MPEG-2 Measurement Decoder R&S DVMD

Analysis and Decoding of MPEG-2 transport streams

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

- 25 DVB or 18 ATSC realtime measurements at a time
- 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 both to DVB and ATSC standards.

PC Software Stream Explorer™ 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.

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- 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 trouble-shooting 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 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. R&S DVMD is thus ideal for all network operators.

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

For the North-American ATSC standard, which is used only for transmission via cable or terrestrial, there are no specific measurement guidelines existing. The realtime checks the R&S DVMD performs in ATSC mode are therefore extensive according to ETR290, where the different ATSC specific system and program information tables (PSIP) are concerned.

Characteristics

By monitoring and analyzing the MPEG-2 transport stream, the Measurement Decoder R&S DVMD performs a completely new kind of measurement task that has arisen from the introduction of digital television. The measurements have been conceived to 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 (Fig 1 and 2) and decodes one of the programs contained therein. 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 makes the new technology transparent so that the user can reliably handle it.

Realtime Analyzer

The analyzer functions of the R&S DVMD comprise a 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.

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. The latter function makes it easy with fixed multiplex to detect whether the transport stream contains the desired quantity of video services and monitor possible service drops. These two errors are not assigned a priority, like with ETR290 errors.

1

2

3

4

1 List of all programs in the transport stream

2 List of all elementary streams in a program

3 Error statistics in DVB mode

4 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 frontpanel LED's. 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") (Fig 3). A list maintained separately (Fig 4) and giving information about the errors occurred including date and time can be obtained. 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 PC software Stream Explorer™ R&S DVMD-B1

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, 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

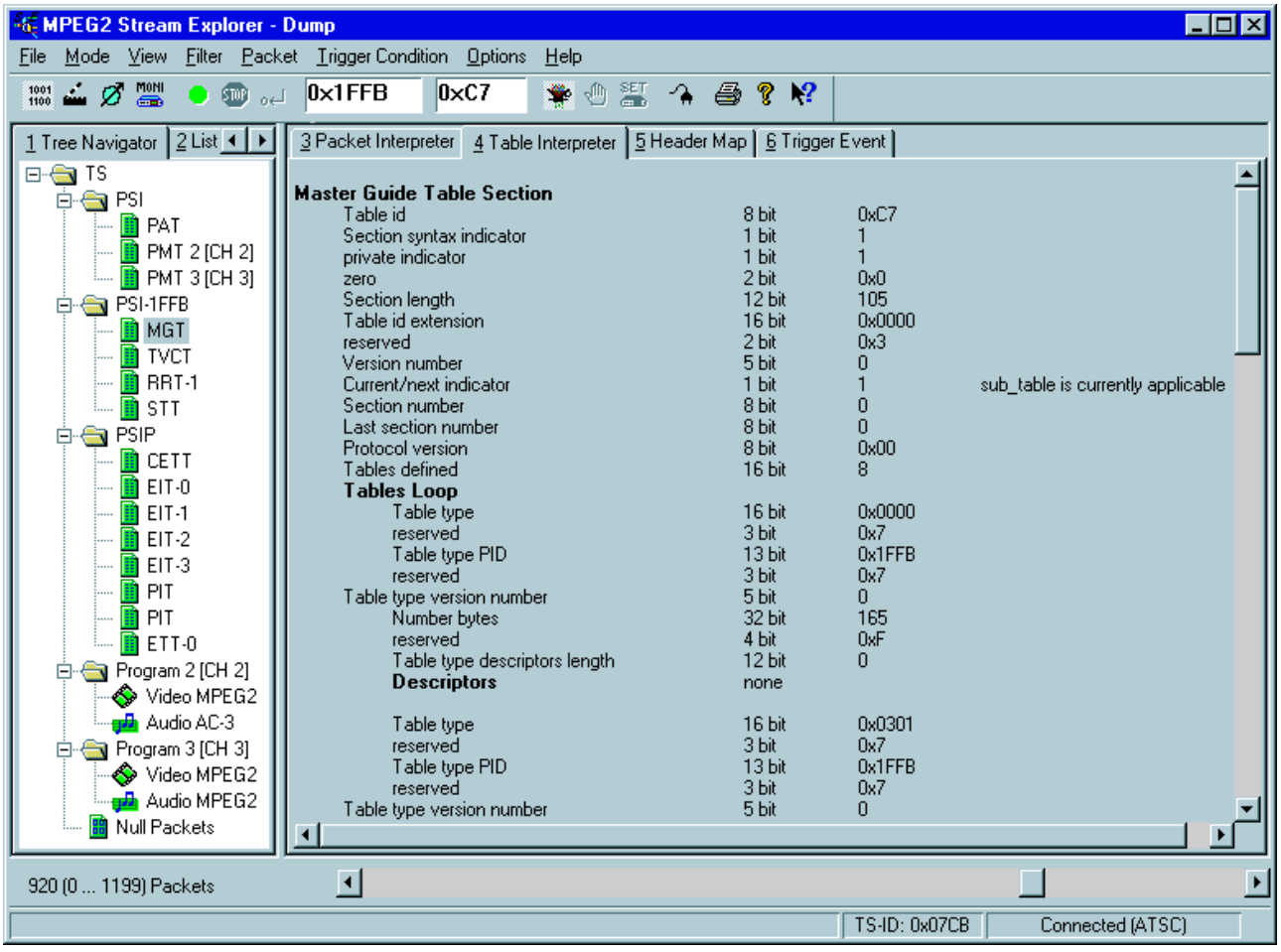
Complementary to the Decoder R&S DVMD, Rohde&Schwarz offers the MPEG-2 Measurement Generator R&S DVG (data sheet PD 0757.2738), which supplies continuous MPEG-2 transport streams comprising combined video, audio and data sequences in an endless loop.

Option alarm lines and parallel interface (R&S DVMD-B5)

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

- 12 lines for signalling errors detected in the transport stream are available at a 15-contact sub-D 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 be chosen to 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 plus tables by means of Stream Explorer™

Stream Explorer™ R&S DVMD-B1

This software enhances MPEG-2 measurement decoder R&S DVMD 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 communication.

In this way commands, instrument settings as well as result data can also be exchanged between both software packages throughout a network connection.

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

Certified Quality System
ISO 9001
DQS REG. NO 1954

Certified Environmental System
ISO 14001
REG. NO 1954

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 No. (ETR 290)	ATSC	DVB
		LED	LCD/OSD	Error condition					
TS_sync_loss	1	TS	TS-Sync	Loss OK	– –	• –	1.1	x x	x x
Sync_byte_error	1	SYNC	Sync Byte	Single Burst	– –	• •	1.2	x x	x x
PAT_error	1	PAT	PAT	Upper Distance Table ID Scrambled	– • –	– • •	1.3	x x x	x x x
Continuity_count_error[2]	1	CONT	Cont. Cnt	Packet Order More Than Twice Lost Packet	• • •	• • •	1.4	x x x	x x x
PMT_error [2]	1	PMT	PMT	Upper Distance Scrambled	• •	– •	1.5	x x	x x
PID_error [2]	1	PID	PID Missing		•	–	1.6	x	x
Transport_error	2	TRANS	Transport		•	•	2.1	x	x
CRC_error [2]	2	CRC	CRC	PAT CAT PMT NIT EIT (DVB) BAT SDT TOT MGT TVCT CVCT RRT STT EIT (ATSC)[1] ETT page 6	• • • • • • • • • • • • • • •	• • • • • • • • • • • • • • •	2.2	x x x x x x x x x x	x x x x x x x x
PCR_error [2]	2	OTHER	PCR	Discontinuity Upper Distance	• •	•	2.3	x x	x x
PCR_accuracy_error [2]	2				•	–	2.4	x	x
PTS_error [2]	2	OTHER	PTS		•	–	2.5	x	x
CAT_error	2	OTHER	CAT	Table ID Missing	• •	• •	2.6	x x	x x
SI_repetition_error	3	OTHER	SI REP	PAT Upp/Low Dist. 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.	• • • • • • • • • • • • • • •	– – – – – – – – – – – – – – –	3.2	x x x x x x x x	x x x x x x x x x x
NIT_error	3	OTHER	NIT	Table ID NIT Upper Dist.	• •	• –	3.1		x
SDT_error	3	OTHER	SDT	Table ID SDT Upper Dist.	• •	• –	3.5		x
EIT_error	3	OTHER	EIT	Table ID EIT Upper Dist.	• •	• –	3.6		x
RST_error	3	OTHER	RST	Table ID	•	•	3.7		x
TDT_error	3	OTHER	TDT	Table ID TDT Upper Dist.	• •	• –	3.8		x
Unreferenced_PID [2]	3	OTHER	Unref. PID		•	•	3.4	x	x
Base_PID_error	3	OTHER	Base PID	Table ID	•	•		x	
Paradigm_error	3	OTHER	PARADIGM		•	–		x	
SI_other_error	–	OTHER	SI OTHER	NIT other Upp/Low Dist. SDT other Upp/Low Dist. EIT other Upp/Low Dist.	• • •	–			x x x
NIT_other_error	–	OTHER	NIT OTHER	NIT other Upp/Low Dist.	•	–			x
SDT_other_error	–	OTHER	SDT OTHER	SDT other Upp/Low Dist.	•	–			x
EIT_other_error	–	OTHER	EIT OTHER	EIT other Upp/Low Dist.	•	–			x
Multiplex_error	–	OTHER	MULTIPLEX	TS ID	–	–		x	x
Datarate_error	–	OTHER	DATARATE		•	–		x	x

[1] Simultaneously for up to 4 different EIT PIDs and 4 different ETT PIDs.

[2] Simultaneously for up to 64 programs and 20 (ATSC)/25 (DVB) different PMT PIDs.

Specifications

Input signals

Transport stream	to 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, according to 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, to 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: 30 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&2 MPEG-2 layer 1&2, low sampling rate

Monitoring

Number of different PMT PIDs	max. 20 with ATSC max. 25 with DVB
Number of programs	max. 64

Controls and indicators

6 front-panel keys and two-line LCD, output of comprehensive test results via text inserted into output signals, remote control via RS-232-C interface

Interfaces

1 RS-232-C interface (remote control or printer)

General data

Rated temperature range	+5 °C to +40 °C (valid specs)
Operating temperature range	0 °C to +50 °C
Storage temperature range	–40 °C to +70 °C
Mechanical resistance	
Sine vibration	5 Hz to 150 Hz, max. 2 g at 55 Hz, max. 0.5 g in range 55 Hz to 150 Hz, complies with IEC 68-2-6,IEC 1010-1 and MIL-T-28800D class 5
Random vibration	10 Hz to 300 Hz, acceleration 1.2 g (rms)
Shock	40 g shock spectrum, complies with MIL-STD-810D and MIL-T-28800D class 3 and 5
Climatic conditions	+25 °C/+40 °C cyclically at 95% rel. humidity, complies with IEC 68-2-30
Electromagnetic compatibility	complies 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	complies to to 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 Measurement Decoder	R&S DVMD	2068.8597.02
Accessories supplied	power cable, operating manual, audio adapter (LEMO Triax to XLR), modem bypass cable	

Options

Software Stream Explorer™[1]	R&S DVMD-B1	2068.9406.02
Option 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.

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

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