



## MPEG-2 Realtime Monitor R&S DVRM

Realtime monitoring and analysis of MPEG-2 transport streams

- ◆ 26 DVB or 18 ATSC realtime measurements at a time
- ◆ Integrated long-term report
- ◆ Analysis of data rates
- ◆ MIP monitoring
- ◆ Trigger-on-error function
- ◆ Remote control via supplied PC software
- ◆ 12 built-in relays for error signalling
- ◆ PC Software STREAM EXPLORER™ available as an option for in-depth analysis down to bit level



**ROHDE & SCHWARZ**

## Characteristics

The R&S DVRM is the optimized solution for the continuous monitoring of MPEG-2 transport streams in realtime. The measurements performed are necessary to ensure smooth interplay of all components of a DTV transmission network. Errors are signalled via the following elements:

- ◆ Front-panel LEDs
- ◆ 12 relay contacts
- ◆ Remote control interface

The R&S DVRM is controlled via the remote interface. It is designed for continuous operation, so all settings are stored in a non-volatile memory ensuring that the device is immediately ready for operation again after a power failure. New remote settings are required only to modify operating parameters or read error statistics.

The R&S DVRM comes with a PC software for remote control. The software runs under Windows operating systems (95/98 or NT/2000/XP). It communicates with the R&S DVRM via a serial interface (RS-232-C) and has a COM/DCOM software interface.

Local control and display elements are not provided because the R&S DVRM is intended for use in networked monitoring systems with one or more the R&S DVRMs being integrated.

## Realtime analyzer

The analyzer functions of the R&S DVRM include realtime protocol analysis of the measured MPEG-2 transport stream. All measurements in DVB mode are in compliance with the Measurement Guidelines for DVB Systems (TR 101 290) issued for the European DVB project, which today serves as an international standard for digital TV transmissions via satellite, cable and terrestrial links. The guidelines define possible error conditions in terms of three different priorities.

In addition to the measurements to TR 101 290, the repetition rates of EIT/SDT/NIT "other" tables are measured in realtime and checked for compliance with predefined upper and lower limits. This function ensures the correct transmission of program-related EPG data in a digital TV network in which several transport streams are transmitted.

For the North American ATSC standard, which is only applied to cable or terrestrial transmission, the guidelines A65 and A54 are considered. Realtime measurements performed by the R&S DVRM in ATSC mode are largely based on TR 101 290. They are adjusted to match the various ATSC-specific system and program information tables, with ATSC-specific parameters being added.

Moreover, the transport stream identification (TS\_Id) is monitored and the data rate of the stuffing bytes is checked against a lower and an upper limit in realtime both in the DVB and the ATSC mode. With fixed multiplex, the limit monitoring function makes it easy to detect whether the transport stream contains the desired quantity of video services, or if services are missing.

Any error can be included or excluded from realtime monitoring. Tolerable errors can thus be masked to save memory.



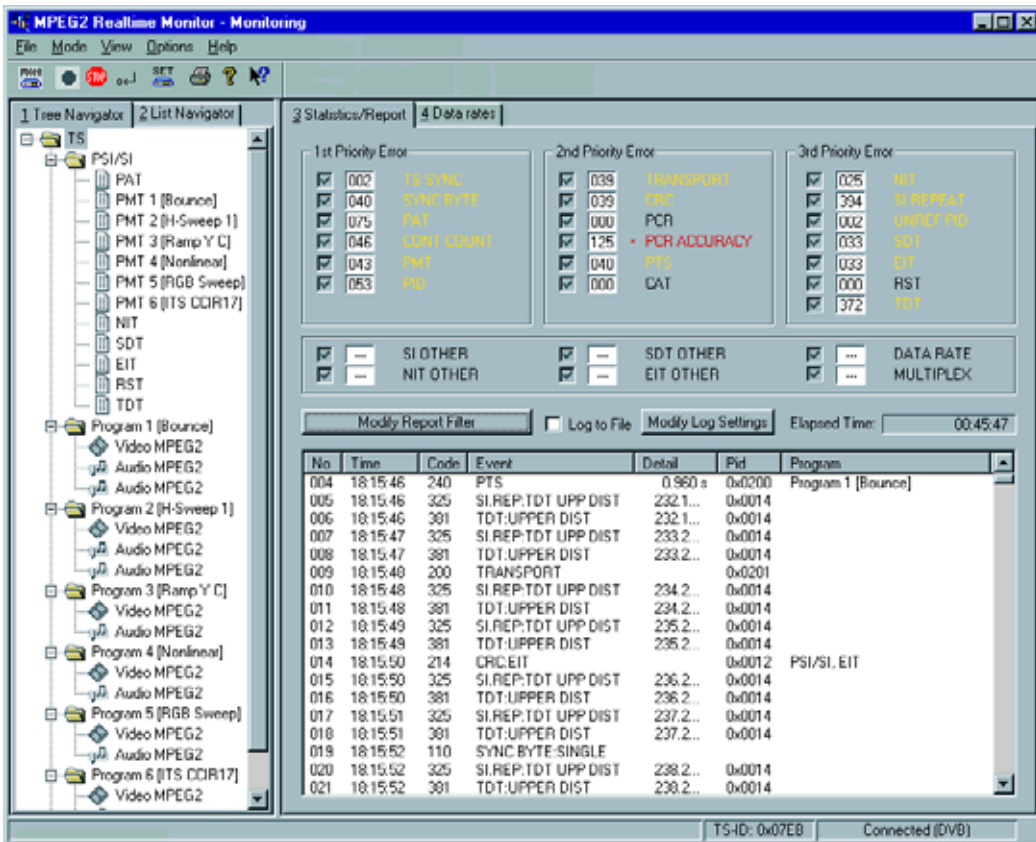


Fig. 1: Display of complete error information

## Error signalling

All errors picked up are first stored in the device. The R&S DVRM also detects sporadic errors. The error statistics of the R&S DVRM provide information on the frequency of occurrence and duration (error seconds) of the various types of error during a measurement period. At the same time, another list is generated with information on errors occurring together with the date and time. This list contains up to 1000 entries in chronological order and can be configured to show selected types of error. When the list is full, it is cyclically

overwritten so that the last 1000 entries are stored in each case.

Errors of the first (highest) priority as well as two errors of the second priority are signalled each by a separate LED on the front panel. All other errors are signalled by an additional, common LED. Detailed error information can be queried via the remote control interface.

If the supplied PC software is used, three information blocks are available simultaneously (Fig. 1):

- ◆ Structure of transport stream with all elements shown in the form of a tree or list (left)
- ◆ Current status as well as error seconds of each error measured in real-time (top right)
- ◆ Chronological list of all errors detected (bottom right)

Besides being displayed on the monitor, the chronological error report can be stored continuously on any PC data medium (e.g. hard disk). In contrast to storage in the R&S DVRM, there is no limitation in length for the report stored on a PC medium.

## Abbreviations

<b>ATSC</b>	Advanced Television Systems Committee
<b>BAT</b>	Bouquet Association Table
<b>CAT</b>	Conditional Access Table
<b>CETT</b>	Channel Extended Text Table
<b>CVCT</b>	Cable Virtual Channel Table
<b>DIT</b>	Discontinuity Information Table
<b>DTS</b>	Decoding Time Stamp
<b>DVB</b>	Digital Video Broadcast
<b>EIT</b>	Event Information Table
<b>EPG</b>	Electronic Program Guide

<b>ETT</b>	Extended Text Table
<b>MGT</b>	Master Guide Table
<b>MIP</b>	Megaframe Initialization Packet
<b>MPEG</b>	Motion Picture Experts Group
<b>NIT</b>	Network Information Table
<b>PAT</b>	Program Association Table
<b>PCR</b>	Program Clock Reference
<b>PES</b>	Packetized Elementary Stream
<b>PID</b>	Packet Identification
<b>PIT</b>	Program Identification Table
<b>PMT</b>	Program Map Table
<b>PSI</b>	Program Specific Information
<b>PSIP</b>	Program and System Information Protocol

<b>PT</b>	Private Table
<b>PTS</b>	Presentation Time Stamp
<b>RRT</b>	Rating Region Table
<b>RST</b>	Running Status Table
<b>SDT</b>	Service Description Table
<b>SI</b>	Service Information
<b>SIT</b>	Selection Information Table
<b>ST</b>	Stuffing Table
<b>STT</b>	System Time Table
<b>TDT</b>	Time and Date Table
<b>TOT</b>	Time Offset Table
<b>TS</b>	Transport Stream
<b>TVCT</b>	Terrestrial Virtual Channel Table

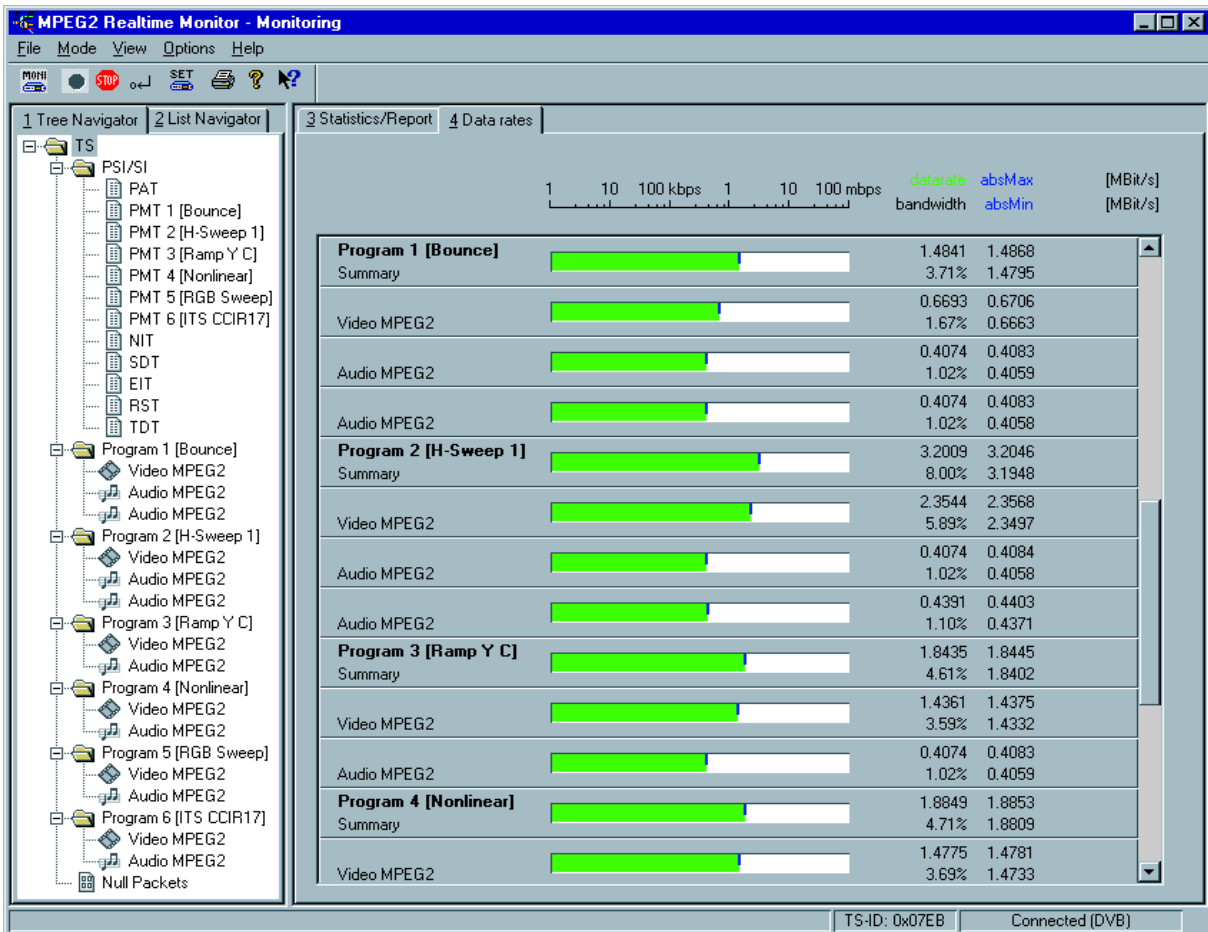


Fig. 3: Graphical display of data rates of all transport stream elements as bargraphs by means of realtime monitor software

In addition, the R&S DVRM provides 12 alarm lines for error signalling which are available at a 15-pin sub-D connector on the rear of the device. Each alarm line can be allocated to one or more types of error (ORed). The contacts close to ground and can be chosen to close or open in the event of an error.

If desired or in case of an error, part of the transport stream (approx. 2 Mbit) can be frozen using the trigger/capture functions of the R&S DVRM, output via the RS-232-C interface and analyzed down to bit and byte level.

### Remote control

In addition to readout and display of complete error information (Fig. 1), the MPEG-2 Realtime Monitor software allows full remote control of the R&S DVRM (Fig. 2). Moreover, it offers moving graphical representation of the data rates of all transport stream elements in the form of bargraphs (Fig. 3).

Apart from continuous storage of the error report on hard disk, the software enables integration of the R&S DVRM into networked monitoring systems via the COM/DCOM interface.

The MPEG-2 Realtime Monitor software thus becomes a server application that is capable of data exchange with other software packages (client applications) in networks as well.

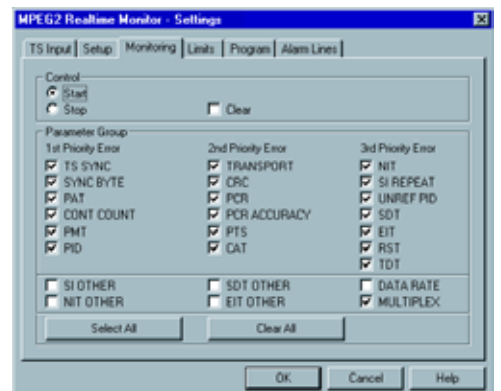


Fig. 2: Full remote control of the R&S DVRM

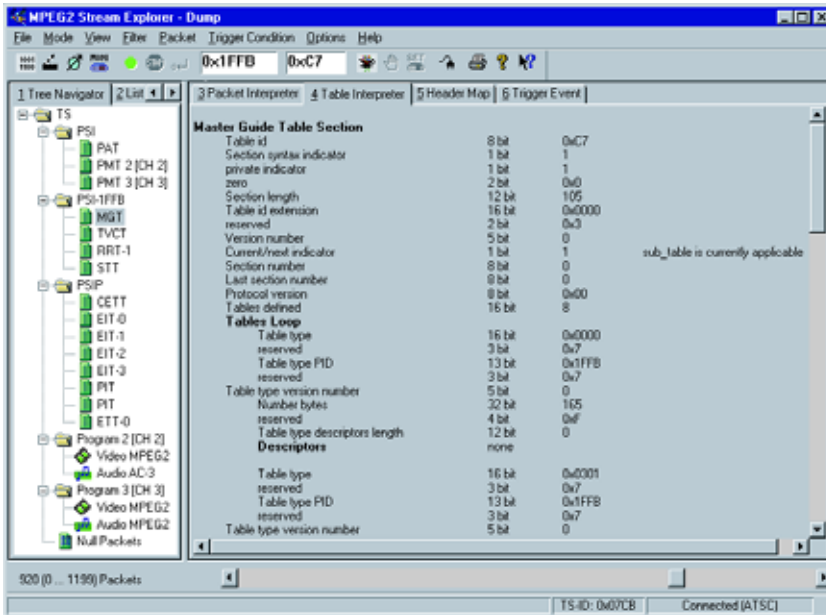


Fig. 4: Enhanced analysis with optional Stream Explorer™ R&S DVMD-B1

### Optional Stream Explorer™ R&S DVMD-B1

This software enhances the MPEG-2 Realtime Monitor R&S DVRM to form a universal analysis system for MPEG-2 transport streams. The software runs under Windows 95/98 /NT/2000/XP on any PC or laptop connected to the R&S DVRM via a serial interface. The easy-to-operate software and the clear presentation of test results in two windows of variable size ensure fast and effective working right from the start.

The R&S DVRM can store a transport stream of up to 2 Mbit and transfer it on request via the serial interface to Stream Explorer™. The device uses several data or event filters or a trigger-on-error function which can be activated via Stream Explorer™. The investigated data quantity of the transport stream can thus be considerably increased if required.

The allocation of all transport stream packets to the transport stream elements and the order of the packets are visible at a glance. Moreover, packet and table contents to ATSC as well as DVB standard are represented in a transparent way in hexadecimal notation together with their meaning.

In addition, Stream Explorer™ can activate realtime analyses in the R&S DVRM and output the results as moving graphical representations on the PC monitor. This considerably enhances the analysis functions of the R&S DVRM.

(For more information on Stream Explorer™ see data sheet PD 0757.3628)

### Option R&S DVRM-B2

The MPEG-2 Realtime Monitor R&S DVRM can handle both the DVB and the ATSC standard. It is factory-configured for DVB, without R&S DVRM-B2. When ordered with the R&S DVRM-B2 option, the device comes preconfigured for ATSC. For changeover of the R&S DVRM to the respective other standard, a PC Windows software is supplied with the R&S DVRM for downloading the required system components from an external PC or notebook.

### SMPTPE 310M Interface R&S DV-B310

The R&S DV-B310 option is offered for the R&S DVG, R&S DVMD, R&S DVRM and R&S DVQ baseband instruments. It is used to connect transport streams according to SMPTPE-310M and replaces a TS-ASI output or input (generator or analyzer) at the rear of the instrument (with the R&S DVQ, the input is replaced at the front). A fixed transport stream data rate of 19.392658 Mbit/s with 188 byte/packet is permissible in line with the ATSC-8VSB standard.

## Realtime measurement functions for ATSC and DVB

Measurement	Priority	Error indication			PID info	Trigger on error	Error No. (TR 101 290)	ATSC	DVB
		LED	LCD/OSD <sup>1)</sup>	Error condition					
TS_sync_loss	1	TS	TS-Sync	Loss OK	— —	* *	5.2.1 - 1.1	x x	x x
Sync_byte_error	1	SYNC	Sync Byte	Single Burst	— —	* *	5.2.1 - 1.2	x x	x x
PAT_error	1	PAT	PAT	Upper Distance Table ID Scrambled	* * *	— * *	5.2.1 - 1.3	x x x	x x x
Continuity_count_error <sup>2)</sup>	1	CONT	Cont. Cnt	Packet Order More Than Twice Lost Packet	* * *	* * *	5.2.1 - 1.4	x x x	x x x
PMT_error <sup>2)</sup>	1	PMT	PMT	Upper Distance Scrambled	* *	— *	5.2.1 - 1.5	x x	x x
PID_error <sup>2)</sup>	1	PID	PID Missing	Video+Audio Data+Other	* *	— —	5.2.1 - 1.6	x	x
Transport_error	2	TRANS	Transport		*	*	5.2.2 - 2.1	x	x
CRC_error <sup>2)</sup>	2	CRC	CRC	PAT	*	*	5.2.2 - 2.2	x	x
				CAT	*	*		x	x
				PMT	*	*		x	x
				NIT	*	*		x	x
				EIT (DVB)	*	*		x	x
				BAT	*	*		x	x
				SDT	*	*		x	x
				TOT	*	*		x	x
				MGT	*	*		x	x
				TVCT	*	*		x	x
				CVCT	*	*		x	x
				RRT	*	*		x	x
				STT	*	*		x	x
EIT (ATSC) <sup>3)</sup>	*	*	x	x					
ETT <sup>4)</sup>	*	*	x	x					
PCR_error <sup>2)</sup>	2	OTHER	PCR	Discontinuity PCR Upp/Low Dist.	* *	* ?-	5.2.2 - 2.3	x x	x x
PCR_accuracy_error <sup>2)</sup>	2				*	—	5.2.2 - 2.4	x	x
PTS_error <sup>2)</sup>	2	OTHER	PTS		*	—	5.2.2 - 2.5	x	x
CAT_error	2	OTHER	CAT	Table ID Missing	* *	* *	5.2.2 - 2.6	x x	x x
NIT_error	3	OTHER	NIT	Table ID NIT Upp Dist.	* *	* —	5.2.3 - 3.1		x
SI_repetition_error	3	OTHER	SI REP	PAT Upp/Low Dist.	*	—	5.2.2 - 3.2	x	
				CAT Upp/Low Dist.	*	—		x	x
				PMT Upp/Low Dist.	*	—		x	x
				NIT Upp/Low Dist.	*	—		x	x
				SDT Upp/Low Dist.	*	—		x	x
				BAT Upp/Low Dist.	*	—		x	x
				EIT (DVB) Upp/Low Dist.	*	—		x	x
				RST Low Dist.	*	—		x	x
				TDT Upp/Low Dist.	*	—		x	x
				TOT Upp/Low Dist.	*	—		x	x
				MGT Upp Dist.	*	—		x	x
				TVCT Upp Dist.	*	—		x	x
				CVCT Upp Dist.	*	—		x	x
RRT Upp Dist.	*	—	x	x					
STT Upp Dist.	*	—	x	x					
EIT (ATSC) <sup>3)</sup> Upp Dist	*	—	x	x					
Unreferenced_PID <sup>2)</sup>	3	OTHER	Unref. PID		*	*	5.2.3 - 3.4	x	x
SDT_error	3	OTHER	SDT	Table ID SDT Upp Dist.	* *	* —	5.2.3 - 3.5		x x
EIT_error	3	OTHER	EIT	Table ID EIT Upp Dist.	* *	* —	5.2.3 - 3.6		x x
RST_error	3	OTHER	RST	Table ID	*	*	5.2.3 - 3.7		x
TDT_error	3	OTHER	TDT	Table ID TDT Upp Dist.	* *	* —	5.2.3 - 3.8		x x
Base_PID_error	3	OTHER	Base PID	Table ID	*	*		x	

Measurement	Priority	Error indication		PID info	Trigger on error	Error No. (TR 101 290)	ATSC	DVB	
		LED	LCD/OSD <sup>1)</sup>						Error condition
Paradigm_error	3	OTHER	PARADIGM		*	—	x		
Multiplex_error	—	OTHER	MULTIPLEX	TS ID	—	—	x	x	
Datarate_error	—	OTHER	DATARATE	Null Upp/Low Limit	*	—	x	x	
SI_other_error	—	OTHER	SI OTHER	NIT Upp/Low Dist.	*	—		x	
				SDT Upp/Low Dist.	*	—		x	
				EIT Upp/Low Dist.	*	—		x	
NIT_other_error	—	OTHER	NIT OTHER	NIT Upp/Low Dist.	*	—		x	
SDT_other_error	—	OTHER	SDT OTHER	SDT Upp/Low Dist.	*	—		x	
EIT_other_error	—	OTHER	EIT OTHER	EIT Upp/Low Dist.	*	—		x	
MIP_error	—	OTHER	MIP	Present Extra	*	—	9.20		x
				Present Missing	*	—			x
				Struct TS Head	*	—			x
				Struct Length	*	—			x
				Struct Max Dly	*	—			x
				Struct STS	*	—			x
				Struct CRC	*	—			x
				Pointer	*	—			x
				Period Pointer	*	—			x
				Period MF Size	*	—			x
				Timing	*	—			x
				TS Rate	*	—			x

<sup>1)</sup> OSD (on screen display) only on R&S DVMD.  
<sup>2)</sup> Simultaneously for up to 64 programs and 20 (ATSC)/25 (R&S DVB) different PMT PIDs.  
<sup>3)</sup> Simultaneously for EIT-0 to EIT-3.  
<sup>4)</sup> Simultaneously for CETT and ETT-0 to ETT-3.

## Specifications

### Input signals

Transport stream  
 Data rate of transport stream  
 Length of data packets

to ISO/IEC 1-13818  
 up to 54 Mbit/s  
 188/204 bytes with DVB  
 188/208 bytes with ATSC

### Signal inputs

Synchronous parallel MPEG-2 transport stream (SPI, LVDS, to DVB-A010)

25-pin connector on front panel, 100 mV (V<sub>pp</sub>) to 2 V (V<sub>pp</sub>), 100 Ω

Asynchronous serial MPEG-2 transport stream, 270 Mbit/s (ASI, to DVB-A010)

BNC connector on front and rear panel, 200 mV (V<sub>pp</sub>) to 1 V (V<sub>pp</sub>), 75 Ω  
 remote control via RS-232-C interface

Control

### Interfaces

Serial interface

Type

Use

Relay outputs

Number

Active state

9-pin sub-D connector on rear panel  
 RS-232-C  
 remote control or printer  
 15-pin sub-D connector on rear panel  
 12 with arbitrary assignment to different types of error, ORed in case of multiple assignment  
 open or closed, selected jointly

## MPEG-2 Realtime Monitor Windows operating software for the R&S DVRM

### System requirements

PC or notebook with Pentium processor (recommended clock frequency min. 100 MHz), Windows 95/98/NT/2000/XP operating system, min. 16 MB RAM (Windows NT: 32 MB), approx. 10 MB hard disk memory, RS-232-C interface (recommended data rate 115 kbit/s), CD-ROM drive

### Monitoring

Number of different PMT PIDs

max. 20 with ATSC  
 max. 25 with DVB  
 max. 64

Number of programs

Error types

DVB

ATSC

Both

TR 101 290 repetition rates of NIT/SDT/EIT "other" tables to TR 101 290 program paradigm transport stream ID (TS\_Id), data rate of stuffing bytes

*Rear view of the R&S DVRM*



## General data

Operating temperature range	+5°C to +40°C (specs complied with)
Permissible temperature range	0°C to +50°C
Storage temperature range	-40°C to +70°C
Mechanical resistance	
Sinewave vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz, meets IEC EN 60068-2-6, IEC 61010-1, MIL-T-28800 D class 5
Random vibration	10 Hz to 300 Hz, at 1.2 g (rms)
Shock	40 g shock spectrum, meets MIL-STD-810 D and MIL-T-28800 D class 3 and 5
Climatic resistance	+25°C/+40°C cyclically at 95% rel. humidity, meets IEC EN 60068-2-30
Electromagnetic compatibility	meets EN 55011-1 and EEN 61326-1 (EMC directive of EU)
Power supply	88 V to 264 V, 47 Hz to 63 Hz, power consumption 50 W
Electrical safety	meets EN 61010-1
Dimensions (W x H x D)	434 mm x 43 mm x 460 mm
Weight	4.9 kg

## Ordering information

MPEG-2 Realtime Monitor	R&S DVRM	2068.8580.02
Equipment supplied	1 R&S DVRM, power cable, modem bypass cable, operating manual, CD-ROM with setup program for installation of MPEG-2 Realtime Monitor PC operating software, update firmware for ATSC and DVB standards, factory-configured for DVB standard	

## Options

SMTPE 310 M Interface	R&S DV-B310	2085.7543.02
Configuration for ATSC Standard	R&S DVRM-B2	2068.9606.00
STREAM EXPLORER™ <sup>1)</sup> Software	R&S DVMD-B1	2068.9406.02
Documentation of Calibration Values	R&S DRM-DCV	2082.0490.24

## Recommended extras

19" Adapter (1 HU)	R&S ZZA-91	0396.4870.00
Service manual		2069.0348.24

<sup>1)</sup> See data sheet PD 0757.3628.

Certified Quality System

**ISO 9001**

DQS REG. NO 1954

Certified Environmental System

**ISO 14001**

REG. NO 1954



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