

1.14 Measurement Systems for MPEG2

1.14.1 Triggered Data Recording

Frequently, signals not conforming to standard occur for a very brief period during data transmission. These events are so short that they usually go unnoticed by the operating personnel. To examine them in detail, they have to be stored. This is done by means of the trigger-on-event functionality of DTV RECORDER GENERATOR DVRG.

As described in section 1.11.3, TS recording can be triggered by an external signal for error analysis. The trigger signal can be delivered, for example, by DVQ, which signals video quality below threshold, or by DVMD, which detects nonconformance with ETR290, for example. The TS section recorded by DVRG includes user-selectable periods before (pretrigger) and after (posttrigger) the trigger event. The recorded TS data streams can subsequently be examined off-line for coding errors, for example in the lab.

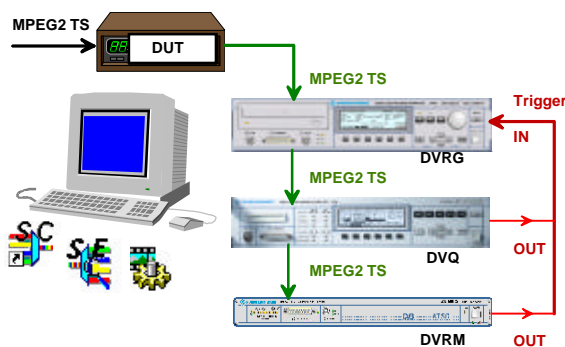


Fig. 1.38 Triggered data recording

Detailed analysis is supported by optional software available for DVMD, DVRM and DVQ.

The STREAM EXPLORER® DVMD-B1 software performs in-depth analysis of recorded transport streams. It allows detailed investigation of the contents of TS packets and the structure of all data contained in a TS. DVMD-B1 outputs the packet contents in hexadecimal format and displays the interpreted header information, adaptation field contents and interpreted PSI and SI tables, so enabling any violations of the MPEG2 protocol to be traced down to the last detail.

Moreover, the tree structure of the overall TS including all syntax elements is displayed, providing an overview of the MPEG2 data stream down to bit level.

The STREAM EXPLORER® DVMD-B1 option is available for both MPEG2 MEASUREMENT DECODER DVMD and MPEG2 REALTIME MONITOR DVRM.

For a detailed description of DVMD-B1 refer to section 1.11.7.

Where special TS data streams are needed for error simulation, the STREAM COMBINER® DVG-B1 option generates new transport streams from existing elementary streams. In the DVG-B1 "Expert" mode, the TS protocol can be modified as required to simulate any deviations from standard that might occur in a transport stream. However, due care should be exercised when working in the "Expert" mode since DVG-B1 comprises no automatic function for error-free TS generation.

1.14.2 TS Monitoring at the Studio Output

Program providers should monitor, at the studio output, all their programs to be carried in a transport stream before these are fed to the cable headend, the satellite uplink or the DVB-T transmitter. This is to ensure good video quality and conformance with the MPEG2 protocol. Monitoring is absolutely necessary with the statistical multiplex method widely used today. After tolerance limits for video quality are specified and corresponding permissible maximum intervals of low video quality (in the order of a few seconds) are defined, any deviation from specified quality levels will be recorded and signalled via alarm contacts.

Monitoring is required not only at the outputs of the multiplexers for the individual programs but also at the output of the multiplexer for the overall transport stream to be broadcast at a high data rate (e.g. 38.153 Mbit/s for DVB-C with 6.9 Msymb/s and 64 QAM).

In the case of DVB-T, an additional test point is provided in the SFN (single frequency network) at the output of the MIP (megaframe initialization packet) inserter. This is to monitor the contents and repetition periods of the MIP packet, which serves for synchronization of the SFN.

All the above measures are taken by the program provider to ensure that

his programs broadcast via a given distribution network (DVB-C, DVB-S, DVB-T or ATSC/8VSB) arrive at TV viewers at home with the guaranteed quality;

any misrouted transport stream signals are detected immediately, and specified video quality levels are guaranteed by applying quality analysis.

The solution to these problems is DVQM (see also section 1.12.1) with the DTV NetView software for simultaneous quality monitoring of up to 12 programs, and DVRM with the associated monitoring software.

As shown in Fig. 1.36, DTV RECORDER GENERATOR DVRG may be added for the triggered recording of transport streams, so providing in-depth signal analysis. It is thus ensured that only transport streams of a defined quality leave the studio for transmission to the viewers.

For the initial measurement of studio equipment, reproducible TS sequences should be used exclusively. Only by using such sequences can comparative measurements be performed at different locations and at different times. MPEG2 coded endless sequences are available on the hard disks of MPEG2 MEASUREMENT GENERATOR DVG or DTV RECORDER GENERATOR DVRG. They can be used to perform measurements either in service, i.e. with the sequences inserted in the transport stream as a separate "program", or out of service with the sequences inserted directly into the feeder link to the TS MUX.

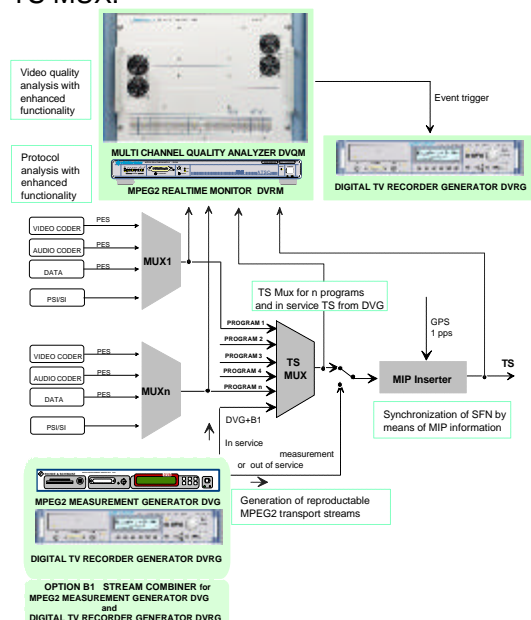


Fig. 1.39 Transport stream monitoring system

1.14.3 Monitoring of Few Programs at the Studio Output

If only a few (i.e. two or three) programs are to be monitored, DIGITAL VIDEO QUALITY ANALYSER DVQ is the most cost-effective solution. Used in conjunction with DVRM and DVRG, it offers measurement functionality identical to that described in 1.14.2. For a more in-depth analysis, the optional QUALITY EXPLORER® DVQ-B1 and QUALITY MONITOR software should be added. Here, too, triggered TS recording is possible by means of DVRG, with trigger signals delivered by DVQ and DVRM.

The programs are tested one after the other. The time required for each program is about 10 s, so that a complete test cycle takes no more than 20 s to max. 30 s. While this cannot be regarded as realtime monitoring, the periods during which the individual programs are interrupted are so short that all critical events and errors are detected.

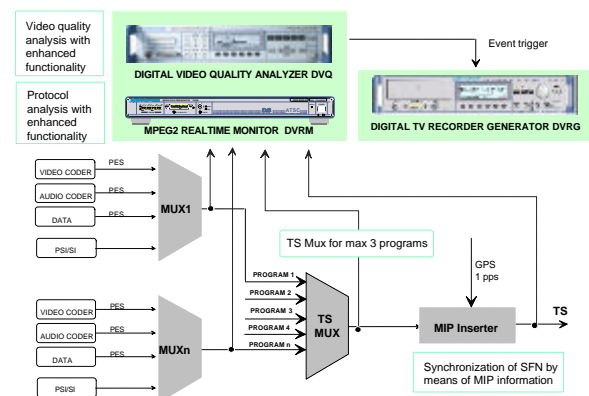











Fig. 1.40 Transport stream monitoring for a few programs only

1.15 Overview of MPEG2 Specific Measurements

Instrument	Measurements and Parameters
MPEG2 MEASUREMENT GENERATOR DVG 	Test signal generator for reproducible MPEG2 measurements, various test sequences
DTV RECORDER GENERATOR DVRG 	Test signal generator for reproducible MPEG2 measurements, various test sequences; recording and playback of MPEG2 and ITU-R BT.601 data streams; triggered recording
STREAM COMBINER®  Option for DVG and DVRG	Generation of endless and seamless TS sequences of video, audio and additional data from existing ESs (elementary streams); ES2Loop (elementary stream to loop) software matches length of video ES to length of audio ES
MPEG2 MEASUREMENT DECODER DVMD 	Realtime protocol analysis of MPEG2 transport stream
MPEG2 REALTIME MONITOR DVRM 	Realtime protocol monitoring of MPEG2 transport stream
STREAM EXPLORER® Option for DVMD and DVRM 	Display of <ul style="list-style-type: none"> - tree structure of overall TS with all syntax elements, - header information of TS packets, - packet contents in hexadecimal format, - interpreted tables
DIGITAL VIDEO QUALITY ANALYZER DVQ 	Measurement of signal quality after MPEG2 coding and decoding; signalling of picture loss, picture freeze; measurement of data rate, temporal and spatial activity; audio monitoring, signalling of sound loss L/R; optionally: descrambling
MULTI CHANNEL QUALITY ANALYZER DVQM 	For up to 12 programs: signalling of picture loss, picture freeze; audio monitoring, signalling of sound loss L/R; optionally: descrambling simultaneous monitoring of video quality
QUALITY EXPLORER®  Option for DVQ and DVQM	Detailed analysis of elementary streams in terms of protocol, DCT coefficients and decoded pixel blocks
QUALITY MONITOR Freeware for DVQ and DVQM	Long-term monitoring of video quality, TA, SA and data rates of programs included in TS
DTV NET VIEW	Remote controlled monitoring of up to 12 programs within one TS by means of DVQM (or DVQ) and DVRM or DVMD via Ethernet including STREAM EXPLORER® (optional) and QUALITY MONITOR