# Optic Link System

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*Abstract* – **In given article is overviewed the digital optic link system and the problem of encoding analog information in communication systems. This system can be used as warless computer networking with out paying for radio band. As optic transmitter used red semiconductor laser.**

## I. Introduction

At present optical channels of information transfer received wide enough application. Examples of the given systems can be remote controls, the infra-red transceivers in embedded systems and opt link computer and telephone networks.

Thus, it was decided to make communication system with optic link communication channel with throughput up speed near 10 Mbps.

The optic link systems are useful, if needed to set communication channel for high distance without using high cost radio LAN systems as WiMAX or WiFi. The sermon puss of this system – you need no pay for radio band and components used on it are very chip.

## II. Overview

For construction of the given system and evident demonstration of its serviceability the working model was assembled. In a role of the transmitted information was chosen digital speech stream. Physically all system can be divided into two blocks which are carrying out the following tasks:

- Coding speech in a digital stream
- Transfer digital signal by optical channel

the schematic diagram of this system is given below on Figure 1.

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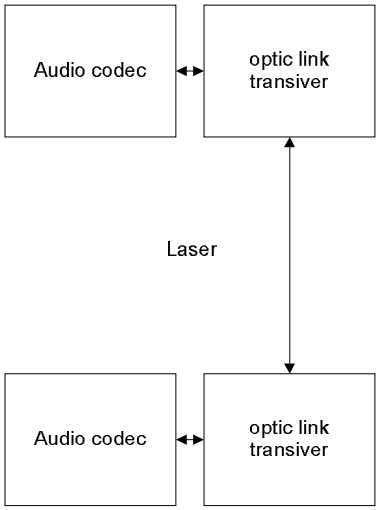


Fig. 1. Optic link system

During researches, it was revealed, that the transfer on the optical communication channel of information with presence of a constant component is not possible without special transformations. The reason to that is noise immunity. For example, in a case over light of the photo receiver an extraneous light source can be understood as a useful signal, thus, not being by those. In a consequence complete, loose of the useful information (payload).

For avoidance of it, it was undertaken to build in the reception module the site filtering a constant component of a signal. Thus the useful signal will be transferred as a code without a constant component. There are some kinds of such code, in this case was chosen one of most widespread - Manchester code.

It represents a meander with frequency twice above than base signal (absence of a constant component). The phase of a signal changes only at transition from unit in a zero and back.

The given principle is used in ports of Irda standard, and in local computer networks. On the Figure 2. Manchester code is given.

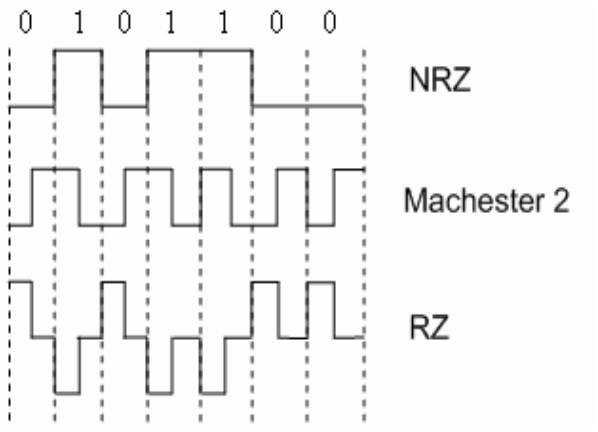


Fig. 2. Manchester 2

## III. CODING OF SPEECH

For simplification in the article described only two analog channel multiplexing in one digital. Two analog

Channels multiplexing is not limit for the system and if it needed number of channels can by increase. As we can see from figure 1, digital communication system consist of two channels, named: left and right. Both analog channels are connected to ADC via analog multiplexor. Time domain multiplexing is realized by alternating multiplexor switching.

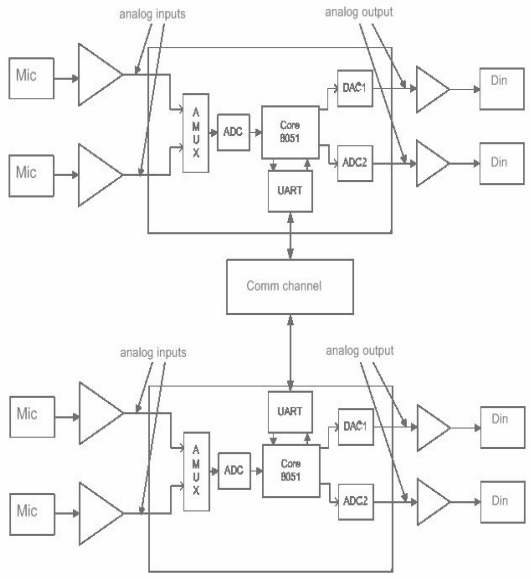


Fig. 3. Digital communication system

As shown at Fig 3 the low frequency analog signal for example from microphone comes to preamplifier. Preamplifier is needed for amplification of weak signal from the microphone to value (In this case 2.5 V), which needed for correct processing in ADC and signal to noise ratio increasing. Preamplifier is implemented on chip LM324.

After preamplification, analog signal comes to input of analog multiplexor (AMUX) which integrated into chip 8051F042. Further conversions are provided in this chip. From the multiplexor output, left and right analog channel signals are sequentially comes to the ADCs input. After analog to digital conversion signal comes to central processor unit (CPU).

The architecture, core speed and instruction set allow to realize all needed algorithms, such as amplitude normalization, signal compression, variable gain amplification, code domain channel interleaving.

Amplitude normalization based on pseudo instant companding algorithm. The essential of this method is a delaying signal during approximately 10 mS, measuring of maximum level of signal at this duration, calculation of coefficient of amplification and multiplication of delayed signal by coefficient of amplification. In common view this method de pictured on Fig 4.

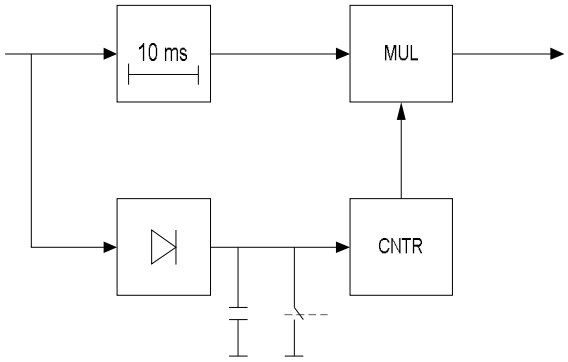


Fig. 4. Amplitude formulizer in common view

Variable gain amplifier allows to adjust level of transmitted audio signal according commands from remote receiver.

Before sending thru communication channel processed digital signal is encoded to packets and send them in Manchester code.

Packet includes: preamble, address, payload and check sum. Besides, packet also includes additional information markers, which make possible correct code demultiplexing by reviser. As result of code demultiplexing by receiver there are two digital streams which after processing by CPU (un compression, etc.) flows to DAC.

DAC provide restoring digital streams to analog signal signals.

## IV. OPTIC LINK TRANSCEIVER

The optical transceiver is submitted as two independent blocks: transmitter and receiver. The transmitter inverts incoming digital stream and transfers it to semiconductor laser diode. Using semiconductor lasers is very effective for it high coefficient of useful work and high speed reaction.

The receiver amplifies the signal, received by the photo diode, amplified it up to amplitude in 3.3 volts, filters a

constant component, comparing the current meaning with previous(noise immunity), inverts it. On the output we have a restored digital stream.

## V. Conclusion

There is variation of adoptive digital communication system with multiplexing a several analog channels in to one digital and optic link communication channel is offered. However components used for design implementation allows realize needed analog processing algorithm.

1. The way described in this article allows to make cost-effective Optic link system.

2. Given system shows high efficacy during testing. Testing time – 1 hour, errors – 0,2%, speed – 10 Mbps.

## VI. Future implementation

In future this system can be worked on speed up to 100 Mbps and used in optic coir communication, warless LAN connections e. t. c

## References


[1] User's reference manual to C8051F04x Silicon Laboratories Inc. 2005. p 29-180.

[2] Frunze A. V. Microcontrollers? It is easy!, M.: «OOO ID SKIMEN», 2002. p 6-240.

[3] Fedorkov B. G., Telec V.A. DAC and ADC microshems: functionality, parameters, implementation M.: ENERGOIZDAT, 1990. p 63-90.

[4] Goroshkov B.I. Radio electronic devises M.: Radio and communication, 1984. p 6-184.

[5] G. Shild C: The Complete Reverence M.: Williams Publishing, 2002. p 40-190.