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R&S®DVMD MPEG-2 Measurement Decoder

Analysis and decoding of MPEG-2 transport streams

The R&S®DVMD measurement decoder is for MPEG-2 and DVB or ATSC what a waveform monitor is for the analog world. It provides everything that is required for reliably handling the new technology. Due to its special features no error goes unnoticed. And all this comes in an easy-to-operate and portable unit.

- 25 DVB or 18 ATSC simultaneous realtime measurements
- Analyzer and decoder in one unit
- Analysis of data rates
- Trigger-on-error function
- Integrated long-term report
- On-screen display on video monitor
- Measurement capabilities for all levels/resolutions (SDTV and HDTV)

The R&S®DVMD analyzes and monitors MPEG-2 transport streams in line with DVB and ATSC standards.

The Stream Explorer™ PC software is available as an option for in-depth analysis down to bit level, for convenient remote control of the R&S®DVMD, and for integration of the R&S®DVMD into networked monitoring systems.

ROHDE&SCHWARZ

- The combination of decoder and analyzer in one unit with conventional operating concept (no PC system) makes the R&S®DVMD the waveform monitor of digital television. It is thus suitable for use wherever MPEG-2 signals have to be checked.
- Realtime measurements and simultaneous in-depth analysis (25 DVB or 18 ATSC measurements at a time) yield extremely fast results. This makes the R&S®DVMD an indispensable tool in development, in troubleshooting as well as in quality management and production.
- Another important application is in the final inspection of MPEG-2 signals before they leave the studio. While the R&S®DVMD checks the video and audio signals at the output, error information is inserted directly into the decoded program (on-screen display).
- Remote-control capability allows integration into automatic monitoring networks. The R&S®DVMD is thus ideal for all network operators.



Characteristics

By monitoring and analyzing the MPEG-2 transport stream, the R&S®DVMD measurement decoder performs a completely new kind of measurement task that is due to the introduction of digital television. The measurements ensure smooth interworking of all components in a DTV transmission network. The R&S®DVMD also provides information about the contents of the transport stream and decodes one of the programs contained in it. The results of the protocol analysis can then be compared to the decodability of video and audio signals. The measurement decoder thus not only supplies comprehensive information about the quality of the transport stream but also makes the new technology transparent so that the user can reliably handle it.

Realtime Analyzer

The analyzer functions of the R&S®DVMD comprise the realtime protocol analysis of the measured MPEG-2 transport stream. In DVB mode, all measurements comply with the measurement guidelines for DVB systems (ETR290). They were initially issued for the European DVB project, but are now being used in all parts of the world as the standard for digital TV transmission via satellite, cable or terrestrial. These guidelines define possible error conditions in terms of three priorities.

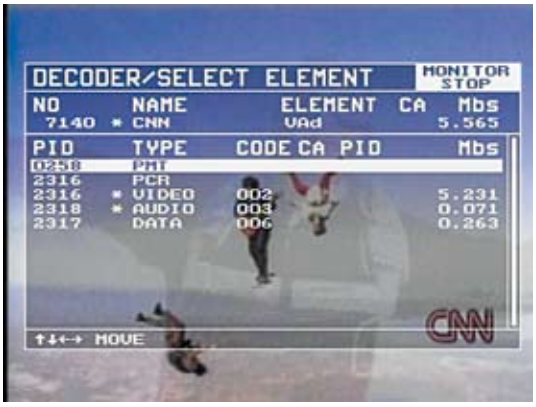
Additionally to ETR290, the table repetition of all "other" EIT/SDT/NIT tables is measured in realtime and checked for compliance with specified upper and lower limits. This feature ensures the proper transmission of program-associated EPG data for a digital TV network, consisting of several transport streams.

No specific measurement guidelines exist for the North-American ATSC standard, which is used only for transmission via cable or terrestrial. The extensive realtime checks that the R&S®DVMD performs in ATSC mode are therefore in line with ETR 290, as regards the different ATSC-specific system and program information tables (PSIP).

Moreover, the unique transport stream identification (TS_Id) as well as the actual data rate of the stuffing bytes are checked in realtime against upper and lower limits. In the case of fixed multiplex, this function makes it possible to detect whether the transport stream contains the desired quantity of video services and to monitor possible service drops. These two errors are not assigned a priority, as are ETR 290 errors.



List of all programs in the transport stream



List of all elementary streams in a program



Error statistics in DVB mode



Error report with detailed information on causes of errors

Abbreviations

ATSC	Advanced Television Systems Committee
BAT	Bouquet Association Table
CAT	Conditional Access Table
CETT	Channel Extended Text Table
CVCT	Cable Virtual Channel Table
DIT	Discontinuity Information Table
DTS	Decoding Time Stamp
DVB	Digital Video Broadcast
EIT	Event Information Table
EPG	Electronic Program Guide
ETT	Extended Text Table
MGT	Master Guide Table
MPEG	Motion Picture Experts Group
NIT	Network Information Table
PAT	Program Association Table
PCR	Program Clock Reference
PES	Packetized Elementary Stream
PID	Packet Identification
PIT	Program Identification Table
PMT	Program Map Table
PSI	Program Specific Information
PSIP	Program and System Information Protocol
PT	Private Table
PTS	Presentation Time Stamp
RRT	Rating Region Table
RST	Running Status Table
SDT	Service Description Table
SI	Service Information
SIT	Selection Information Table
ST	Stuffing Table
STT	System Time Table
TDT	Time and Date Table
TOT	Time Offset Table
TS	Transport Stream
TVCT	Terrestrial Virtual Channel Table

Error messages

Any error occurring is directly indicated by front-panel LEDs. The R&S®DVMD also detects sporadic errors. Moreover, it provides error statistics showing how often and for how long a particular type of error has occurred within a specific time interval ("error seconds"). The R&S®DVMD can output a list that is maintained separately and provides information about the errors occurred, including date and time. The list contains up to 1000 entries listed by time and may be edited to cover a single type of error only.



Online diagnosis: insertion of important data into decoded picture and profound analysis via optional R&S®DVMD-B1 Stream Explorer™ PC software

If there is an error, the trigger/capture facilities of the R&S®DVMD can be used to freeze part of the transport stream affected by the error (approx. 2 Mbit) and output it via the RS-232-C interface in order to analyze it down to bit and byte level.

Decoder

An MPEG-2 transport stream usually consists of a number of programs which may contain video, audio and data streams (elementary streams). The R&S®DVMD decodes a video and an audio stream from the selected program. The decoded video signal is simultaneously output in CCVS, analog Y/C and digital serial ITU-R601 formats. Audio signals are output as analog stereo signals and as digital AES/EBU signals.

Signal generator

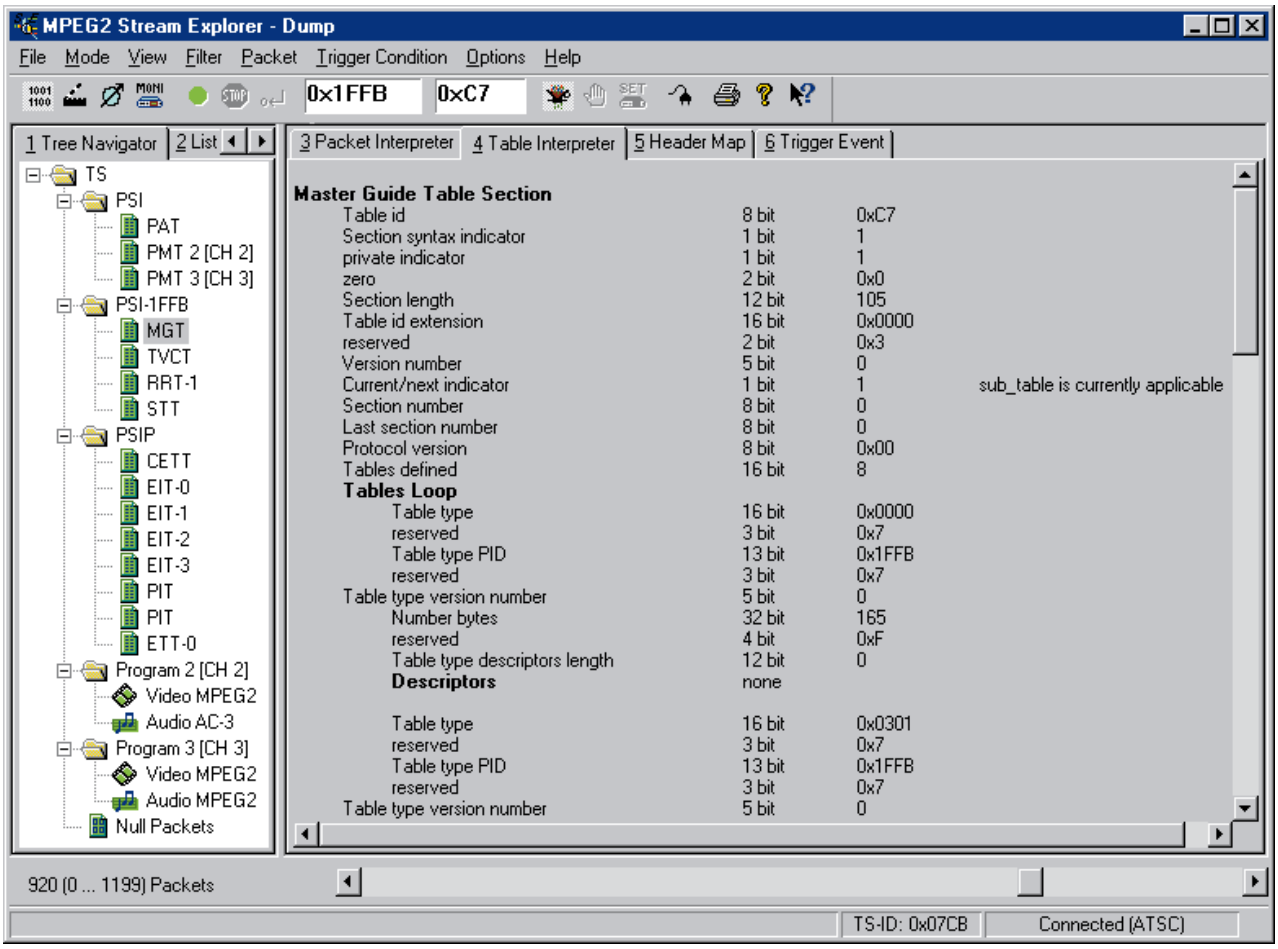
Complementary to the R&S®DVMD decoder, Rohde&Schwarz offers the R&S®DVG MPEG-2 measurement generator (data sheet PD 5213.7225.32), which supplies continuous MPEG-2 transport streams containing combined video, audio and data sequences in an endless loop.

Alarm lines and parallel interface option (R&S®DVMD-B5)

This option enhances the R&S®DVMD by two interfaces on the rear panel.

- 12 lines for signaling errors detected in the transport stream are available at a 15-contact D-sub connector; each line can be allocated to one or several types of errors (ORed) in a menu; the contacts close to ground, and in case of an error they can either close or open
- The second interface is a parallel printer interface for hardcopy output of test reports, program contents, and instrument settings

This option can also be retrofitted any time by an authorized service technician (except devices with serial number 842 208/****).



Clear display of ATSC transport stream and tables by means of Stream Explorer™

R&S®DVMD-B1 Stream Explorer™

This software enhances the R&S®DVMD MPEG-2 measurement decoder to form a universal analysis system for MPEG-2 transport streams. It runs under Windows 95/98 or Windows NT/2000/XP on any PC or laptop connected to the R&S®DVMD 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®DVMD can store a transport stream of up to 2 Mbit and transfer it on request via the serial interface to Stream Explorer™. The R&S®DVMD uses several data or event filters (TRIGGER ON ERROR) which can be activated via Stream Explorer™. The investigated data quantity of the transport stream can thus be considerably increased if required. Moreover, Stream Explorer™ can activate realtime analyses in the R&S®DVMD and output the results as moving graphic representations on the PC monitor. The realtime measurement functions of the R&S®DVMD are thus considerably enhanced.

Furthermore, all local functions of the R&S®DVMD can be remote-controlled by Stream Explorer™ and the error report can be continuously stored on hard disk with unlimited number of entries. Stream Explorer™ itself can be remote-controlled by means of other software packages (client applications) via an interface for task-to-task communications.

Thus, commands, instrument settings as well as result data can be exchanged between the two software packages throughout a network connection.

(For more detailed information about Stream Explorer™, see data sheet R&S®DVMD-B1, PD 0757.3628)

Realtime measurement functions of ATSC and DVB

Simultaneous monitoring of all signals in transport stream

Measurement	Priority	Error indication			PID info	Trigger on error	Error number (TR 101 290)	ATSC	DVB
		LED	LCD/OSD[1]	Error condition					
TS_sync_loss	1	TS	TS Sync	Loss	–	*	5.2.1 – 1.1	×	×
				OK	–	*		×	×
Sync_byte_error	1	SYNC	Sync Byte	Single	–	*	5.2.1 – 1.2	×	×
				Burst	–	*		×	×
PAT_error	1	PAT	PAT	Upper Distance	*	–	5.2.1 – 1.3	×	×
				Table ID	*	*		×	×
				Scrambled	*	*		×	×
Continuity_count_error[2]	1	CONT	Cont. Cnt	Packet Order	*	*	5.2.1 – 1.4	×	×
				More Than Twice	*	*		×	×
				Lost Packet	*	*		×	×
PMT_error[2]	1	PMT	PMT	Upper Distance	*	–	5.2.1 – 1.5	×	×
				Scrambled	*	*		×	×
PID_error[2]	1	PID	PID Missing	Video+Audio	*	–	5.2.1 – 1.6	×	×
				Data+Other	*	–			
Transport_error	2	TRANS	Transport		*	*	5.2.2 – 2.1	×	×
CRC_error[2]	2	CRC	CRC	PAT	*	*	5.2.2 – 2.2	×	×
				CAT	*	*		×	×
				PMT	*	*		×	×
				NIT	*	*			×
				EIT (DVB)	*	*			×
				BAT	*	*			×
				SDT	*	*			×
				TOT	*	*			×
				MGT	*	*		×	
				TVCT	*	*		×	
				CVCT	*	*		×	
				RRT	*	*		×	
				STT	*	*		×	
				EIT (ATSC)[3]	*	*		×	
				ETT[4]	*	*		×	
PCR_error[2]	2	OTHER	PCR	Discontinuity	*	*	5.2.2 – 2.3	×	×
				PCR Upp/Low Dist.	*	–		×	×
PCR_accuracy_error[2]	2				*	–	5.2.2 – 2.4	×	×
PTS_error[2]	2	OTHER	PTS		*	–	5.2.2 – 2.5	×	×
CAT_error	2	OTHER	CAT	Table ID	*	*	5.2.2 – 2.6	×	×
				Missing	*	*		×	×
NIT_error	3	OTHER	NIT	Table ID	*	*	5.2.3 – 3.1		×
				NIT Upp Dist.	*	–			
SI_repetition_error	3	OTHER	SI REP	PAT Upp/Low Dist.	*	–	5.2.2 – 3.2	×	
				CAT Upp/Low Dist.	*	–		×	×
				PMT Upp/Low Dist.	*	–		×	×
				NIT Upp/Low Dist.	*	–			×
				SDT Upp/Low Dist.	*	–			×
				BAT Upp/Low Dist.	*	–			×
				EIT (DVB) Upp/Low Dist.	*	–			×
				RST Low Dist.	*	–			×
				TDT Upp/Low Dist.	*	–			×
				TOT Upp/Low Dist.	*	–			×
				MGT Upp Dist.	*	–		×	×
				TVCT Upp Dist.	*	–		×	
				CVCT Upp Dist.	*	–		×	
				RRT Upp Dist.	*	–		×	
				STT Upp Dist.	*	–		×	
				EIT (ATSC)[3] Upp Dist	*	–		×	
Unreferenced_PID[2]	3	OTHER	Unref. PID		*	*	5.2.3 – 3.4	×	×
SDT_error	3	OTHER	SDT	Table ID	*	*	5.2.3 – 3.5		×
				SDT Upp Dist.	*	–			×

Measurement	Priority	Error indication			PID info	Trigger on error	Error number (TR 101 290)	ATSC	DVB
		LED	LCD/OSD[1]	Error condition					
EIT_error	3	OTHER	EIT	Table ID	*	*	5.2.3 – 3.6		×
				EIT Upp Dist.	*	–			×
RST_error	3	OTHER	RST	Table ID	*	*	5.2.3 – 3.7		×
TDT_error	3	OTHER	TDT	Table ID	*	*	5.2.3 – 3.8		×
				TDT Upp Dist.	*	–			×
Base_PID_error	3	OTHER	Base PID	Table ID	*	*		×	
Paradigm_error	3	OTHER	PARADIGM		*	–		×	
Multiplex_error	–	OTHER	MULTIPLEX	TS ID	–	–		×	×
Datarate_error	–	OTHER	DATARATE	Null Upp/Low Limit	*	–		×	×
SI_other_error	–	OTHER	SI OTHER	NIT Upp/Low Dist.	*	–			×
				SDT Upp/Low Dist.	*	–			×
				EIT Upp/Low Dist.	*	–			×
NIT_other_error	–	OTHER	NIT OTHER	NIT Upp/Low Dist.	*	–			×
SDT_other_error	–	OTHER	SDT OTHER	SDT Upp/Low Dist.	*	–			×
EIT_other_error	–	OTHER	EIT OTHER	EIT Upp/Low Dist.	*	–			×
MIP_error	–	OTHER	MIP	Present Extra	*	–	9.20		×
				Present Missing	*	–			×
				Struct TS Head	*	–			×
				Struct Length	*	–			×
				Struct Max Dly	*	–			×
				Struct STS	*	–			×
				Struct CRC	*	–			×
				Pointer	*	–			×
				Period Pointer	*	–			×
				Period MF Size	*	–			×
				Timing	*	–			×
				TS Rate	*	–			×

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

Rear view of the R&S®DVMD (with R&S®DVMD-B5 alarm lines option)



Specifications

Input signals	
Transport stream	in line with ISO/IEC 1-13818
Data rate of transport stream	up to 54 Mbit/s
Length of data packets	188/204 bytes for DVB; 188/208 bytes for ATSC
Signal inputs	
Synchronous parallel MPEG-2 transport stream (LVDS, in line with DVB-A010)	25-pin connector on front panel, 100 mV to 2 V (V_{pp}), 100 Ω
Asynchronous serial MPEG-2 transport stream, 270 Mbit/s (ASI, in line with DVB-A010)	BNC connector on front and rear panel, 200 mV to 1 V (V_{pp}), 75 Ω
Signal outputs	
Video CCVS (PAL, SECAM, NTSC)	BNC connector on front and rear panel, 1 V ±1 % (V_{pp}), 75 Ω
Video luminance (Y)	BNC connector on rear panel, 1 V ±1 % (V_{pp}), 75 Ω
Video chrominance (C)	BNC connector on rear panel, 0.7 V ±1 % (V_{pp}), 75 Ω
C/L gain	±2 %
C/L delay	±30 ns
Return loss (0 MHz to 6 MHz)	34 dB, CCVS on front panel: 25 dB
Frequency response (typical values)	
0 MHz to 3 MHz	+1 %/–2 %
<4 MHz	+1 %/–5 %
<5 MHz	+1 %/–15 %
Audio	unbalanced, not free floating
Level (full scale)	6/9/12/15 dBu ±0.5 dB
Frequency response (40 Hz to 15 kHz)	±0.5 dB relative to 1 kHz
S/N ratio	>70 dB, unweighted
THD	>70 dB
Video serial digital (ITU-R 601)	BNC connector on rear panel, 800 mV (V_{pp}), 75 Ω
Audio left, audio right	LEMO Triax connector on front and rear panel, <50 Ω
Audio serial digital (AES/EBU)	LEMO Triax connector on rear panel, 4 V (V_{pp}), 110 Ω
Decoding	
Video	main profile and main level (SDTV)
Audio	MPEG1 layer 1 and 2; MPEG-2 layer 1 and 2, low sampling rate
Monitoring	
Number of different PMT PIDs	max. 20 with ATSC, max. 25 with DVB
Number of programs	max. 64, control via RS-232-C interface
Interfaces	one RS-232-C interface (remote control or printer)
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	
Vibration	
Sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz, max. 0.5 g in range 55 Hz to 150 Hz, in line with IEC 68-2-6, IEC 1010-1, and MIL-T-28800D class 5
Random	10 Hz to 300 Hz, acceleration 1.2 g (rms)
Shock	40 g shock spectrum, in line with MIL-STD-810D and MIL-T-28800D class 3 and 5
Climatic conditions	+25 °C/+40 °C cyclically at 95 % relative humidity, in line with IEC 68-2-30
Electromagnetic compatibility	in line with EN 50081-1 and EN 50082-2 (EMC directive of EU)
Power supply	88 V to 264 V, 47 Hz to 63 Hz
Power consumption	50 W
Electrical safety	in line with EN 61010-1
Dimensions (W × H × D)	434 mm × 43 mm × 460 mm (17.1 in × 1.7 in × 18.1 in)
Weight	4.9 kg (10.8 lb)

Ordering information

Designation	Type	Order No.
MPEG-2 Measurement Decoder	R&S®DVMD	2068.8597.02
Accessories supplied: power cable, operating manual, audio adapter (LEMO Triax to XLR), modem bypass cable		
Options		
Stream Explorer™ [1] Software	R&S®DVMD-B1	2068.9406.02
Alarm Lines and Parallel Interface	R&S®DVMD-B5	2068.9393.02
Documentation of Calibration Values	R&S®DVM-DCV	2082.0490.15
Recommended extras		
19" Adapter (1 HU)	R&S®ZZA-91	0396.4870.00
Service manual		2069.0348.24

[1] See data sheet PD 0757.3628.





More information at
www.rohde-schwarz.com
(search term: DVMD)

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