

Transport Stream Analyzer

Software

SW-4811B

V1.46

Instruction manual

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1. Introduction

CableWorld Ltd started developing the SW-4811B Transport Stream Analyzer software in 2005. Since then the software has been extended continuously and has been revised many times and it will be developing according to the users' demand in the future, too. Making the software aims at supporting the work of developing and operational engineers. As the software is made by developing engineers it supports mainly the work of designers and the demands of operators take the second place sometimes. .

The software can be installed by the exe file downloaded from the software page of the www.cableworld.hu web site. The installer exe installs the software in the directory

Files\CableWorld\SW_4811BC:\Program

unless the user specifies otherwise. The software can be simply removed, so its installation is well recommended for learning and testing. The development happens in Windows XP environment, so performing the simple tasks will not put special requirements on the PC. The transport stream usually is a high speed data stream, so its reception and displaying the picture and sound carried requires a powerful processor capacity. The P4/2-3 GHz PCs and laptops are suitable for solving the majority of the tasks today.

Important note: Due to high data speeds, examining and displaying the transport stream is possible only when the virus checking software and firewalls, etc. are switched off!

After installing, the software can be started by clicking the icon appearing on the desktop. The running software appears on the screen as shown in Figure 1.1. The desired mode must be set when entering the Input Selector page for the first time. On exit the setting will be saved and the next run starts with the saved settings.

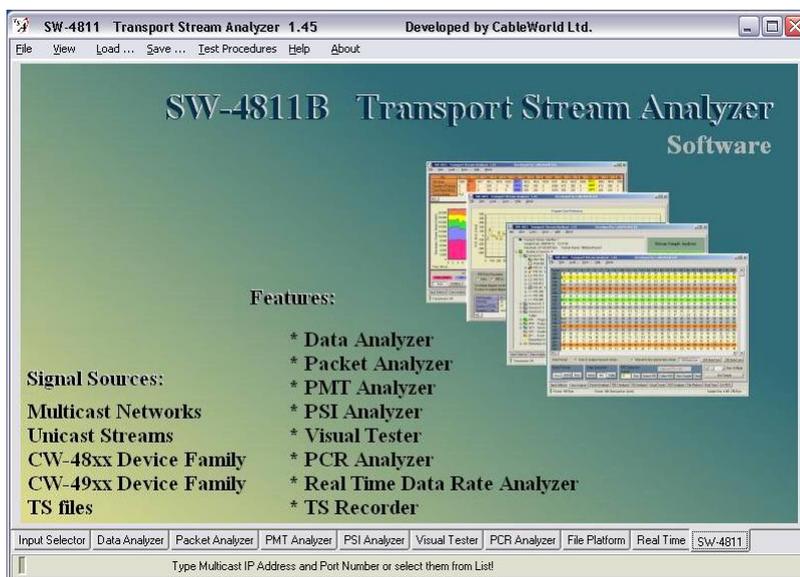


Figure 1.1

Introductory screen of the SW-4811B TS Analyzer

We appreciate receiving all remarks, experiences, recommendations and ideas with our products and software at the cableworld@cableworld.hu e-mail address, and we pay respect to them at our further developments. Further information on applying the devices can be asked for at that address, as well.

2. Input Selector

The hardest step in analysing the transport stream is putting the transport stream into the PC. In the CableWorld's systems the Ethernet connection of the computer is used for this. The 10Base-T, 100Base-T or 1000Base-T type connections can be used to input the TS, but the streams of higher data speed can not input at the connection of lower capacity. On entry the Input Selector page, the View menu item offers the modes for inputting the transport stream as is shown in Figure 2.1.

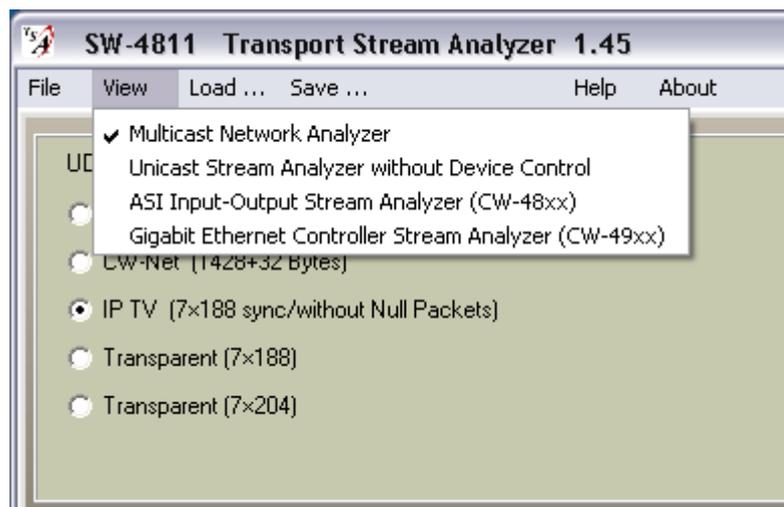


Figure 2.1
GUI for setting the mode

2.1. On selecting the Multicast Network Analyzer mode the PC asks for the multicast data stream to be sent in from the network. The user's task is setting IP address and the port number of the multicast stream to be received. These two data can be given by typing in the box or selecting from the pull-down list. The pull-down list can be modified by a text editor in the SW4811B.ini file. The software uses the current data of these two boxes.

2.2. The devices or programs of other manufacturers may be able to send a transport stream to your computer. On selecting the Unicast Stream Analyzer mode the user's task is setting the stream sending. The software receives the stream arriving at the TS port 59920. The value of the TS Port can be modified in the SW4811B.ini file.

2.3. The CW-48xx series devices of CableWorld are able to forward the signals of the inputs and the outputs to the PC. On selecting the ASI Input-Output Stream Analyzer mode the software automatically commands the device to start or stop sending the stream.. The input or output can be selected with the Selector switch.

2.4. There is no selector in the gigabit system of CableWorld; the four transport stream senders of the Gigabit Ethernet Controller can be controlled separately. On selecting the Gigabit Ethernet Controller Stream Analyzer mode the software orders the Gigabit Ethernet Controller to send one of the four streams.

The route of the transport stream forwarded over the IP network is shown on the screen.

The transport stream can be inserted in the UDP packets of the Ethernet (further on IP) network in many ways. On selecting the CW-Net format you can ask for transport streams with 32 byte measuring data from the CableWorld devices only.

On selecting the 7×188 byte IP TV packet format, the CableWorld devices are instructed to remove the null packets.

On selecting the transparent 7×188 byte format, the null packets will not be removed. The format modifying commands have no effect on the devices of other manufacturers.

On selecting the transparent 7×204-byte format, the null packets will not be removed.

For beginners the automatic format setting is recommended, later the format should be chosen according to the requirements of the measurement to be performed.

In using the SW-4811B software controls the CableWorld devices with instructions. The IP address set on the Device Controller Platform determines, which device the instructions will be sent out for. The IP address can be set step by step or by clicking the element in the pull-down list. The pull-down list can be modified in the CW4811B.ini file. On checking the 'Use CW-Net' box, the instructions will be sent out in the 10.123.13.xx IP address range. At unchecked condition an optional IP address range can be given.

The parameters of the device on the IP address set formerly, can be queried by clicking the Query button. When the software does not find the device, the display over the button goes red.

The transport stream is so complex and complicated data stream, that its wholeness cannot be examined for every feature continuously. When a few simple parameters should be examined, usually a real time analysis is used. In this case, at receiving the data the examination of these parameters is performed simultaneously. The disadvantage of this method is that at increasing data rate the computer can perform less and less examinations. For a full, unlimited examination, get sample from the transport stream and analyse the stored sample, so that you can have enough time for performing the detailed examination.

The 'Get Sample' button is used to get samples with size of 1 Mbyte to 20 Mbytes. This sample is received by every analyser module. On the Input Selector page the sample is used only for checking the being of the connection and the probable effectiveness of the sample. As the result of the first examination, the size of the sample and the packet formats can be seen.

On selecting the CW-Net format, a continuity counter will be built in the UDP packets, so the software can detect the loss of the packets. At this format the software sends only the perfect part of the sample to analyse and displays the defective part as 'Transmission loss' as shown in Figure 2.2.

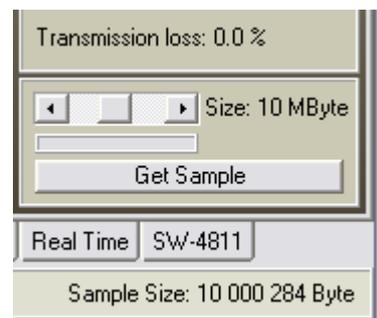


Figure 2.2
Displaying the 'Transmission loss'

Supplementary information:

The computer load, the data speed of the Ethernet connection can be checked with the Task Manager software. For checking start the TS Analyzer software and the Task Manager, too. On displaying the transport stream or getting sample from the stream the display of the Task Manager shows the temporary parameters. In the first example a transport stream arriving from satellite at speed about 40 Mbit/s is sampled. The sample size is 20 Mbytes and the sampling is repeated in succession three times. The result of the examination is shown in Figure 2.3.

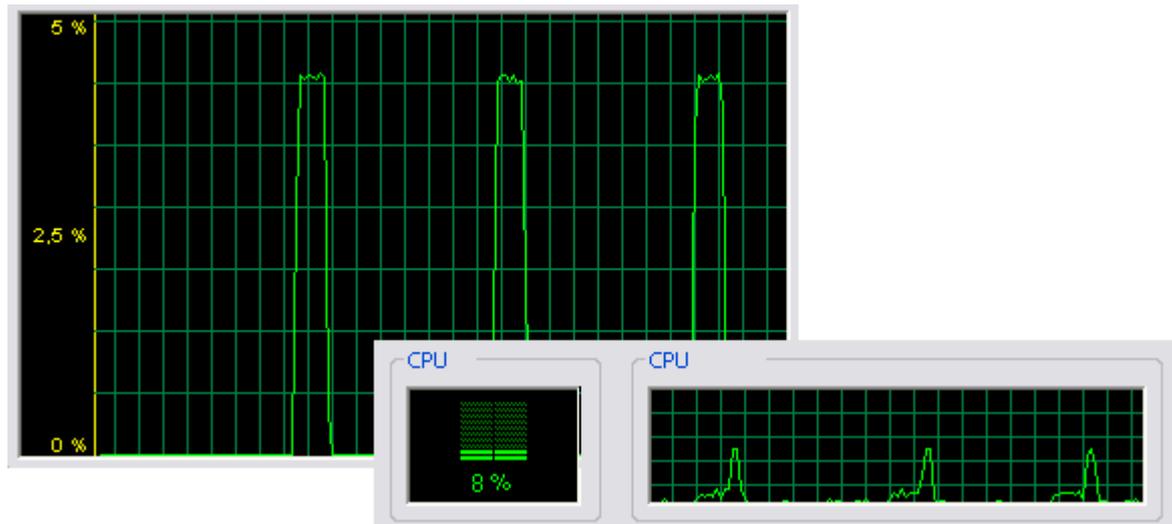


Figure 2.3
Data traffic of the network connection and the processor load
at getting 20-Mbyte samples

The figure shows, that the gigabit connection of the computer is loaded/exploited at 4% by the TS input. During the sampling period, when the transport stream data are written in RAM, the load of the CPU (P4/2.8) is 8-10 %. Then, during the data processing (troubleshooting, sync search, analysing the tables, etc.) it goes up to about 50 %.

In the second example, displaying the 16:9 MPEG-2 encoded picture loads the processor of the computer continuously at 25-30 %. Displaying several pictures or performing additional measurements during displaying, can be prepared with considering these circumstances.



Figure 2.4
CPU load at displaying a 16:9 MPEG-2 encoded picture

3. Data Analyzer

The Data Analyzer displays the bytes of the transport stream in a table. The horizontal rows of the table in Auto mode are 188 or 204 byte long according to the arriving transport stream packet format, manually they can be set to 188, 204 or 256 byte long. In the cells of the table the bytes can be displayed in hexadecimal, decimal and ASCII format. The columns of the table cover the whole sample.

The Data Selector colours and marks the packets according to the value of the PID or helps understanding the data of the tables. On clicking the 'Search PID' button the PID Selector will search the next packet in the sample, having the selected PID. The PID value can be given in decimal and hexadecimal format. On clicking the 'Collect PID' button, these packets will be displayed as excepted from the sample. The collected packets can be saved in file independently, too. On clicking the 'View Sample' button the display of the original sample can be restored. When asking for the selection of the PID, on clicking any packet of the table, the software displays the PID value and shows the coherent packets. The test report sheet of the Data Analyzer is shown in Figure 3.1.

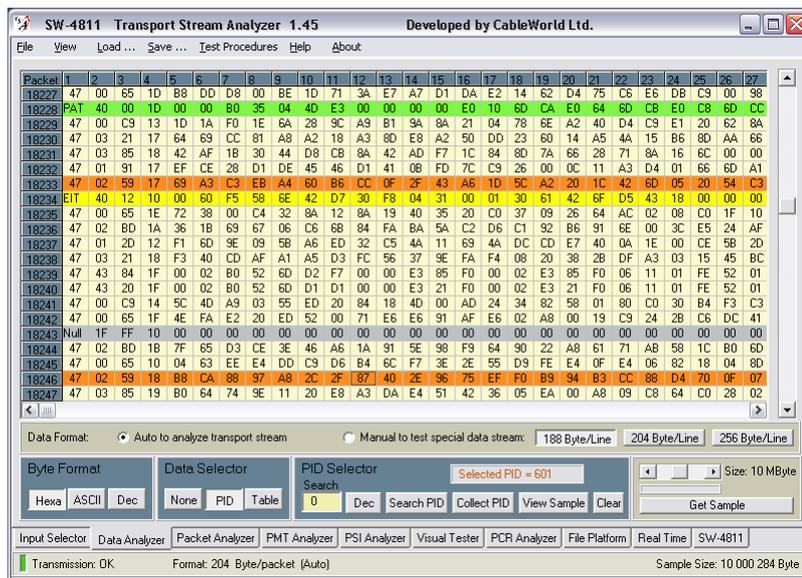


Figure 3.1
Test report sheet of the Data Analyzer

The Data Analyzer permits for inspection the deepest details of the transport stream, but the evaluation of the results requires some skills.

In the Tools menu item the user can find procedure for examining the Transport Error Indicator bit and the Continuity Counter.

Beyond sampling the SW-4811B software can process transport streams saved in file, as well. On using the 'Load TS from File ...' command the first part of the file (maximum 20 Mbytes) will be analysed. In case of large files the part to be analysed can be cut out on the File Platform.

The Data Analyzer in 256 byte/row format can display any data streams (e.g. text or picture file content).

4. Packet Analyzer

The Packet Analyzer analyses on the packet level. The table of the test report sheet shows the PID values of the packets in the sample. The table shows the number of the packets and the calculated data rates. On clicking any column of the table the relative data rate of the selected packets appears in the diagram. The diagram is a very sensitive indicator, demonstrates the percental time difference of the earlier or later arrival of the individual packets related to the uniform distribution.

Under the table detailed information is available about the data of the TS and the selected elementary stream. The display of the TS data shows sync errors in the sample, too. The test report sheet of the Packet Analyzer is shown in Figure 4.1.

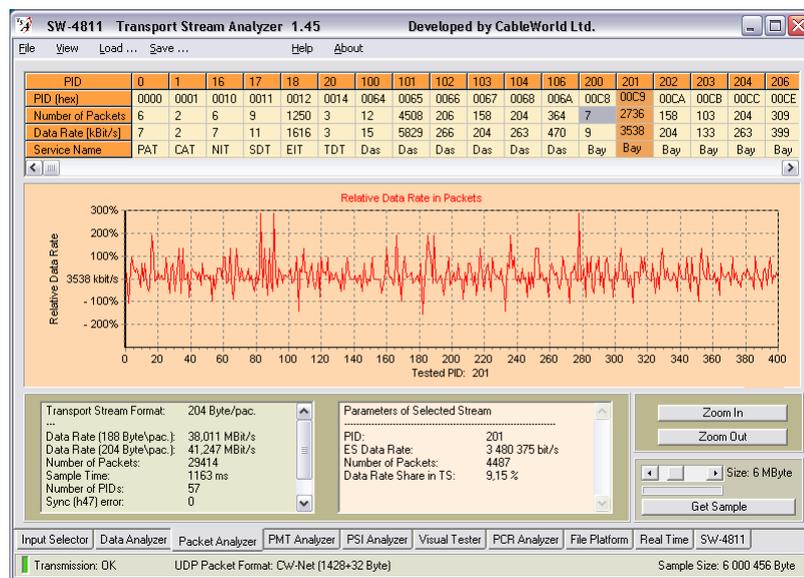


Figure 4.1
Test report sheet of the Packet Analyzer

The Packet Analyzer is an important support for remultiplexed streams, encoded transmissions and similar complex tasks.

5. PMT Analyzer

After getting the sample the Transport Stream Analyzer software analyses the data of the sample in many respects and makes a record. On the basis of the measuring results the PMT Analyzer (using the data of the tables), displays the results with the well-known tree structure. The opened tree-structure tries to display as many data as possible, but the user's job is to display them in the proper depth. Some parts of the display on the right go yellow, if the analysis assigned to them was not successful for lack of data. The test report sheet of the PMT Analyzer is shown in Figure 5.1.

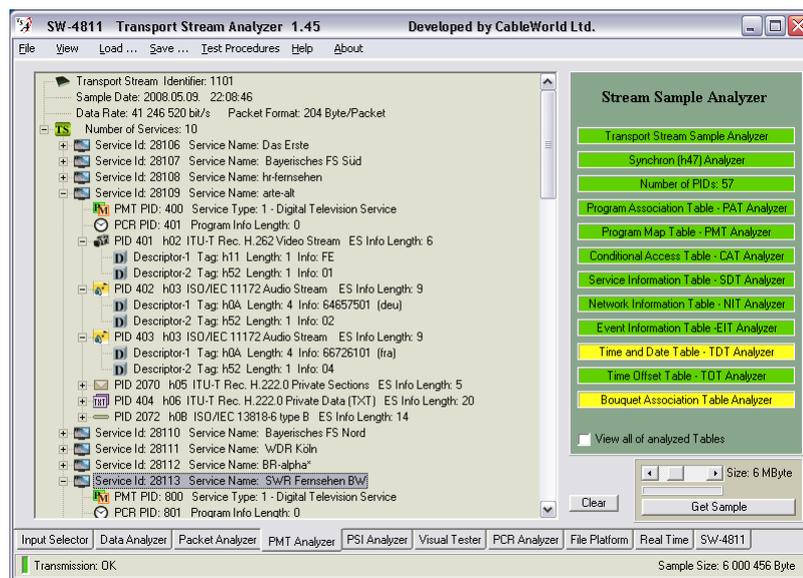


Figure 5.1
PMT Analyzer test report

The PMT Analyzer uses the PAT-PMT-SDT table approach; examines the transport stream from the viewpoint of the set-top box, most of the displayed data come from the tables. This is the cause, that the examination results shows perfect-looking transport streams, when the TS comprises no elementary stream beyond the tables, so it is almost empty.

6. PSI Analyzer

Among the transport stream data, the tables comprise the program specific information (PSI). The correct operation of the devices requires the proper structure of the tables. The PSI Analyzer performs the detailed analysis of the tables. The users should decide if the displayed details are correct, they know what they want to do with them.

The PAT Analyzer examines the first PAT table of the sample. The Next button can be used to ask for the examination of the next PAT table. The displayed results can be saved in file.

The PMT Analyzer analyses the first sample of every PMT table in one step, so the analysis takes a long time. Here the analysis of the additional tables cannot be asked for.

Analysing the SDT, CAT, TDT, TOT tables is performed as shown at the PAT table. The analysis of the NIT and other tables is under development.

The PES Analyzer and the Adaptation Field Analyzer perform the analysis at the PID value typed in the box. The Next button can be used to ask for the examination of the next set of data, here too. Evaluation of these data requires the deep knowledge of the MPEG encoding system.

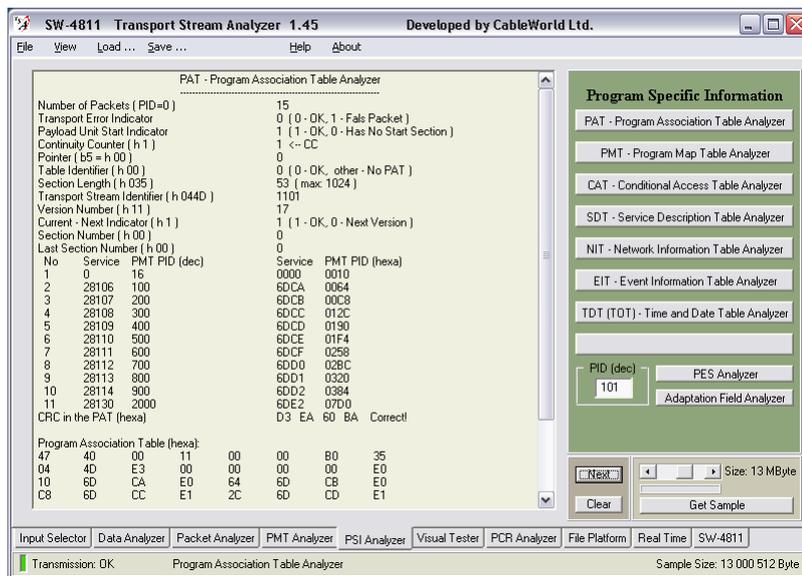


Figure 6.1
PSI Analyzer test report sheet

7. Visual Tester

The Visual Tester is the most favourite measuring function of the software, which displays the picture and sound information carried in the transport stream. After getting the sample the upper table shows the video and audio PID values of the sample, the lower table shows the the values typed in by the user. The lower table can be written in Programming mode, and can be copied from the upper one with the mouse, too. At replay the streams for visualisation can be selected from the lower or the upper table. Always the the PID values selected with the mouse will be visualized. The GUI of the Visual Tester is shown in Figure 7.1.

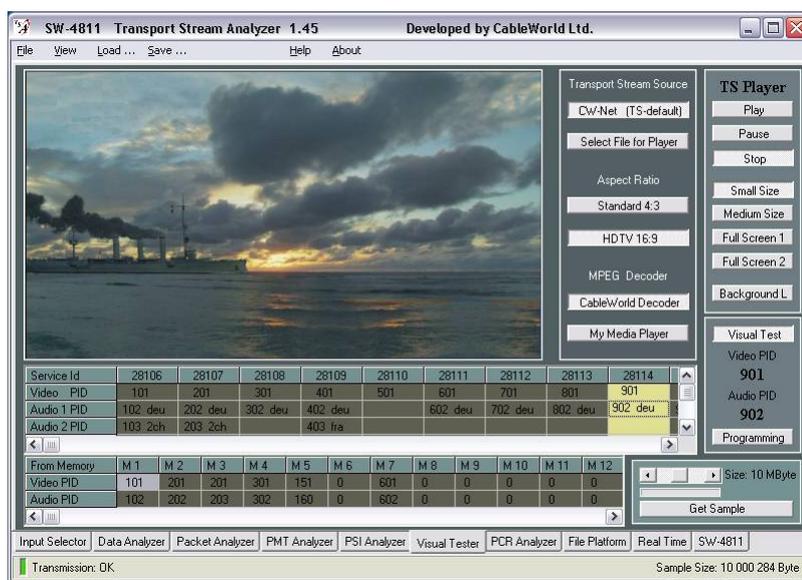


Figure 7.1
 GUI of the Visual Tester

For displaying the picture and sound the MPEG-2 Decoder software of CableWorld and the Media Player (Power DVD, VinDVD stb.) installed on the PC can be used. At using Media Player the required software should be installed in advance.

The Visual Tester can display transport stream saved in file, but those programs should be analysed separately. If the content of the file is known, the PID value of the program to be replayed can be given directly by clicking an element in the lower table. If it is not known, analyse the content of the file before replay (Load TS from file ...) and the required PIDs appear in the upper table.

Due to the overlay technology the visualized picture can be inserted in documents by trick. At running the software the monitor picture put on the clipboard with the Alt + Print Screen buttons will not comprise the visualized picture. Stop visualization (Stop), and run a second copy of the software; then the monitor picture on the clipboard will comprise the picture of the visualized program, too.

Since the 1.46 version, the TS Analyzer software has been completed with the module required for displaying the MPEG-4 encoded SD and HD programs. This module uses the media player installed in your PC, i.e. it works only if your PC uses a software suitable for decoding the MPEG-4 format video data stream. During developments we used the PowerDVD v8 software, so we suggest using it first.

Decoding the MPEG-4 format video data stream requires a powerful PC and a high quality video card. Installing the Direct-X9 software is required as well. The expected load of the P4/2,8GHz PC when using the PowerDVD-v8 software is as follows:

- In case of SD programs: 15 to 45 %, depending on the content
- In case of HD programs: 80 to 100%, depending on the content

The load over 90-95 % means an overload for the PC, the replay will jam, the picture and sound will be fragmented. The rate of loading in the PC can be seen in the Task Manager panel.



Figure 7.1
GUI of the Visual Tester at version 1.46 (MPEG-4 HD)

8. PCR Analyzer

After getting the sample the PCR Analyzer collects the PID values of the elementary streams comprising the PCR data and displays them in the table of the test report sheet. The data processing happens on clicking a column of the table, one by one. The text-box shows the calculated data, the diagram displays the variation of the PCR data with time.

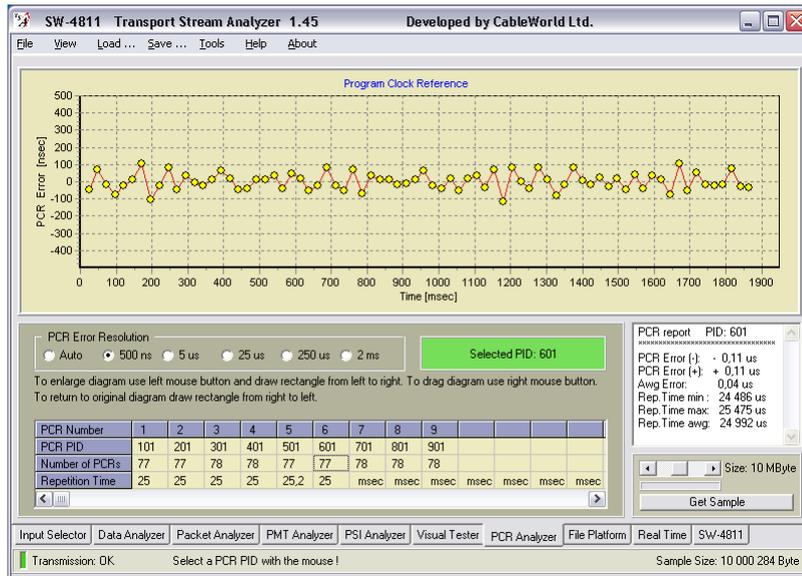


Figure 8.1
The test report sheet of the PCR Analyzer

For examining the PCR, the software can get correct time data only in the CW-Net format, so use always UDP packets of CW-Net format! In any other formats the PCR repetition time is correct enough, but the data of the diagram may have errors of order of magnitude, so only the nature of the PCR course maybe predicted.

Measuring the PCR error is a complex task, the diagram tries to illustrate the deviation of the successive PCR data from the ideal value. The TR 290 measurement guide orders using different low-pass filters for numerical determination of the PCR error. The PCR Analyzer displays the instantaneous values, low-pass filter has no effect on them.

Measuring the PCR requires very high accuracy. The software supposes, that the bytes in the sample arrive with even timing, as the IP network masks some part of the slips of bytes and packets (the part inside the 7×188 byte UDP packet). The accuracy of the measurement can be increased by increasing the size of the TS sample.

9. File Platform

The first module of the File Platform is the TS Recorder, which helps recording the transport stream in file continuously. As the data rate of the transport stream is very high, before starting the recording, click the 'Create or Select File Name ...' button to create the empty file for storing the TS. Use the 'Clear and Record' button for recording! The 'Clear' inscription warns, that the content of the previous file will be cleared without question on clicking the Record button, the incoming TS overwrites the former content.

The high data rate of the TS quickly increases the size of the file, so the careful setting of the Auto Stop is very important!

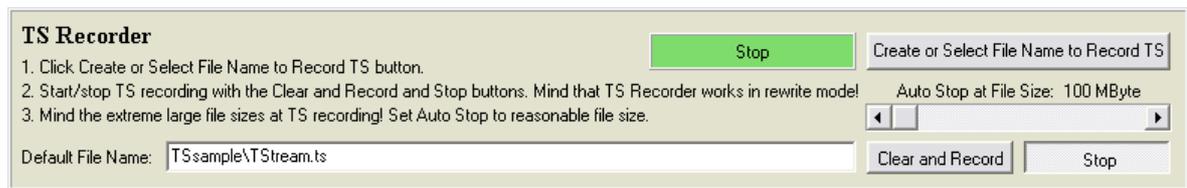


Figure 9.1
GUI of the TS Recorder

The mass of transport stream data saved in file is so high, that cannot be analysed directly. The files can be opened with the TS File Sampler, and after setting the position and size, the sample to be analysed can be cut out. Then the Load Marked out Sample button loads the sample in the analyser. The file comprises no data in reference to data rate, the analyser makes the displays according to the data rate given by the user.

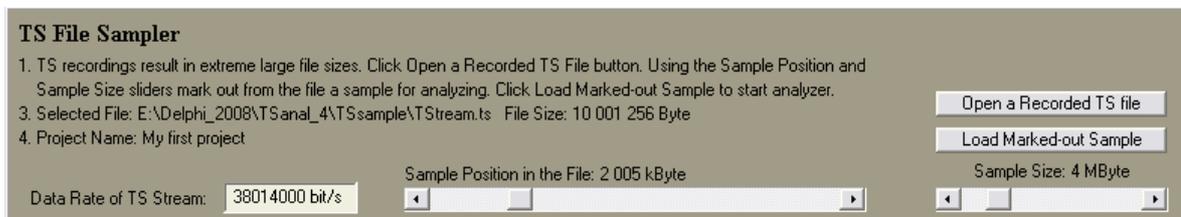


Figure 9.2
GUI of the TS File Sampler on cutting out a 4-Mbyte sample

The TS Player converts the transport stream recorded in file to IP data stream. Primarily it can support the development work. Select the file to be replayed with the TS File Selector button, then set the start position of the replay.

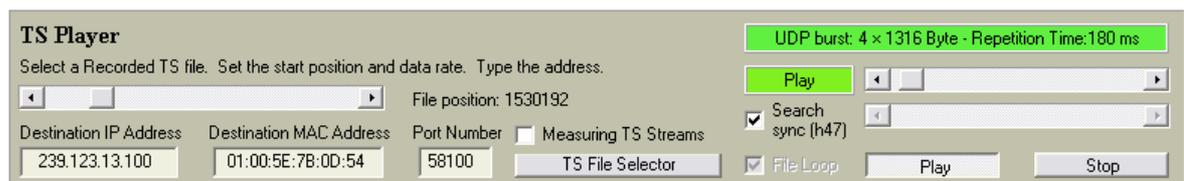


Figure 9.3
GUI of the TS Player

After selecting the file, type the data of the UDP packet IP Address, MAC address and Port Number in the boxes. The rate of sending the UDP packets and the number of UDP packets sent successively in one cycle (UDP Burst), together determine the output data rate. In case of high data rate the real output data rate especially depends on the computer power, so the data are only for information. Check the boxes for searching the sync byte and repeating the replay (File Loop).

Important note: The data rate of the replay and the PCR data inserted in the transport stream are not in connection, so displaying the picture and sound will not be faultless. The player was designed primarily for data streams not bound close to time (tables, EPG, test signals, etc.).

An important field of applying the TS Player is, generating test signals, measuring packets for troubleshooting. On checking the 'Measuring TS Stream' check-box, the GUI of Figure 9.4 appears and the mode of the TS Player changes, too.

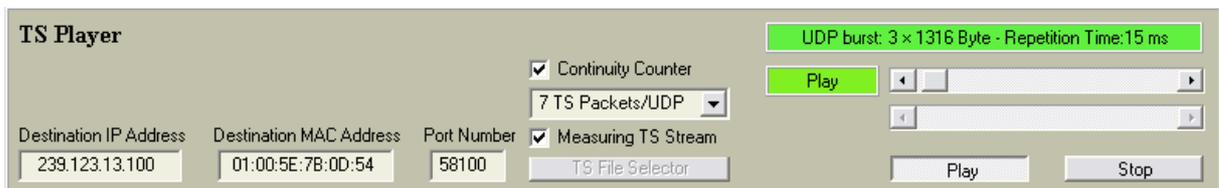


Figure 9.4
GUI of the TS Player, when sending out the measuring packets

The content of the measuring packets: After the h47, the value of the byte is equal with the sequential number of the byte. The value of byte 71 is modified to b8. When the Continuity Counter is switched on, the value of byte 4 will be modified in every packet (packet by packet). The size of the packet is always 188 byte. The number of TS packets in the UDP packet can be set from 1 to 7.

In the Play mode the TS Player accepts modifying a few parameters only. The complete parameter list will be processed on starting the replay (Stop-Play).

10. Real Time Analyzer

The Real Time Analyzer examines, the data rates of the components in the transport stream as a function of time. The diagram can examine the data rate of 6 elementary streams simultaneously. The Peak Search function orders the six components of the highest data rate in the sample to the coloured diagrams. Contrary to this, any elementary stream can be displayed by clicking first the table PID value, and then the coloured rectangle under the diagram for linking. For examining the streams appearing in the sample only sometimes, the PID value to be examined can be typed in the cell at the end of the table.

The data rate of the components can be displayed independently and one on the other with the Separated/Peak to Peak switch. The diagram can be shifted and enlarged with the mouse. Any diagram can be switched off simply by drawing a stream of low data rate (e.g. PAT), or a non-existing PID value.

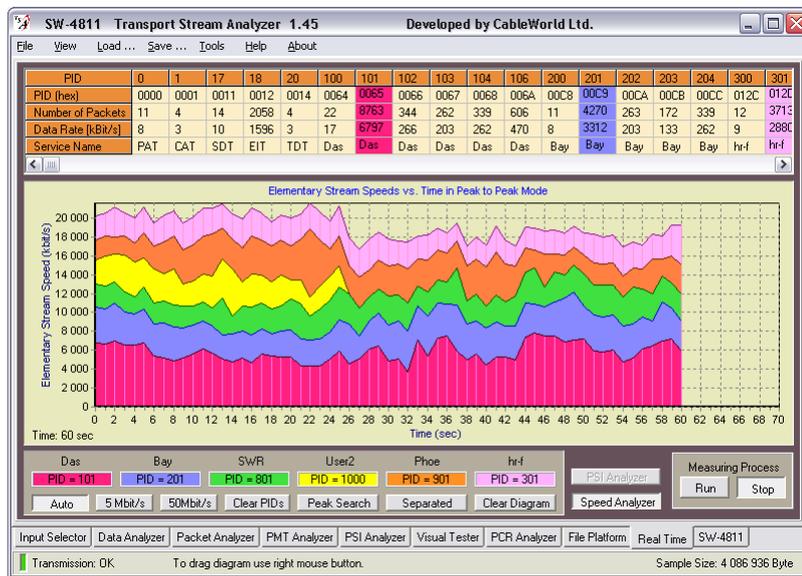


Figure 10.1

Test report sheet of the Real Time Analyzer at examining the sum of data rates. During measurement at the 26th second the fourth component was switched off by setting the PID=1000.

The left-side axis of the diagram can be fixed to 5 and 50 Mbit/s size, in auto mode the software set it to the occurring maximum value of the measurement. At long-term examination the occurring peak value is stored as the maximum of the axis. The diagram can be enlarged by drawing rectangle with the mouse, and can be shifted with the right button. The original state can be restored by drawing a rectangle from right to left.

11. Frequently asked questions

1.

12. Comment