Monitoring systems

MPEG-2 Monitoring System R&S®DVM100 / 120

Comprehensive monitoring of MPEG-2 transport streams

**Demanding tasks**

The requirements placed on test and measurement instruments for monitoring digital TV signals are constantly increasing: Due to the often high number of transport streams, these instruments must be compact and able to clearly display the multitude of measurement results. To avoid unnecessary alarms, it is essential to exclude individual elements from monitoring, depending on the currently monitored transport streams, or to specially set limit values for triggering an alarm. The idea is to provide a system that can be easily handled by the operator and at the same time offers specialists a wide variety of analysis functions.

Since the introduction of digital terrestrial emission, a monitoring mechanism for single-frequency networks (SFN) has become necessary. Other coveted features include easy integration into central network management systems and uncomplicated remote control.

**FIG 1** By using one R&S®DVM100 and two R&S®DVM120, up to 20 transport streams can be monitored simultaneously.
Based on years of expertise and intensive interaction with its customers, Rohde & Schwarz has developed a new scalable measurement system for monitoring MPEG-2 transport streams that covers all of these diverse requirements: the R&S® DVM100 and the R&S® DVM120 (FIG 1).

Base units with excellent characteristics

The R&S® DVM100 (FIG 2) of only one height unit (HU) is the core of the system. Its large-scale integrated, fast analyzer board allows simultaneous monitoring of up to four transport streams in realtime. An integrated powerful controller prepares the measurement results transparently and provides the graphical user interface (GUI). The unit also offers a fast network connection (100Base-T) for integration in Ethernet networks. It is locally operated by means of the standard PC components keyboard and mouse via an intuitive GUI on a high-resolution screen.

For remote control of the unit, the user interface can be ported to any controller via the integrated network connection. Multicolour LEDs on the front panel indicate the most important status information and measurement results, offering a snapshot of the current status directly on the unit. The system also provides twelve relay outputs which the user can assign to the individual measurement parameters. SNMP is supported for integration into central network management systems.

For monitoring more than four transport streams at one location, the R&S® DVM100 can be expanded by the R&S® DVM120, which also occupies 1 HU and covers up to eight transport streams. It is controlled by the R&S® DVM100 and contains two analyzer boards featuring characteristics identical to those in the R&S® DVM100.

An R&S® DVM100 manages up to five analyzer boards so that one R&S® DVM100 and two R&S® DVM120 – occupying together only three HU – permit simultaneous monitoring of up to 20 transport streams (FIG 1).

Monitoring of all parameters

The system monitors virtually all TR101290 parameters listed in the Measurement Guidelines under priorities 1, 2 and 3. These include checking if :

- a transport stream is present (TS sync loss),
- the continuity counters are correctly incremented,
- the CRC of the individual tables is correct,
- all referenced PIDs are transmitted and if non-referenced PIDs are present.

Moreover, the system checks the table refresh rates, the PCR jitter and the distances between the individual PCR values.

Practical experience shows that monitoring just these parameters is in many cases not sufficient. The R&S® DVM100/120 thus monitors additional parameters (FIG 3): For example, to detect unwanted changes in the transport stream it checks whether programs or elements are added or omitted and if the TS ID or the stream type are changing. If it has been correctly signalled in the transport stream, this type of change is not detected during monitoring purely in accordance with the guidelines. All the same, the omission of a program, for example, may not have been intended. In this case, the MPEG-2 Monitoring System R&S® DVM100/120 cannot be deceived and recognizes such events.

In particular if encrypted contents are emitted, for example with pay per view, it is vital that the contents are definitely encrypted. To ensure this, the system continuously monitors the conditional access information.

FIG 2
R&S® DVM100 (top) and R&S® DVM120 (bottom): LEDs on the front panels allow a quick overview of the system status.
Limit values for the data rates can be specifically defined for each transport stream and each elementary type so that the individual elements of the transport stream (tables and elementary streams) do not occupy bandwidths that are too high. Since lower limit values can be defined as well, a simple mechanism for checking the presence of the individual elements is available.

When SFNs are monitored, all additional parameters necessary for this specific transmission form are analyzed.

In-depth analysis functions

To complement the continuous monitoring of the individual parameters, the system offers several tools for more detailed analyses, including a table interpreter which enables the contents of any user-selected table to be read. Plus, the headers of the TS and PES packets can be displayed in interpreted form. The system graphically displays the data rates of all checked elements, complemented by numerous auxiliary information such as maximum and minimum value. To analyze problems with PCR values, both PCR accuracy and PCR overall jitter can be graphically displayed and analyzed as a function of time by using various filters. In addition to further analysis functions, the time intervals between the individual PCR values are graphically displayed (FIG 4). All analysis functions can be performed without interrupting monitoring.

1) The only measurement not supported is the measurement of the buffer fill level (priority 3.3).
2) Profiles defined in the Measurement Guidelines.
FIG 5
The graphical user interface in the Topology view with four measurement points (port 1 to port 4) in a system configuration diagram (example).

FIG 6
Display of the error counters and the report. Specially marked are the windows SITE and INPUT (displayed in each view) with the hierarchical structures for selecting a transport stream and its elements.
Versatile configuration

When the system was developed, great importance was placed on offering the user a wide spectrum of configuration options (FIG 3). For example, users can deactivate the monitoring of specific elements that are not included in the transport stream. They can also assign each of the well over 100 measurement parameters individually to one of the three groups, i.e. alarm, warning and information, so that an occurring error is displayed along with its associated class. Thus, even less practised users can immediately classify an error. To optimally match the individual transport streams, the users can set the limit values of the individual measurement parameters.

Self-explanatory user interface

FIG 5 shows the graphical user interface in the Topology view. The left area is for navigation within the transport streams and is always visible. All monitored transport streams are listed on the top left; on the bottom left is an overview of the contents of the selected transport stream. This allows quick navigation in the transport streams at all times. The display in the right area depends on the selected function.

The Topology view was specifically developed for clear visualization of the measurement results. It represents each measurement point of a transport stream by means of a symbol. The symbols are placed at any position in front of a user-stored picture, for example a block diagram of the monitored system or a photo of the rack used. The symbols visualize the current status of the transport stream and are also used for selecting the transport stream (FIG 5).

Convenient: view of the transport stream elements

All elements of a selected transport stream are listed in a hierarchical structure in the bottom left area of the user interface (FIG 6). For easy classification, they are represented as symbols, for example for video and for audio. If an error occurs in the transport stream, a report entry is generated and the error-causing element is marked for detailed analyses by means of a red highlighting.

The hierarchical structure also allows convenient filtering of the report: After an element has been marked, only the associated report entries remain visible, making it very easy to generate the error history of a transport stream element.

Summary

The MPEG-2 Monitoring System R&S® DVM100/120 is an excellent solution for transport stream monitoring. It prepares the measurement results in a transparent way and can be intuitively operated; plus, it additionally provides all tools for in-depth analyses. Thus, it can be immediately run by the operator without any need for extensive training and still remains a versatile tool for specialists for analyzing MPEG-2 transport streams.

The system can be equally used in playout centers and networks both for terrestrial signals as well as for signals via cable or satellite; it allows easy adaptation to the required measurement range and the desired measuring depth and can be conveniently upgraded at a later time.

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Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CRC</td>
<td>Cyclic redundancy check</td>
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<tr>
<td>ID</td>
<td>Identifier</td>
</tr>
<tr>
<td>PCR</td>
<td>Program clock reference</td>
</tr>
<tr>
<td>PES</td>
<td>Packetized elementary stream</td>
</tr>
<tr>
<td>PID</td>
<td>Packet identifier</td>
</tr>
<tr>
<td>SFN</td>
<td>Single frequency network</td>
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<tr>
<td>SNMP</td>
<td>Simple network management protocol</td>
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<tr>
<td>TS</td>
<td>Transport stream</td>
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