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RoF using Subcarrier Multiplexing/Amplitude Shift Keying (SCM/ASK) for providing Broadband Wireless Access

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ABSTRACT

Fiber optics transmission system refers that it carries information in the form of optical signal using 1550 nm, which are effective in view of high throughput and reliability for long distance network. It uses TDM multiplexing technology that combine multiple signals which are available as electrical enable to increase throughput by minimizing an investment in medium. This paper deals with the twin concepts of optical transmission networking and Radio transmission technology. When user have specific mobility requirement, then we may need of implementing wireless in access network so that user requirement can be achieved. Optical transmission networking is implemented with TDM devices like TM, ADM, R/R, DXC and fiber optics and Radio transmission is implemented with radio devices like Modulator , hybrid coupler, circulator and SCM ASK for providing wireless broadband. With the increasing deployment and growth in transport networks based on TDM technology, solving the classic network design and planning problem of optimizing cost and scalability for given traffic requirements becomes ever critical. The concept is implemented in network to increase the bandwidth and also to offer the limited mobility to user and network is optimized through BER, Optical spectrum analyzer, Optical power meter visualize. Finally network gets extended in coverage area and maximizing bandwidth by ensuring the performance parameters of network such as latency, reliability, SNR.

Keywords: SCM, RoF , Radio over Fiber, RF, TDM, ASK.

I. INTRODUCTION

Nowadays, there is an increasing demand for broadband services which leads to ever-growing data traffic volumes over these services. In addition to the high-speed, symmetric, and guaranteed bandwidth demands for future video services, the next-generation access networks are driving the needs for the convergence of wired and wireless services. Radio-over-Fiber Technology, the integration of microwave and optical networks .It is a potential solution for increasing capacity and mobility as well as decreasing costs in the access network, by RoF. Telecommunication is a process of transmitting or receiving information over a distance by any electrical or electromagnetic medium. Telecommunication can be possible in 2 ways analog and digital communication.

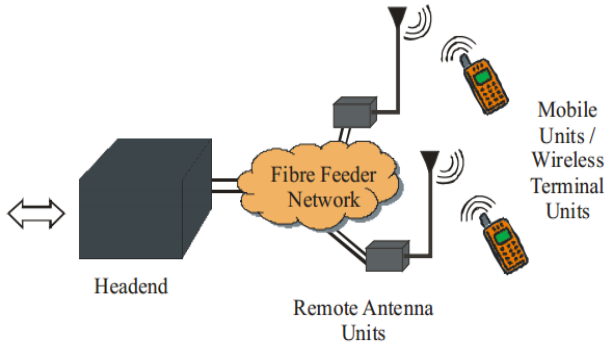
When communication is carried using only single Baseband signal on a line, its called as Baseband communication. But due to high bandwidth requirement Broadband communication need to be used. Broadband communication is the process of combining a number of individual baseband signals into a common frequency band or into a common bit stream for transmission.

Broad communication uses Time Division Multiplexing (TDM) to cater multiple voice frequencies. Many modulation techniques can be used to done the secure data transmission. In my concept we are using SCM ASK. Amplitude-shift keying (ASK) is a form of amplitude modulation that represents digital data as variations in the amplitude of a carrier wave.

The transmitters in optical fiber links are CW laser diodes. Infrared light, rather than visible light is used more commonly, because optical fibers transmit infrared wavelengths with less attenuation and dispersion. The need for periodic signal regeneration was largely superseded by the introduction of the erbium-doped fiber amplifier, which extended link distances at significantly lower cost.

1.1. Radio over Fiber (RoF)

Radio over Fiber system is very attractive technique for wireless access network, because it can transmit microwave and millimeter wave through optical fiber for long and short distance. It is also possible to support WLAN and current 4th generation mobility network. Radio over Fiber system, it is the integration of RF and optical network and it increase channel capacity of mobility and application systems, as well as decreasing cost and power consumption. This system provide radio access has a number of applications to merge in the recent and next generation wireless systems includes Central Site (CS) and Remote Site (RS) connected to an optical fiber link, and signal is transmitted between CS and RS in the optical band through RoF network. This architecture as the BS to different network units is present, as shown in Fig. 1



The Radio over Fibre System Concept

There are many benefits of this system. Some advantages will be given,

1) Low Attenuation loss
2) Large bandwidth
3) Immunity to Radio Frequency interference
4) Easy installation and maintenance
5) Reduced Power Consumption
6) Dynamic resource Allocation

And some applications are given below,

1) Satellite communications
2) Mobile radio communication
3) Broadband access radio
4) Multipoint Video Distribution Services (MVDS)
5) Vehicle communication
6) Wireless LAN with mobility support

II. BASIC FUNCTIONS OF RADIO OVER FIBER SCM ASK

It reduces the deployment and maintenance costs of wireless networks while providing low power consumption and large bandwidth for very attractive technique in the wireless access. In addition, RoF technology enables such as macro-diversity for handover.

2.1. DISPERSION

Dispersion is the widening of pulse duration as it travels through a fiber. As a pulse widens, it can broaden enough to interfere with neighboring pulses (bits) on the fiber, leading to inter symbol interference. Dispersion thus limits the bit spacing and the maximum transmission rate on a fiber-optic channel. As described earlier,one form of the dispersion is an intermodal dispersion. This is caused when multiple modes of the same signal propagate at different velocities along the fiber. Intermodal dispersion does not occur in a single-mode fiber.

2.2. ATTENUATION

Fiber attenuation, which necessitates the use of amplification systems, is caused by a combination of material absorption, Rayleigh scattering, Mie scattering, and connection losses. Although material absorption for pure silica is only around 0.03 dB/km (modern fiber has attenuation around 0.3 dB/km), impurities in the original optical fibers caused attenuation of about 1000 dB/km. Other forms of attenuation are caused by physical stresses to the fiber, microscopic fluctuations in density, and imperfect splicing techniques.

III. RESULT AND DISCUSSION

3.1. Bit Error Rate

BER may be affected by transmission channel noise,

interference, distortion, bit synchronization problems, attenuation, and wireless multipath fading.

1) Max Q factor=8.63
2) Min BER=2.94896e-018
3) Eye height=0.000333881
4) Threshold=0.00025812

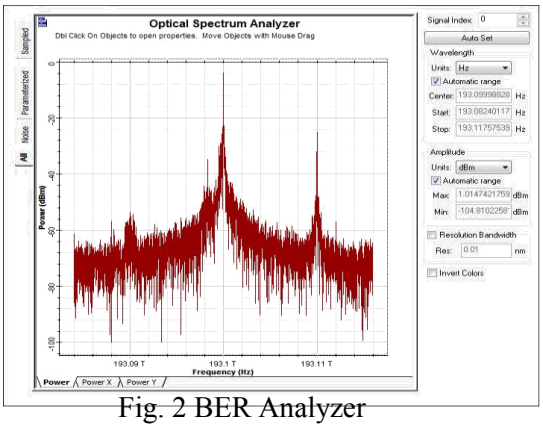


Fig. 2 BER Analyzer

3.3. TRANSMISSION SIDE VISUALIZER

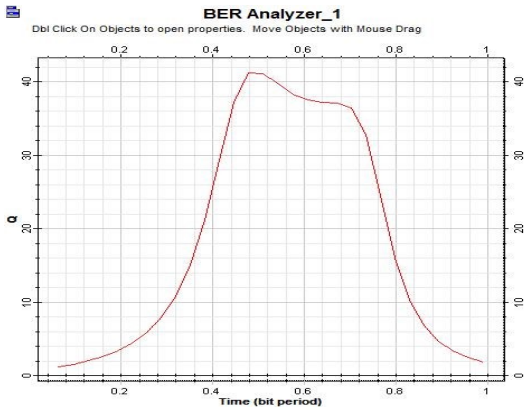


Fig. 3 Transmission side

Fig. 6 shows the signal at the AM transmitter using optical time domain visualizer. Time slots will be in X axis with the time difference of 30ns and the power will be in Y axis with the power difference of 20dbm.

3.4. SPECTRUM ANALYZER

Optical spectrum analyzer is used to split signals in constituent wave length. The signal is graphically displayed, with power on horizontal axis and wavelength on vertical axis. Spectrum analyzer in the transmitter side and receiver side indicates the spectrum signal of each signal. Each channel the spectrum will be same but it will vary in amplitude due to long transmission.

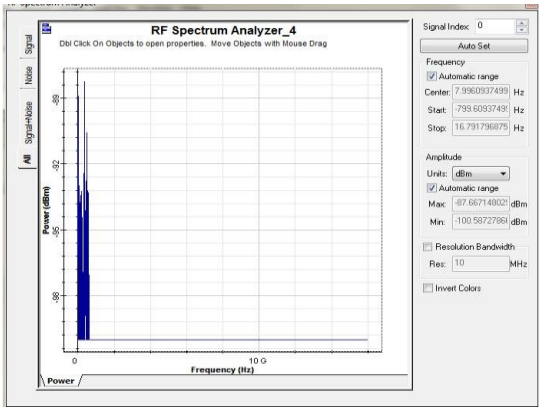


Fig. 4 Spectrum analyzer receiver side

Fig. 5 shows the signal at the electrical amplitude demodulator using optical spectrum analyzer. Frequency will be in X axis with the difference of 10 GHZ and the power will be in Y axis with the power difference of -3 dBm.

3.5. EYE DIAGRAM ANALYSIS

The eye diagram is used to view the performance in digital transmission. The eye diagram provides the instantaneous view by repetitively to achieve good view of its behavior

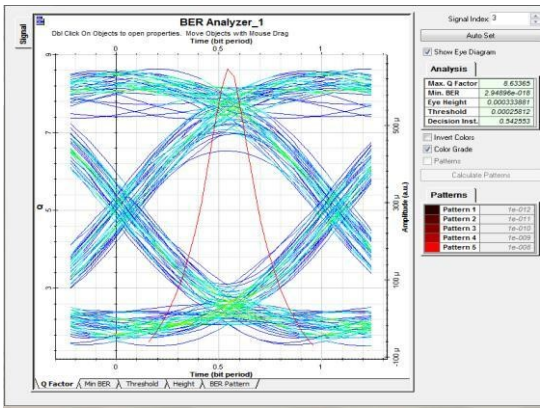


Fig. 5 Eye Diagram analysis

IV. CONCLUSION

In this project, we have designed and implemented a bidirectional radio over fiber ROF system different types of modulations have been used. Our system is a very effective solution for wireless systems due to increasing the demand for multiservice operation and hence broadband access, it is a reliable and cost effective communication system that can support

anytime, anywhere, and any media are needed. It is able to alleviate the increasing demand for high-bandwidth services. AM has been used for re-modulation of a down-link signal over 10 km . Also, it showed that the proposed system has potential application in next-generation convergent wireless-wired optical network. The second part has been proposed as a solution for increasing bandwidth demand. The combination of ASK and SCM has been performed to provide high data rates and bandwidth in wireless communication. We have analyzed the performance of ASK/SCM Radio over Fiber System. The results obtained here show that increasing total number of sub-carriers channels has a significant impact on performance of ASK-SCM ROF system. The most significant advantage of SCM in optical communications is its ability to place different optical carriers together closely. Finally we discuss the proposed ASK-RoF model. The whole hierarchical simulation system model was constructed and simulated successfully using a commercial optical system simulator. By varying both the input optical power and the number of subcarriers, the log of bit-error-rate (BER) can be achieved. The results obtained here show that the combination of ASK technology and ROF technology makes it possible to transform the high speed RF signal to the optical signal, so that the optical fibers with broad bandwidth can be used.

V. REFERENCES

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