

## SIMULATION OF ADSL FOR NEEDS OF EDUCATION

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*The aim of this paper was formed a model of co-operation of systems in access network with adjustable parameters. The main sight is on simulation of all ADSL system, which describes transmission principle among ADSL modems. Following this simulation it is possible to understand the principle of ADSL systems and finally better design power spectra of systems operated on other couple of cable so, to be possible to reach what perhaps biggest transmission speeds at preservation of transmission quality. Simulation programme can be used to educational needs like as objective teaching material acceptable to placing on internet.*

**Keywords:** ADSL, simulation, MATLAB

### 1. INTRODUCTION

The paper comes from the reference [8] above all. The environment MATLAB 6 Release 12 and Simulink 4.0 were used. In libraries pre-defining blocks [7] were used. The resulting model is not absolutely accurate model of ADSL system [12] (there are used explicit simplification in the simulation), it simulate its activity and it is suitable above all to insertion to the tutorials namely to explication of principles and functions of ADSL technology.

Pre-setting of input parameters and displaying of needed graphs and dependences is facilitated by the help of graphic user's menu. The simulation begins by the command Start\_ADSL in the command window of Matlab programme. They have to however be accessible all needed files and have to be well adjusted the path to the working directory.

### 2. PROBLEM STATEMENT

On the creation of ADSL system model was issued from models in [4], [5] a [7].

#### 2.1 Model of ADSL modem – Upstream

The data source is in this case Bernoulli random binary generator from its conduct frames which contain  $(BIT\_IN\_UP*2-16)$  bits. Input variable BIT\_IN\_UP (BIT\_IN\_DOW) designates the number of bits of halve output frame after addition of eight check CRC bits. The block multiple selector is used for frame division into two ways, the input frame is there divided into two halves. Two unsecured frames are so formed. One of them goes through interleaving and second one through non-interleaving path.

In a cyclic encoder are subsequently inserted in the end of unsecured frame eight check bits. At the end of the transmission string cyclic decoder decodes received frames and checks last eight bits, if it is the octave of zero the frame was transmitted

faultlessly. In the event of badly received of bit location the error is displayed in part for error rate measurement in the appropriate path for upstream.

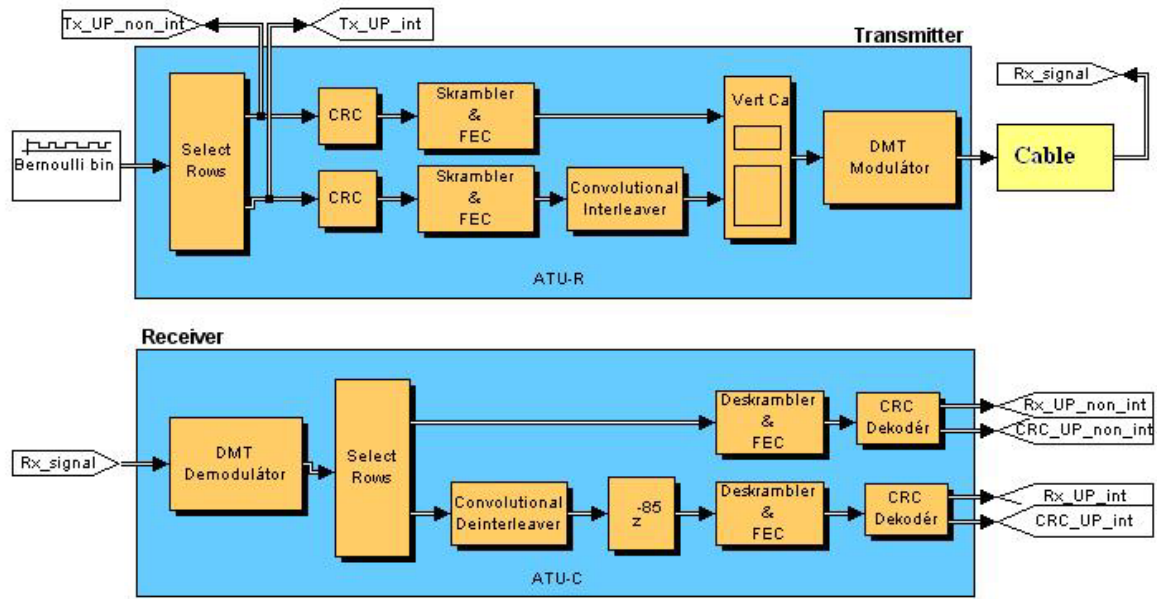


Fig.1 Scheme of ADSL transmission system for upstream direction

### 2.2 Model of ADSL System - Downstream

Simulation model of ADSL system for downstream direction is almost like as for upstream direction. The main difference is in structure of DMT modulator. For downstream direction DMT modulator contains 16 modulator-bank. Every bank of QAM modulators is like each other and includes as well as for upstream direction 16 rectangular modulators QAM.

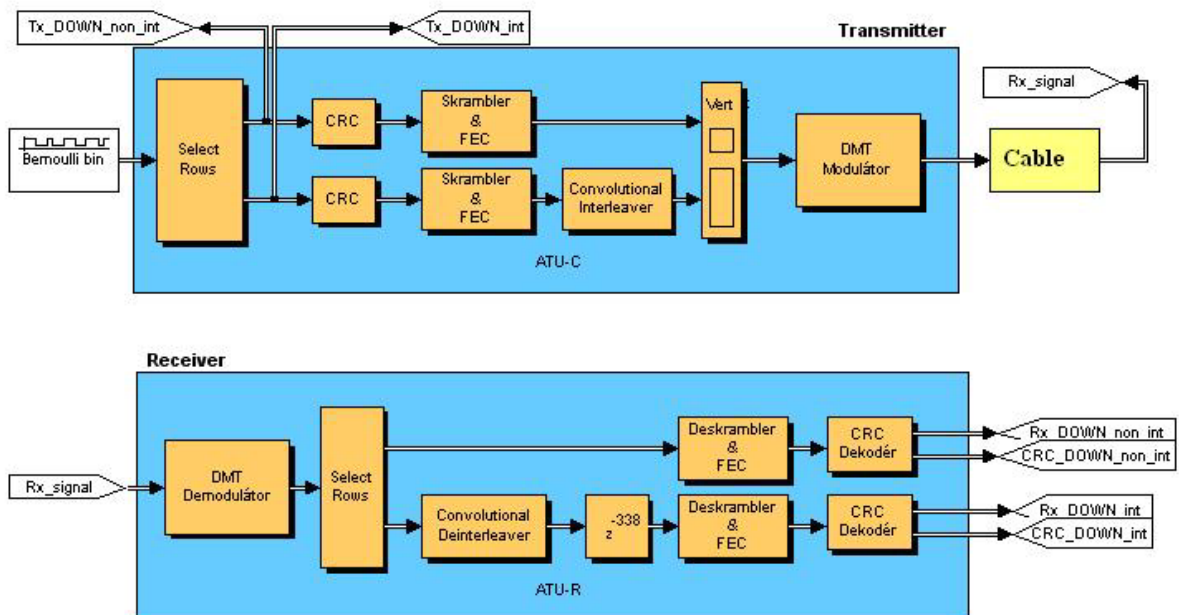


Fig.2 Scheme of ADSL transmission system for downstream direction

### 2.3 DMT Model

The model of DMT modulator function is a part of simulation programme. The model is not dependent upon input parameters which are calculated in initialization parts like the ones was in previous cases. The model consists from data source, that is formed by Bernoulli random binary generator, from DMT modulator, which consists from 16 modulator-bank.

The cable model is represented by AWGN block and there is not in it included disturbance from surrounding systems.

The block further contains block of DMT demodulator where proceeds inversion operations in the opposite order like in DMT modulator.

After error rate location follows block, which compares frames transmitted sources and compares them with frames that goes from DMT demodulator. The model of DMT modulation on the Fig.3.

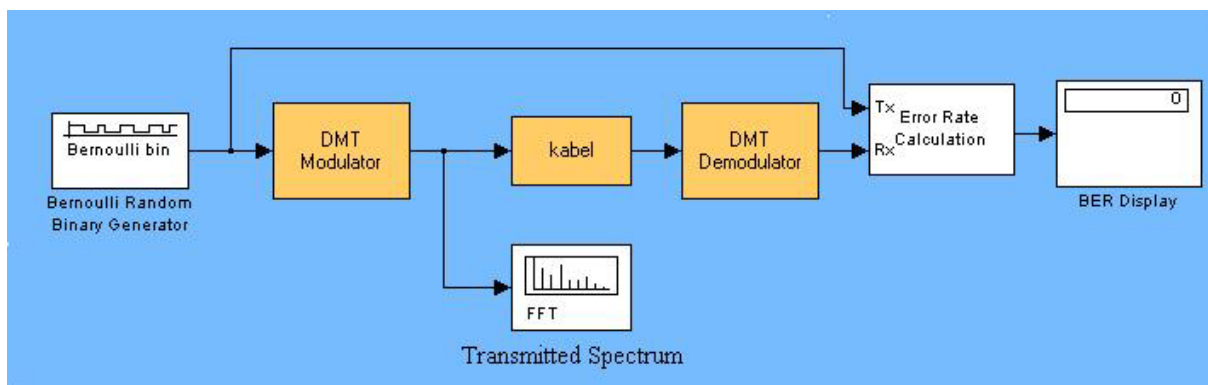


Fig.3 Model of 256- channels DMT created in Simulink Programme

### 3. CONCLUSION

The aim of this research was design and realize the active functional model of co-operated systems in the access network by the help of technology ADSL. The simulation of telephone cable that connects terminals and exchanges (DSLAM) is not described in this paper, but it was designed and can be use here. The simulation of modems for the upstream respectively downstream transmission and from the simulation of discrete multi-frequency modulation DMT. The simulation of modems gives us accurate image of what how whole system ADSL works.

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