Simulative Analysis of DPSK modulated WCDMA based RoF System

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Abstract-In this paper, WCDMA-ROF system incorporating Pseudo-orthogonal coding is demonstrated. Hybrid architecture is proposed where data communication is enabled via a combination of optical code and radio-over-fiber techniques with DPSK (Differential phase shift key) modulation. We use WCDMA encoders and decoders in order to obtain a preferable performance of proposed WCDMA-ROF system. Line width of transmitted signal is adjusted in order to obtain minimum interference and preferable results are obtained. The effect of narrow band interference in the WCDMA spectrum is investigated through simulation.

1. Introduction

Radio-over-fibre (RoF) technology has emerged as an approach for reducing radio system costs because it simplifies the remote antenna sites and enhances the sharing of expensive radio equipment located at appropriately sited (e.g. centrally located) Central Stations (CS) and is cost effective too. Research efforts are being done for many decades to introduce multimedia competency like high speed Internet access, high quality image transmission and video into mobile communications [1]. Different standard agencies and governing bodies are trying to integrate a wide variety of proposals for third generation cellular systems. UMTS (Universal Mobile Telecommunication Systems) employs Wideband Code Division Multiple Access (W-CDMA) radio access technology to offer greater spectral efficiency and bandwidth for mobile network operators. WCDMA is a technology to realize multiplexing transmission and multiple accesses by coding in optical domain, which supports multiple simultaneous transmissions in the same timeslot and same frequency [2]. Moreover WCDMA has advantages over TDMA and WDMA [3]. The Coherent detection techniques in WCDMA have phase information of carriers and perform in bipolar approach whereas incoherent detection has no such type of information and it performs in unipolar [4]. The physical bandwidth of the channel is increased by the SAC-OCDMA technique [5]. There are different detection techniques of SAC-OCDMA which are used to reduce the effect of MAI (multi-access-interference). Coherent and Incoherent detection technique are generally used to reduce the effect of MAI [6]. Comparison of OCDMA and WDM PON and discussed WCDMA is better solution for symmetric traffic in PON [7]. This paper presents the trends and features of RoF based WCDMA techniques in communication systems. The multi-access-interference (MAI) and fiber dispersion[10] are the main main problems of WCDMA .This paper focus on the
hybrid WCDMA system which allows high user capacity which supports upto 16000 to 32000 users. Chaotic optical codes have been used to overcome the interference between parallel transmission [10]. Construction and architecture of WCDMA which allows to achieve asynchronous transmission speed. Encoder/Decoder (E/D) used to generate codes at the rate of 2.56Tbps over 50km fiber [11]. Optical implantation of Fourier transform. Also compare OFDM with WCDMA system [12]. Construction and architecture of wavelength division multiplexing-passive optical networks (XDMA-WDM-PON) having three solutions TDMA, OCDMA and OFDMA which is essential for optical access networks of the future. Also discussed OFDMA-WDM-PON architecture is best for optical access networks of the future [13]. The results show that NAND detection technique with MDW code provide better performance and also supports more users [14]. We have already achieved good results within MIMO-OFDM system with OADM recently for optical-OFDM system and Monitoring and Compensation of Optical Telecommunication Channels [12-17].

2. System Setup
Four wavelengths used for this system i.e.1550nm, 1550.8nm, 1551.6 and 1552.4nm. Four mode-locked lasers are used to create a dense WCDMA multi-frequency light source. Delay and Inverse delay are used in Encoders and decoders. In this system, there are 16 users transmitting data at high data rate i.e.9.95Gbps. The central station (CS) transmits optical intermediate (IF) and local oscillator (LO) signals to the remote node where amplification and optional wavelength conversion takes place. DPSK-encoded multiple data channels and local oscillator frequencies over a common optical fiber are transmitted and optionally achieve simultaneous wavelength conversions while keeping crosstalk penalties at minimum. The demodulated channels are transmitted to remote antenna stations (RAS) covering each cell that can also be microcells or pico cells depending upon the architecture. The encoded data from these 2 users get multiplexed and then passed through the 60-km span of standard single mode fiber. The output from standard fiber gets demultiplexed and then output passed to user’s decoder. This decoded signal then arrives at receiver and BER tester. In this paper we consider 16 users for encoder, encoder output from 16 users multiplexed. Losses occur in the encoded output because of more number of users at high data rate. After receiving output, we can observe the results that BER of channel 1 and 16 is 4.45×10^{-22} and 1.6×10^{-13} respectively and Q factor for channel 1 and 16 is 19.9dB and 15.8dB respectively. MAI is directly affected by number of users if number of users increase then it will enhance the MAI.
3. Results and discussions:

The Figure 2 and Figure 3 shows modulated data and spectrum respectively before encoding at User 1.

We have placed encoders for 16 users. The encoded data from the users is multiplexed and then passed through a 10-km span of standard single mode fiber (SMF) followed by a loss compensating optical amplifier.
Amplifiers can also be used to compensate for the insertion losses due to encoders, multiplexers, demultiplexers and decoders if needed. The output signal from a fiber span is then passed through splitter/demultiplexer and routed to the user’s decoder. The decoded signal finally arrives at optical receiver and BER tester.

4. Conclusions

In the proposed system with proper control over linewidth for different multiple users, the performance of Wideband code division multiplexed Radio over fiber system is analyzed and concluded the best operating conditions for such a communication system.

5. References


[8] K. Fouli and M. Maier, "OCDMA and Optical Coding: Principles, Applications,


