Using FPGA for filtering data of Transport Stream

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***Abstract*—The switchover to digital television broadcasting system in Hungary, more SD and HD channels available free of guarantees . Receiving of the program , followed into the IP environment will broadcast local network is available , the structure of which allows you to filter based on the channel PID identifier. The fact that the network is connected, a television program to be available for users, is controlled using FPGAs, which use novel and has several advantages .**

I. Introduction

The IPTV acronym reminds most of the people to the television service of the bigger telecommunication companies sent on an ADSL network, which offers different extra services (stoppable, recordable broadcast) for the subscribers. They need to place a device called Set-Top-Box in their homes in order to get access to the programs.

In our case, the acronym of the IPTV means an other service mode, which is the possibility of receiving the freely accessible Hungarian television channels of the DVB-T broadcast.

II. The construction of DVB-T broadcast

The output signals of the video and audio recording devices can be found in the studios have really big data velocity so transmitting them directly would be uneconomic. Using compress procedures led to decrease the velocity of the data, these are based on a MPEG (*Moving Pictures Experts Group*) standard. In Hungary in case of the video signals the MPEG-4 H.264 format coding is in use, with which it is possible to transmit HD content resulting the half of the data velocity.

Beside the sound and picture signs, teletext and other services also insurable for the users. These three data types separately, create ES- Elementary Stream, which are separated to packages with different size according to their content. We call it PES – Packetized Elementary Stream, which are not able to transmitting because of their different size. Because of this the PES should divided up to TS (Transport Stream Packet) packages with the same size.

The size of a single TS package is 188 bytes, which begin with a 4 byte header. The first byte of the header is the synch byte, which has the value 47 hex. This is how the beginning of a new package can be detected. The PID (Packet Identifier) located in this same place on 13 bit, which is referred to the content of the package (picture, sound or other signs). The packet, from the sender side supplied with a 16 byte Reed-Solomon error correcting code, so it's size increased to 204 byte. In the IP environment it is not transmitted, in this case a 188 byte format is used. The fix sized TS packages are transmitted in MPEG (MPEG-Transport Stream) data flow. Beside the elemental data multiplexed into the TS we have to place the tables which describes the programs can be found in the TS (PSI-Program Specific Information) and tables which are containing information related to the service (SI-Service Information) in the data flow. These Tables have a unique PID and table identifier.

PSI tables:

- PAT - Program Association Table
- PMT - Program Map Table
- CAT - Conditional Access Table

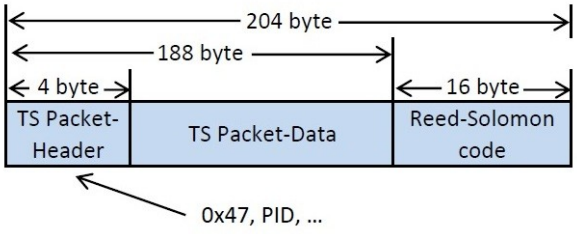
SI tables:

- NIT – Network Information Table
- SDT – Service Description Table
- TDT – Time and Date Table

III. TS package in IP environment

Transmitting of the TS Packets through a local network happens in Ethernet data packages, in case of sending these packets there are assumptions which have to come true:

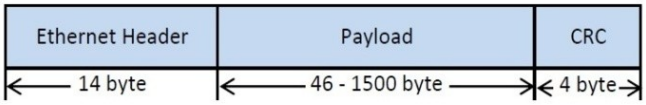
- their size may not be smaller 64 bytes
- there have to be 12 byte pauses between the packets



1. TS Packet

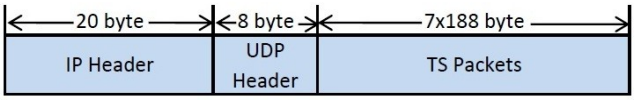
In the 14 byte header of the packet placed the MAC address of the sender and receiver devices. The useful

data follows it, considering the size it should be 46 byte. The maximum data content of an Ethernet packet may be 1500 byte. For Transport Stream sending, because of the audio and the visual data representation in real time, the usage of the UDP protocol is the most beneficial.



2. Ethernet Packet

The header of the UDP/IP packet placed in the part of the useful data content of the Ethernet packet. Firstly, the 20 byte IP header, after that the 8 byte UDP header. Deducted these two header longitude from the maximally 1500 byte UDP/IP packet, just 1472 byte remained to transmission. Split these value with the fix sized TS packets (188 byte), we get, that we can send 7 full Transport Stream packet simultaneously.[3]



3. Ethernet Packet – Payload Field

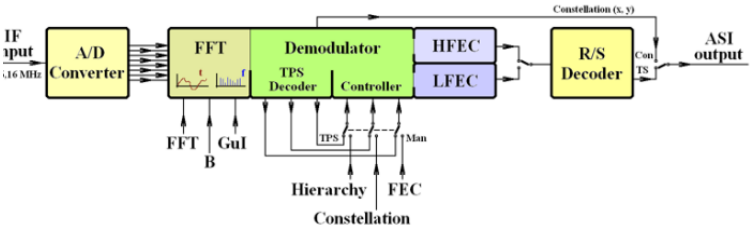
IV. APPLIED DEVICES

For receiving the DVB-T broadcast, an it's transmission in IP network devices were used developed by CableWorld Kft. These devices have not got control panels, their settings can be made through a computer. The devices work with an individually developed CW-Net system. It provides an opportunity to control them and transferring, analysing the Transport Stream.

CW-4875 OFDM Demodulator Quad

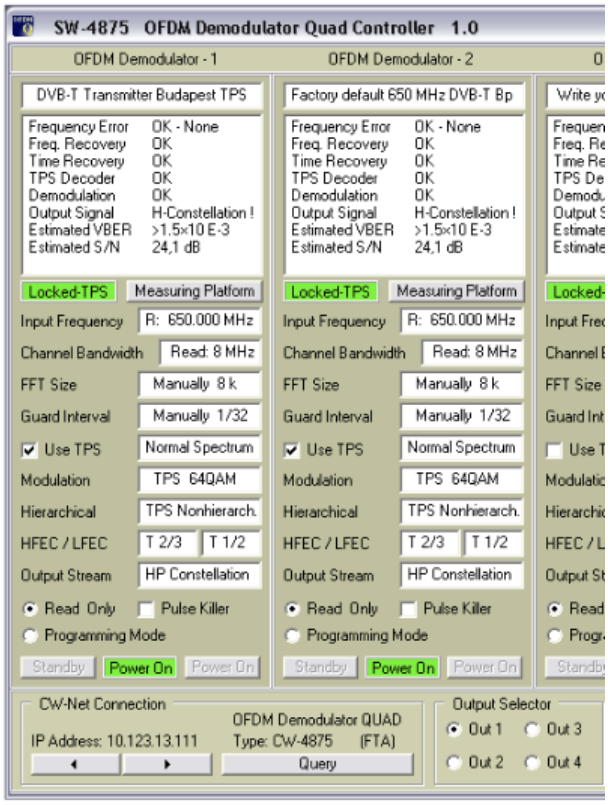
4. CW-4875 OFDM Demodulator Quad

5. CW-4875 OFDM Demodulator Quad backside



6. CW-4875 OFDM Demodulator Quad Block diagram [5]

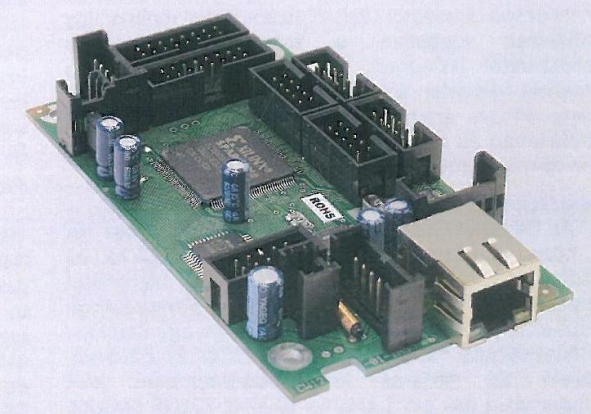
CW-4875 type device contains 4 OFDM demodulator, with which it can receive simultaneously the sender signals of 4 DVB-T. The ASI inputs of the device can be row, with which it is easier to distribute the input signals. The settings of the parameters of the demodulator solved with a software called SW-4875 which is was written for this purpose.



7. The SW-4875 software interface

This device has also a CW-4901 type Gigabit Ethernet Controller with which we can nourish the received ASI signal in the IP network and we have an opportunity to receive the signals come from the network. Is possible to configure the proper settings of these functions with the SW-4901 software. [4]

CW-4900 Ethernet Controller



8. CW-4900 Ethernet Controller

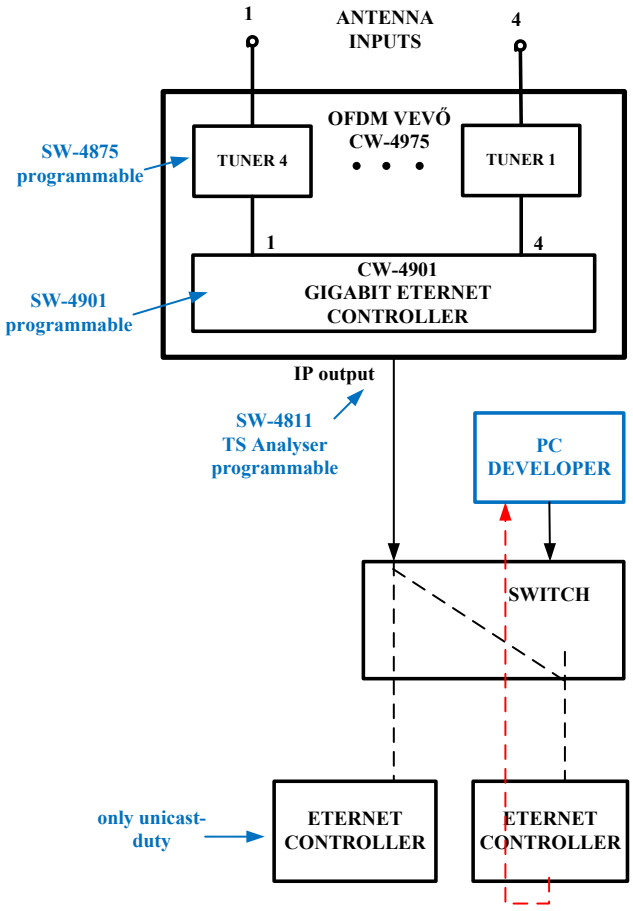
The CW-4900 Ethernet Controller was the first device of the CableWorld Kft which was able to place the Transport Stream to IP environment. The interface of this device works in a 100Base-T environment. The possibilities according to the sending of the TS packets are multiple similarly to the CW-4901 device. The only difference, that the CW-4900 is just able to multicast receiving.

On the panel there are two terminal, one for send, one for receive TS and two paralell,8 bit input and output which are for support the controlling. The NCO supplies the clock signal which is necessary for sending the Transport Stream. Its signal leaded to a connector also. A FPGA device responsible for processing the messages comes from the local area network. The settings of the Ethernet Controller can be write or read out through a parallel interface and a microcontroller controls the storage of it.

V. APPLIED SETUP

After connecting the DVB-T antenna to the ASI input of the OFDM Demodulator, using the SW-4875 software it is possible to configure the pickup properties. The Multi Program Transport Stream is sent to the Cw-4900 Ethernet Controller's IP after the right settings are applied and the unicast mode is choosen in the SW-4901 software. The input data stream is tested with a analizator softwer which is developed to that task. The TS pickup settings can be softened by using the analizator's results.

The FPGA, which is located in the CW-4900 controller panel, is programmed in VHDL language to send the chosen channel's Single Program Transport Stream from the datastream, that contains more channels, to the user. The filtered output TS is sent to the network in multicast mode and it is not contain the other channels so the bandwidth for that purpose is decrease a lot.



9. Applied setup

VI. THE BENEFITS OF USING THE FPGA

To keep the users satisfaction the media matters has to be streamed in real time. The opportunities provided by the FPGA are good for that purpose. Using this feature of the fast and parallel device the real time data sending can be reached along with the low usage, that does not charge the user with extra cost. This device is not using an Operation System, so the chance of the freez is not possible and the illegal access can be avoid.

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