RADIO ACCESS POINT DESIGN FOR RADIO OVER FIBER TECHNOLOGY

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ABSTRAK

Rangkaian kawasan tempatan wayarles (WLAN) adalah digunakan pada peningkatan bilangan tempat-tempat. Dalam bangunan-bangunan pejabat, hospital-hospital, lapangan terbang melepak, dan sebagainya. dengan kenaikan gaji laris untuk data berkelajuan lebih tinggi penghantaran, ini WLAN memerlukan untuk menyediakan lebih tinggi keupayaan-keupayaan pemindahan data, yang memerlukan frekuensi-frekuensi gelombang mikro tinggi. Oleh itu, jangkauan antena radio stesen mendapat lebih kecil dan apa saja lagi titik akses radio (KETUKAN) adalah diperlukan untuk meliputi satu kawasan tertentu. Untuk menyimpan stesen belanja dapat dikawal, stesen-stesen antena sepatutnya seperti mudah sebagai mungkin dan isyarat pemprosesan isyarat yang serupa sebagai mungkin dan banyak fungsi-fungsi harus bertumpu di stesen hujung kepala kemudian untuk dibawa lutsinar antara titik akses radio (KETUKAN) dan stesen hujung kepala. Satu mod gentian optikal, sebagai digunakan dengan meluas dalam jarak jauh 50 kilometer dan rangkaian metropolitan, menawarkan mencukupi lebar jalur untuk ini. Tetapi adalah mahal untuk penggunaan tertutup. Tujuan kajian ini adalah mereka bentuk dan menyerupai satu titik akses radio untuk radio atas teknologi gentian. Simulasi-simulasi telah diusahakan menggunakan optisytem. Komponen-komponen bermakna adalah electroabsoaption pemodulat (EAM) titik akses seperti radio daripada komponen Power Amplifier PA dan Band-pass Filter BPF. Titik akses radio adalah dibuat-buat di kekerapan 2.4 GHz.

ABSTRACT

Wireless local area network (WLAN) is being used at increasing number of places. In office buildings, hospitals, airport lounges, etc. with the raise in demand for higher speed data delivery, these WLAN need to provide higher data transfer capacities, which requires high microwave frequencies. Thus, the reach of the radio antenna station gets smaller and ever more radio access point(RAP) is needed to cover a certain area. To keep station's cost under control, the antenna stations should be as simple as possible and as much as possible signal processing signal functions should be centralized at the head end station. The modulated microwave signals need then to be carried transparently between the radio access point (RAP) and head end station. Single mode optical fiber, as extensively used in long distance 50 km and metropolitan network, offer adequate bandwidth for this. The purpose of this study is to design and simulate a radio access point for radio over fiber technology. The simulations were performed using Optisytem. The main components were electroabsoaption modulator (EAM) as radio access point instead of the component Power Amplifier (PA) and Band-pass Filter (BPF). The radio access point is simulated at frequency of 2.4 GHz.

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CHAPTER 1

1.1 Introduction

Wireless Communication is becoming an integral part of today's society. The proliferation of mobile and other wireless devices coupled with increased demand for broadband services are putting pressure on wireless systems to increase capacity. To achieve this, wireless systems must have increased feeder network capacity, operate at higher carrier frequencies, and cope with increased user population densities. However, raising the carrier frequency and thus reducing the radio cell size leads to costly radio systems while the high installation and maintenance costs associated with high-bandwidth silica fiber render it economically impractical for in-home and office environments.

Radio-over-fiber (RoF) technology has emerged as a cost effective 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) Switching Centers (SC) or otherwise known as Central Sites/Stations (CS). On the other hand, Graded Index Polymer Optical Fiber (GIPOF) is promising higher capacity than copper cables, and lower installation and maintenance costs than conventional silica fiber.

Wireless access – fixed or mobile is regarded as an excellent way to achieve broadband services. Of course, it is the only possibility for mobile access (in particular if global mobility is required), however wide application of fixed wireless broadband access is also foreseen. It is well known that both due to unavailability of lower microwave frequencies and to the insufficient bandwidth of lower frequency ranges, next generation wireless access systems – both mobile and fixed – will operate in the upper microwave/millimeter wave frequency band. As in a cellular

system both increased traffic and propagation properties of millimeter-waves require small cells, further as millimeter-wave circuits are rather expensive, the cost of base stations (BSs) will be of determining role.

One emerging technology applicable in high capacity, broadband millimeter-wave access systems is Radio over Fiber called also (Fiber the Air). In this system in order to decrease the costs of BSs, most of signal processing (including coding, multiplexing, RF generation & modulation etc) is made in central stations (CSs) rather than in the BSs. The signal to and from these is transmitted in the optical band, via a fiber optic network. This architecture makes design of BS-s really simple, in the simplest case a BS doesn't comprise else than optical-to-electrical (O/E) and electrical-to-optical (E/O) converters, an antenna and some microwave circuitry (two amplifiers and a diplexer). Or, as it will be mentioned, in principle even the amplifiers can be omitted. In the last decade or so significant research work was done in this field with significant results; the number of publications is abundant. The most important results are summarized in a recent monograph [1]. While, architecture, techniques, benefits, as well as problems to be solved are extensively discussed in [1] and papers referred to in [1], not too much has been told about special problems of resource management and channel allocation. The aim of this report is, after presenting basic design and fields of application of the RoF concept, to give an, as far as known by the author, first short outline on these questions.

1.2 Objective of project

The objective of project is to simulate a low power radio access point (RAP) for transmission using optisystem simulation software. The main part in the radio access point is electro absorption modulator (EAM) as radio unit.

1.3 Scope of project

In this project, simulation model will be developed that integrates both radio frequency (RF) wireless and optical fiber systems that would be transparent to

different systems such as GSM, UMTS.etc. In this simulation models might consist of Pico cell base station and central end optical fiber link model that may use commercially available parameters and power control subsystem modeled in the optisystem are used to contact the whole heretical models.

First of all, the principle of radio over fiber (ROF) system characterized by fiber optic link and free space radio discussed. An electroabsorption modulator transceiver will be used for (RAP) designed. Thereby the (RAP) cost will be reduced. Once familiar with principle and the environment of the optisystem software low power (RAP), at the last the behavior of the system will be anal sized.

1.4 Problem statement

The difficulty which faces radio communication is limited available frequency spectrum. Also numerous reflection stationary objects such as wells, furniture and movable object such as people, animals cause hard environment for – high speed radio transmission. In addition using many components in radio access point make the system less reliability and cost, lastly poor signal coverage.

1.5 Thesis outlines

This is written to bring the reader step by step going in the main core of the content Chapter 1 Provides the introduction to this project where brief background of the study problem and to the statement of the problem. Followed by the Objective, and the scope of the study.

Chapter 2 reviews the literature, which includes introduction to the RoF, the benefits, and applications of the Radio over Fiber Technology in both satellite and mobile radio communications. In addition various types of RoF BS or radio access unit have also been covered.

Chapter 3 covers the basic optical fiber communication link and surveys the state of the art on RoF technologies with a special emphasis devoted to RoF system operating at mm-wave bands and provides information about the fiber characteristics, and structure of electroabsorption modulator which presented the main component in radio access point (RAP).

Chapter 4 describes the methodological processes by showing detailed diagram of the methods implemented as well as highlighting briefly the steps those have been followed to achieve the objective of this project.

Chapter 5 presents the results derived from the methods explained where some analyses and simulations were done based on the EAM effects. Finally the conclusions of the study, as well as some suggestions for future work were summed up in Chapter6.

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Although radio transmission over fiber is used for multiple purposes, su.Â Radio-over-Fiber (RoF) technology entails the use of optical fiber links to distribute RF signals from a central location (headend) to Remote Antenna Units (RAUs). In narrowband communication systems and WLANs, RF signal processing functions such as frequency up-conversion, carrier modulation, and multiplexing, are performed at the BS or the RAP, and immediately fed into the antenna.Â Fiber Optics are designed to handle gigabits speeds which means they will be able to handle speeds offered by future generations of networks for years to come. RoF technology is also protocol and bit-rate transparent, hence, can be employed to use any current and future technologies. Radio over fiber (RoF) or RF over fiber (RFoF) refers to a technology whereby light is modulated by a radio frequency signal and transmitted over an optical fiber link. Main technical advantages of using fiber optical links are lower transmission losses and reduced sensitivity to noise and electromagnetic interference compared to all-electrical signal transmission.