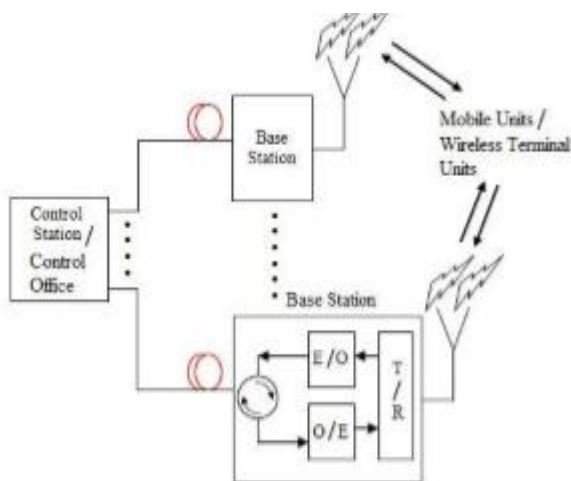


Fig. 2 General diagram of Radio over Fiber [5]

2. Literature Survey

J.J vegas, [9] et al, In this author represents a scenario of RoF in which low cost optoelectronic components are used for distributing data over various antennas. As we know in RoF system complex and costly equipments are used to transfer data over the wireless network. In this various design issue regarding RoF system is discussed along with another parameters like bandwidth supported by the channel, modulation frequency of the channel and sub carriers in OFDM. Hence it is proved that noise introduced in the signals does not affect much more on range of the signals in wireless network. From the cost point of view RoF is best technology to be used as compare to other

technologies. S. Ghafoor [8] et al in this paper author describes that to reducing the Bit Error rate of lowest power penalty in case of RoF system is quite a major problem. In this paper performance of WFDMA system which poses the 5 Gbps on off Keying (OOK) signals and 5 base stations in 6 km area is evaluated. In this paper it is shown by the author that the proposed technique has less BER and is much efficient as compare to other techniques. The value received of BER in proposed technique is negotiable in case of multimedia and real time application. Technology which makes it much efficient from performance point of view. RoF is a technology which is used to access or control the bandwidth of the wireless system. It is used to control the data traffic over the wireless networking system. It is used in real time multimedia applications because it provides the high capacity multimedia services. The RoF system is designed by using Optisystem 10 is an integrated system which uses both radio frequency wireless and optical fiber; there is a central node or base station, remote access unit and a link which is made up of optical fiber.

3. Basic RoF System Architecture:

A basic RoF system is shown in Figure 3. In the downlink transmission, RF signals modulate the laser diode directly and results in intensity modulated optical signals. Afterwards, they are transmitted through an optical fiber to the base station [2-4]. At the BS, the signals are demodulated directly employing a photodiode for recovering the RF signals. Furthermore, they are amplified and radiated by an antenna. RoF technology is known as intensity modulation and direct-detection based on modulation and detection. The opposite process is carried out at the BS, where the RF signals from the antenna directly modulate the laser diode and then the resulting optical signals are transmitted through an optical fiber to the CS. At the CS, the intensity modulated optical signals are demodulated directly employing a PD for recovering the RF signals. After that, the signals are amplified and further processed. The basic configuration of RoF link system consist of central station and remote access unit (RAU) connected by a single mode fiber[2]. Radio over fiber offers many advantages like large bandwidth, low attenuation loss, immunity to radio frequency interference, satellite communication and many more.

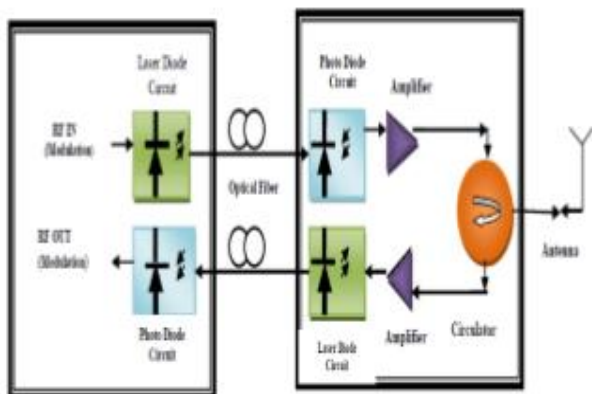


Fig.3 Radio over fiber system architecture [2]

4. Advantages, Application and Limitations of Radio over Fiber: RoF system has many advantages. Some of the most important advantages are discussed below:

4.1 Large Bandwidth: Theoretically, the optical fiber has unlimited bandwidth. The optical carrier frequencies are typically ~ 200 THz; in contrast with the microwave carries frequencies, typically ~ 1 GHz. Thus, the increase in information being transmitted over the optical fiber is ensured due to the high frequency carrier.

4.2 Low Attenuation Loss: Optical fiber used between the CO and BS has several advantages as compared to free space and copper cable transmission media. Thereafter the signal is radiated by the antenna located at the BS up to different users. The optical fibers available in the market have very low attenuation, thus they can be used to serve the purpose of reducing the losses between CO and CS which are separated far apart. The typical example is the Corning SMF which has the attenuation of 0.2 dB per km at the operating frequency of 1550 nm [5-8].

4.3 Easy installation and Maintenance: In RoF system, Modulation and Switching equipments are installed in the CO/CS and shared by several BSs. This facility makes the installation and maintenance cost to be reduced at an appreciable level. This is in contrast with conventional wireless communication where the modulators and switching equipments are centralized at the BS. This makes the system maintenance costly in case of conventional wireless communication since many several BSs are required in order to provide sufficient coverage to different users.

4.4 Immunity to RF interference: Since the RF signal is transmitted over the optical fiber, there is no way for electromagnetic interference. This property is very attractive because it provides security and privacy. Moreover, the quality and integrity of the information are preserved since the eavesdropping is banned in optical communication. Besides this Dynamic Resource Allocation and Low Power Consumption

Applications of RoF System: Due to the many advantages and quality of signal provided by RoF system, it has many applications, some most common are discussed below:

Video Distribution Systems (VDSs)

Satellite Control

Cellular Networks

Vehicle Communication

Wireless LANs (WLAN)

Mobile Broadband Service

Limitations of RoF System:

RoF system is an analogue transmission system. It detects light and modulates the analogue signals. Hence like any analogue system signal impairments like distortion and noise in the signals are vital in RoF also. These impairments are used to bounds a limit on Noise Figure and Dynamic Range NF and DR respectively. DR stands for dynamic range and plays an important role in mobile systems [7] like GSM because the power at Base station which comes from MUs fluctuates continuously. It refers that the power received from MU which is located nearest to the base station may be higher as compare to that one which is located far away from the Base station but within in the range of same cell [1].

5. Conclusions

After a deep study of various research papers and review paper on radio over fiber (RoF) discussion has come to the conclusion that RoF is much more superior technology to transmit the information from generation point to destination point. As it is known with the time lots of technology came to the existence and with the demand of high quality of service, higher data rate and low cost each technology replaced by new one after some time. With pace of time population increasing

exponentially so to meet the demand at lower cost new technology came so that demand can be fulfilled. After studying various papers it has been found that right now RoF is one of leading technology which have tremendous advantageous and application and faster with respect to other application.

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