Products: R&S®DVM50, R&S®DVM100, R&S®DVM120, R&S®DVM400

DVB-H Measurements with the R&S®DVM

Basics and Application

Application Note

The DVB-H standard is a specification for bringing television broadcast services to handheld receivers. In order to save battery power, data for a specific service is transmitted in short bursts. This type of transmission utilizes special techniques within the transport stream.

The R&S®DVM offers a wide range of functions to analyze the characteristics of the DVB-H transport stream. This document describes the characteristics of the DVB-H transport stream and shows how the R&S®DVM can be used for efficient analysis in research and development, production, and broadcasting.

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Subject to change – H. Gsoedl 07.2006 – 7BM59_0E

1 Overview

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2 Requirements

To access the DVB-H analysis functionality, your R&S®DVM device must have the data broadcast analysis functionality (R&S®DVM400: DVM-B1, R&S®DVM50/100/120: DVM-K11) installed.

3 Introduction

For more than 100 years (since the advent of the automobile), the concept of "mobility" has been synonymous with individual independence.

The onset of the Internet era in the late 20th century and the global spread of the mobile telephone have also helped to shape expectations, which, for today's consumers, are reachability, information, and individuality – anywhere, anytime. In the early days, mobile phones were "only" expected to ensure that the user could always be reached by telephone, but expectations are now trending more and more toward multimedia content.

Over the course of the past decade, broadcasting responded to the demand for more information and entertainment by introducing digital standards which allow several broadcasts/services to be carried in one frequency channel. However, these technologies pertain primarily to an extension of conventional stationary reception. See [2] for more information.

DVB for mobile devices was hampered by a lack of absolutely essential power saving features, as well as by a lack of practicable implementations for mobile reception. To meet those challenges, the European Telecommunication Standardization Union developed the DVB-H standard (where H stands for handheld).

4 DVB-H (ETSI EN 302 304) – General Overview

As noted above, this application note will discuss baseband analysis. For the sake of completeness, this section will briefly touch upon the details of the standard's RF component. For further details and procedures for testing the RF component of DVB-H, see [1].

RF characteristics (improved mobile reception)

The speed of non-stationary terminals differs from null. This speed component results in the Doppler effect. The Doppler effect describes the fact that movement (of the transmitter or receiver) causes a frequency (f) to shift (Δf), so that the resulting frequency on the other side (transmitter or receiver) is $f + \Delta f$.

In multicarrier modulations such as DVB-T (coded orthogonal frequency division multiplexing, or COFDM for short), where the standard calls for either 2048 (2k mode) or 8192 (8k mode) carriers, modes with a lower number of carriers are less affected by the Doppler effect because the subcarrier spacing is wider.

Reduced symbol length is a side effect in COFDM with a smaller number of carriers. The reduced symbol length results in a reduction of the guard interval which was introduced for multipath reception, and a higher transmitter density (see single frequency network [2]) is required. That, in turn, results in higher costs to the network operators. However, the 2k mode also allows application of better error protection measures (in-depth interleaving).

For DVB-H, the 4k mode was added to the 2k and 8k modes. The 4k mode is the middle ground between improved mobile reception properties, error protection (in-depth interleaving), and transmitter density.

Time slicing at the transport stream level (power save function)

As noted above, receivers manufactured to conventional standards (DVB-T) require too much energy to be practical for battery-operated devices. So DVB-H introduced the time slicing approach in order to reduce the power consumption of mobile, handheld devices.

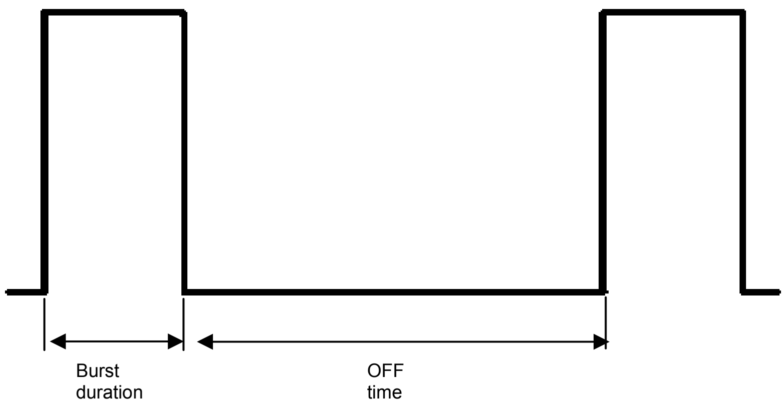


Fig. 1: Time slicing (schematic)

Time slicing is the transmission of data for a specific service in bursts rather than in a continuous stream (the TS is still continuous). Responding to signals in the transport stream, the receiver switches on only when a data burst is being transmitted. The receiver is then turned off during the OFF time. This results in a considerable reduction of the receiver's power requirements.

The R&S®DVM provides efficient and powerful analysis and monitoring functions which allow analysis of time slicing and of the transmitted data.

In order to illustrate the broad range of functions provided by the R&S®DVM, the following section will discuss the underlying details of DVB-H baseband.

5 The DVB-H Transport Stream (ETSI EN 301 192, ISO/IEC 13818-6)

This standard utilizes the Internet Protocol (IP) in order to flexibly accommodate DVB-H program contents in the different transport layers.

Multiprotocol encapsulation (MPE)

In DVB-H, multiprotocol encapsulation is used to carry IP packets over the MPEG-2 transport stream.

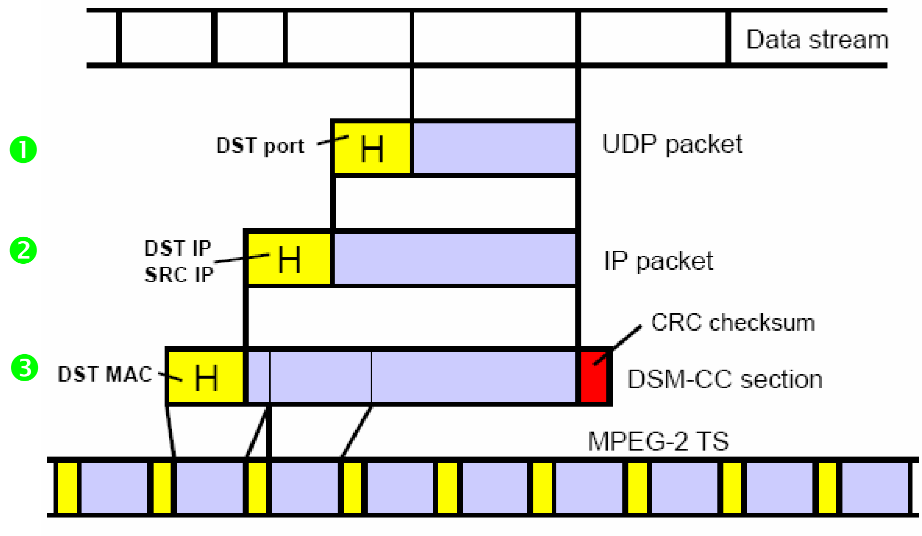


Fig. 2: Multiprotocol encapsulation (MPE) [1]

Multiprotocol encapsulation is a process in which data is integrated in data packets with different specifications so that it can be transported in different transport systems.

For DVB-H, MPE encapsulation is handled as follows:

➊ The data to be transmitted is bundled in user datagram protocol (UDP) packets (UDP packets only include the destination port in their header information since the protocol does not return an acknowledgment of receipt).

➋ The UDP packets are then packed in IP packets which do include the sender's and recipient's IP addresses in their header information.

➌ In the third and last step, the resulting IP packets are integrated in data storage media command and control (DSM-CC) sections (table id = 0x0E). These sections are defined in ISO/IEC 13818-6.

The header of a DSM-CC packet contains the following information:

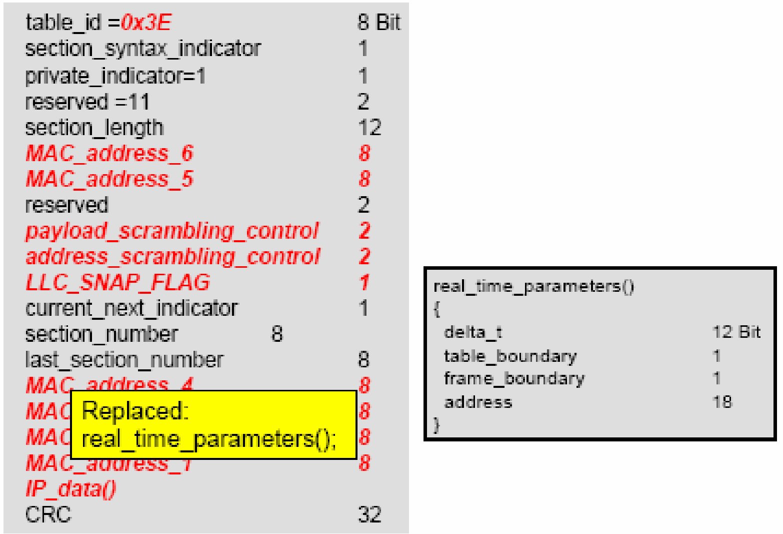


Fig. 3: DSM-CC header [1]

The recipient MAC address can be used as a selection criterion for addressing a specific service. However, only the last two bytes (5, 6) are used for this. This type of signaling can be used if different programs are transmitted in packets with the same PID. Bytes 1 to 4 are used to signal time slicing (see the preceding section). In DVB-H, those DSM-CC sections are referred to as MPE sections.

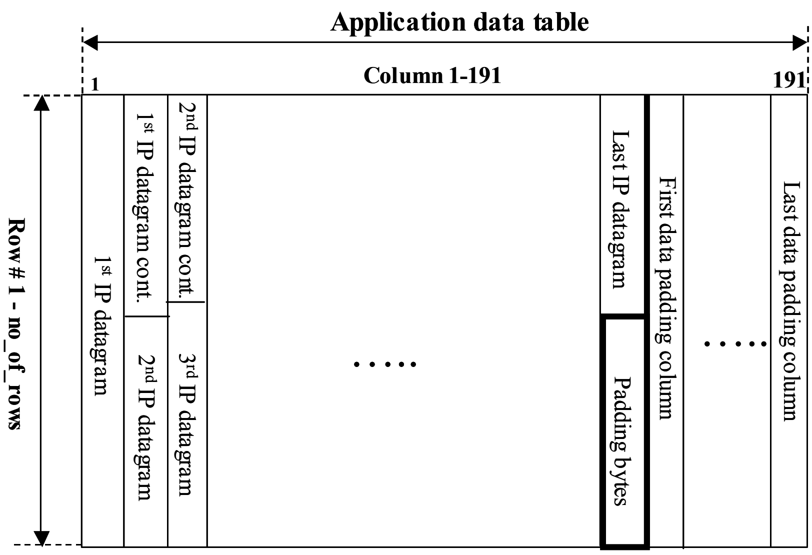


Fig. 4: User data in the application data table (MPE sections) [4]

The application data table (MPE section) consists of 191 columns with a maximum of 1024 rows. The IP datagrams (also called IP packets) constitute the payload of the MPE sections. Starting with the first byte in the upper left-hand corner (first cell), the IP datagrams are inserted column by column. The bytes are strung together as shown in Fig. 4. After all available IP datagrams have been inserted in the MPE section, the remaining cells are filled with zero bytes (which are also called padding bytes).

Multiprotocol encapsulation – forward error correction (MPE-FEC)

The DVB-H standard defines MPE-FEC sections (multiprotocol encapsulation – forward error correction) so that error-free IP datagrams for clean decoding can be achieved in spite of high packet losses which can occur, for instance, if the receiver moves at too high a speed.

MPE-FEC sections are normal MPE sections with Reed-Solomon encoding which then, by means of the resulting overhead (25% more), permits error correction on the decoder side.

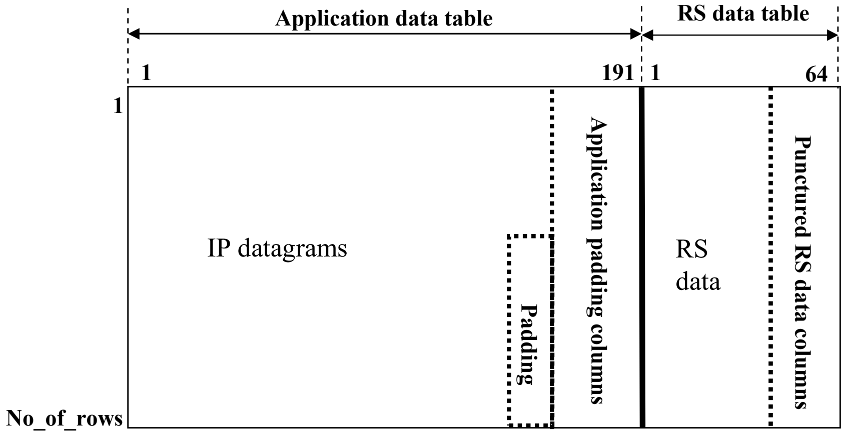


Fig. 5: MPE-FEC frame [4]

After the above-mentioned 191 columns in the application table have been filled, a 64-byte checksum can be calculated for each of the rows and inserted, row by row, into the RS data table. The overhead resulting from the FEC encoding can be reduced by omitting the RS columns. This procedure is called puncturing.

One MPE-FEC frame is transmitted in each time slice burst. The use of MPE-FEC sections is optional for each of the DVB-H services.

MPE signaling

The following excerpt from the implementation guidelines [5] will show the steps involved in MPE signaling:

"All IP platforms supported on a particular transport stream are announced in NIT (or optionally in BAT, in which case NIT announces the BAT). To access an INT sub_table on a particular transport stream, the below described procedure may be used:

- Search NIT for linkage_descriptor with linkage_type 0x0B.
    - If found, the descriptor announces the service_id and platform_id for each available INT sub_table.
    - If not found, search for linkage_descriptor with linkage_type 0x0C.

  - If found, the descriptor announces the BAT where linkage_descriptor with linkage_type 0x0B is available.

  - If not found, INT is not available, and IP services (if any) on the actual DVB network cannot be accessed.

- Search PMT sub_table using the service_id from the step 1.

- The PMT announces the elementary stream carrying a particular INT sub_table.

Note that selecting one of the INT sub_tables effectively selects the associated IP platform.

INT announces access parameters for IP streams, and associates each IP stream with an IP datagram stream. The access parameters consist of parameters to identify the DVB network (network_id), the transport stream (original_network_id and transport_stream_id), the DVB service (service_id) and the component (component_tag).

Selecting IP platform is typically done by the user. To receive an IP service, INT sub_table of the IP platform supporting the service is checked, to get access parameters for each of the IP datagram streams carrying the elements of the service.

Using the access parameters, receiver searches for the PMT sub_table (identified by the service_id), which then announces the elementary stream (identified by the component_tag) carrying the requested IP stream. On the elementary stream, the receiver typically would filter the IP stream based on IP address."

For a detailed description of the DVB-H transport stream, see [1].

6 R&S®DVM Analysis of DVB-H Signaling

The R&S®DVM family provides a broad range of functions for comprehensive monitoring and analysis of the above-referenced characteristics of the DVB-H transport stream.

Displaying DVB-H contents

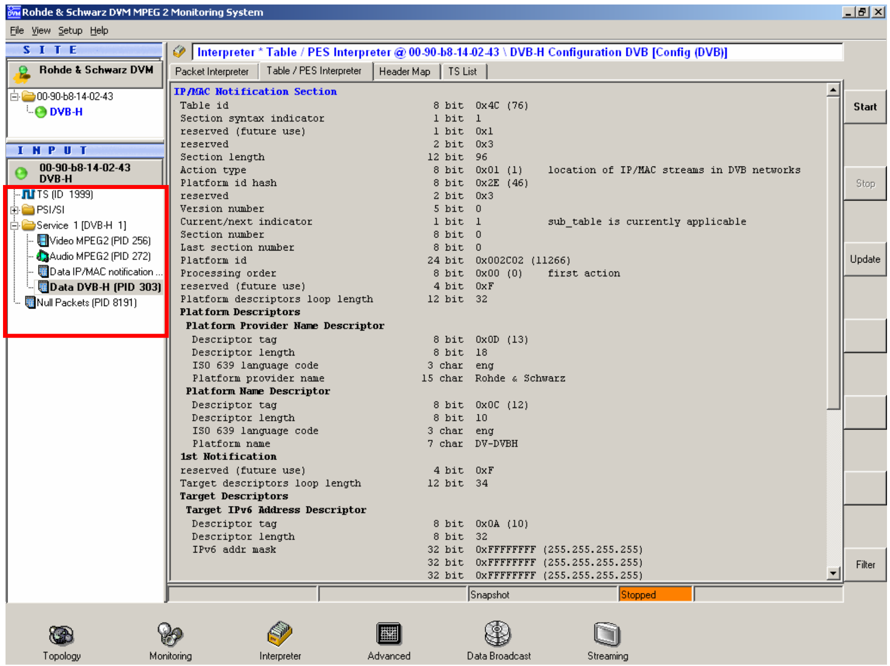


Fig. 6: DVB-H Signaling in the Transport Stream

As can be seen in the above screenshot, in the section marked in red, the contents of the transport stream are listed in a tree structure. In addition to the standard-specific tables (PSI/SI), all available programs are shown as folders.

The example above shows a program with additional data DVB-H content and standard encoded MPEG-2 audio and video.

In accordance with the standard, the IP/MAC notification table is interpreted as a service, which is why the INT is not listed under PSI/SI in the Service folder.

As noted in Section 4, the network information table (NIT), the IP MAC notification table (INT), and the program map table (PMT) have special significance for analyzing the signaling of the multiprotocol encapsulation (MPE) specified in the DVB-H standard.

The following steps will show how the R&S®DVM can be used to ensure correct signaling of the service.

The tables mentioned can be interpreted with the Interpreter application.

Fig. 7: Interpreter area

Interpretation of the PMT table

3rd Stream			
Stream type	8 bit	0x05 (5)	Private Sections
reserved	3 bit	0x7	
Elementary PID	13 bit	0x0120 (288)	
reserved	4 bit	0xF	
ES info length	12 bit	10	
Data Broadcast Id Descriptor			
Descriptor tag	8 bit	0x66 (102)	
Descriptor length	8 bit	8	
Data broadcast id	16 bit	0x000B (11)	IP/MAC Notification Table
Platform ID data length	8 bit	5	
Platform id	24 bit	0x002C02 (11266)	
Action type	8 bit	0x01 (1)	location of IP/MAC streams in DVB netw
reserved	2 bit	0x3	
INT versioning flag	1 bit	0	
INT version	5 bit	0	
4th Stream			
Stream type	8 bit	0x90 (144)	DVB-H MPE and MPE-FEC sections
reserved	3 bit	0x7	
Elementary PID	13 bit	0x012F (303)	
reserved	4 bit	0xF	
ES info length	12 bit	7	
Data Broadcast Id Descriptor			
Descriptor tag	8 bit	0x66 (102)	
Descriptor length	8 bit	2	
Data broadcast id	16 bit	0x0005 (5)	Multiprotocol Encapsulation
Stream Identifier Descriptor			
Descriptor tag	8 bit	0x52 (82)	
Descriptor length	8 bit	1	
Component tag	8 bit	0x26 (38)	

Fig. 8: PMT table

The program map table (PMT) contains references to all elementary streams of the selected service. As shown above, video, audio, and data ES references are listed in the stream loops.

Stream type, an 8-bit indicator, signals the contents of the elementary stream. Some examples:

0x01: MPEG-1 video

0x02: MPEG-2 video

0x05: private sections

0x90: DVB-H MPE and MPE-FEC sections

The entries for **Elementary PID** refer to the packet identifiers (PID) of the transport stream packets associated with each of the elementary streams.

For data services, the elementary stream is referenced via **Data Broadcast ID**, for example:

0x005: Multiprotocol encapsulation

0x00B: INT table

Interpretation of the INT table

```
Platform Descriptors
 Platform Provider Name Descriptor
  Descriptor tag                          8 bit  0x0D (13)
  Descriptor length                       8 bit  18
  ISO 639 language code                   3 char eng
  Platform provider name                 15 char Rohde & Schwarz
 Platform Name Descriptor
  Descriptor tag                          8 bit  0x0C (12)
  Descriptor length                       8 bit  10
  ISO 639 language code                   3 char eng
  Platform name                           7 char DV-DVBH
1st Notification
reserved (future use)                     4 bit  0xF
Target descriptors loop length           12 bit  34
Target Descriptors
 Target IPv6 Address Descriptor
  Descriptor tag                          8 bit  0x0A (10)
  Descriptor length                       8 bit  32
  IPv6 addr mask                         32 bit  0xFFFFFFFF (255.255.255.255)
                                         32 bit  0xFFFFFFFF (255.255.255.255)
                                         32 bit  0xFFFFFFFF (255.255.255.255)
                                         32 bit  0xFFFFFFFF (255.255.255.255)
  IPv6 addr                              32 bit  0xFF0E0000 (255. 14.  0.  0)
                                         32 bit  0x00000000 (  0.  0.  0.  0)   ❶
                                         32 bit  0x00000000 (  0.  0.  0.  0)
                                         32 bit  0x000000AB (  0.  0.  0.171)
reserved (future use)                     4 bit  0xF
Operational descriptors loop length      12 bit  11
Operational Descriptors
 IP/MAC Stream Location Descriptor
  Descriptor tag                          8 bit  0x13 (19)
  Descriptor length                       8 bit  9
  Network id                             16 bit  0x07D0 (2000)
  Original network id                    16 bit  0x07D0 (2000)   ❷
  Transport stream id                    16 bit  0x07CF (1999)
  Service Id                             16 bit  0x0001 (1)
  Component tag                           8 bit  0x26 (38)
CRC 32                                   32 bit  0x3435784E  CRC ok
```

Fig. 9: IP/MAC notification (INT) table

As described under "Multiprotocol encapsulation (MPE)" (Section 4), the elementary streams in DVB-H are integrated into the DSM-CC section of the transport stream via IP packets.

The INT table takes on a kind of signaling function for the transmitted IP packets. Fig. 9 shows the specified destination IP address (❶) for the IP contents which are transmitted via the selected service (❷).

Network id, Transport stream id and Service ID form a unique triplet, which identifies a service consisting of one or more PIDs.

Interpretation of the NIT table

In general, the network information table describes all physical parameters of a DVB transmission channel.

Transport descriptors length	12 bit	23	
Service List Descriptor			
Descriptor tag	8 bit	0x41 (65)	
Descriptor length	8 bit	3	
Service List			
Service id	16 bit	0x0001 (1)	
Service type	8 bit	0x01	digital television service
Terrestrial Delivery System Descriptor			
Descriptor tag	8 bit	0x5A (90)	
Descriptor length	8 bit	11	
Centre frequency	32 bit	0x02DF7940	482.000000 MHz
Bandwidth	3 bit	0	8 MHz
Priority	1 bit	1	high priority
Time_Slicing_indicator	1 bit	0	Time Slicing used
MPE-FEC indicator	1 bit	0	MPE-FEC used
reserved (future use)	2 bit	0x3	
Constellation	2 bit	2	64-QAM
Hierarchy information	3 bit	4	non-hierarchical, in-depth interleaver
Code rate (HP stream)	3 bit	1	code rate 2/3
Code rate (LP stream)	3 bit	1	code rate 2/3
Guard interval	2 bit	2	1/8
Transmission mode	2 bit	1	8k mode
Other frequency flag	1 bit	0	no other frequency in use
reserved (future use)	32 bit	0xFFFFFFFF	
Time Slice and FEC Identifier Descriptor			
Descriptor tag	8 bit	0x77 (119)	
Descriptor length	8 bit	3	
Time Slizing	1 bit	1	used
MPE-FEC	2 bit	1	used with Reed-Solomon (255,191,64)
reserved (future use)	2 bit	0x3	
Frame Size	3 bit	3	2048 kbits 1024 rows
Max Burst Duration	8 bit	255	5120 ms
Max Average Rate	4 bit	4	256 kbps
Time Slice FEC Id	4 bit	0x0 (0)	
CRC 32	32 bit	0x18B01723	CRC ok

Fig. 10: Network information table (INT)

In our case, the NIT contains the time_slice_fec_identifier descriptor (green). It provides basic non-dynamic information on, for example maximum burst duration, burst size and FEC in use.

7 Time-Slicing - R&S®DVM DVB-H Time Slice Analyzer

The DVB-H time slice analyzer (❶) can be selected in the "Streaming" application of the R&S®DVM. When "Start" (❷) is pressed, the R&S®DVM DVB-H time slice analyzer (❸) opens in a separate window.

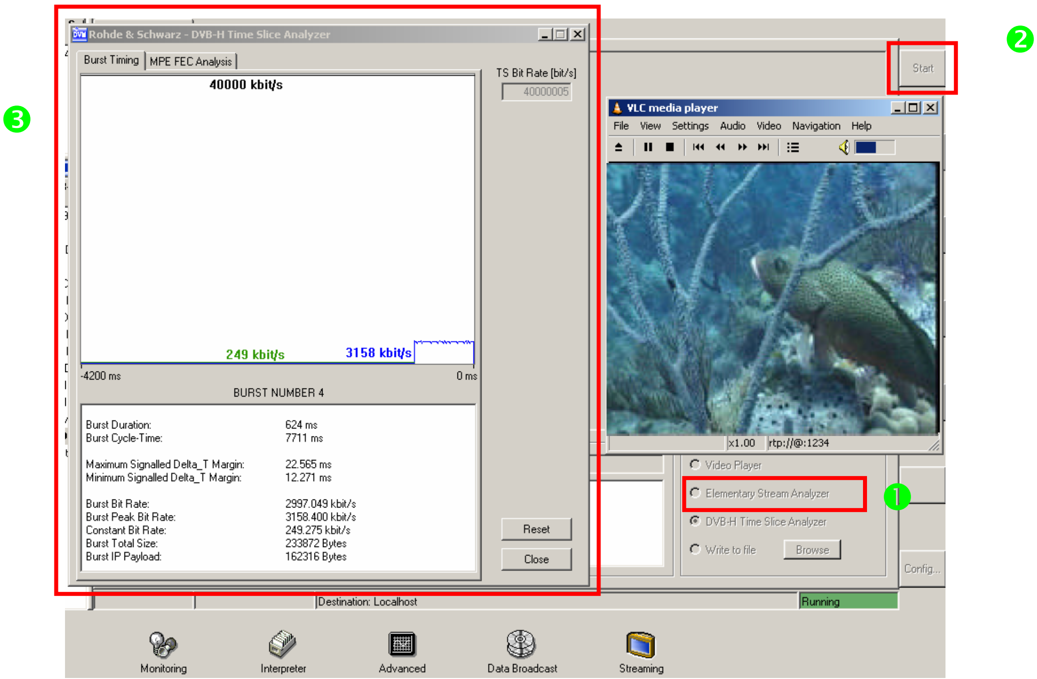


Fig. 11: Time slice analyzer

The window consists of two panes:

- Burst Timing – measured values and diagrams pertaining to burst timing and data rates
- MPE FEC Analysis – measured values such as power savings, burst timing and data rates (includes the values from the Burst Timing pane)

In the following sections, we will discuss the measured values that are displayed in the window panes.

Measurement parameters

Various DVB-H transmission parameters can be determined under ETSI EN 101 192; these parameters are displayed on the R&S®DVM. But the R&S®DVM also provides other functionalities.

Burst Timing

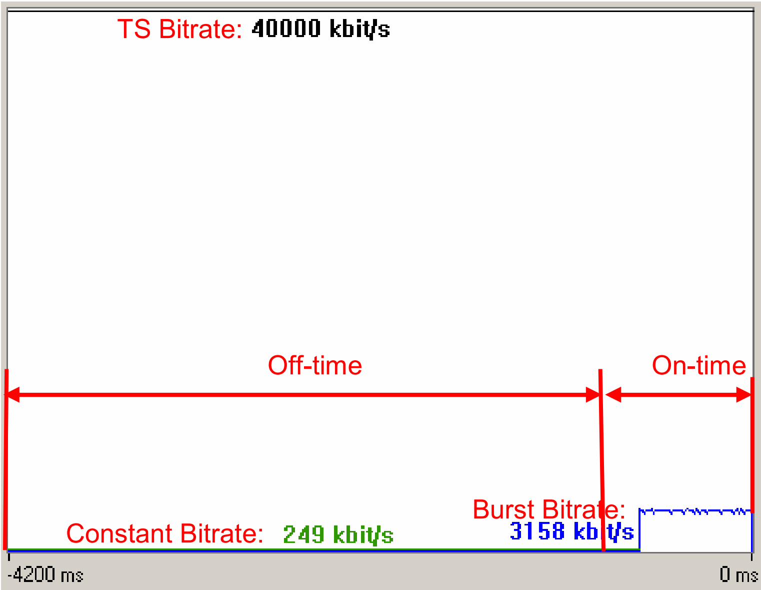


Fig. 12: Burst timing diagram

The above diagram shows the burst structure of the incoming transport stream. Labels for the measured values are shown in red.

The following sections of this document contain a detailed description of the measured burst timing and data rate values which are shown both in the diagram and in the list below. The measured values listed under "Burst Timing" can also be found as a subset under "MPE-FEC analysis."

MPE-FEC analysis

The parameters displayed are categorized under FEC, power save function, bandwidth, and transmission.

FEC:

FEC:	Used
Number of Rows:	1024
Number of Padding Columns:	28
Number of Puncturing Bytes:	0
Burst FEC Code Rate:	0.718

FEC Indicates if forward error correction of the MPE sections is being used.

Number of Rows (N_R) If FEC is activated, the number of rows of the MPE-FEC frame is shown here.

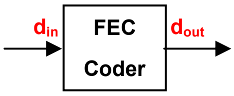
Number of Padding Columns (N_{PC}) If FEC is activated, the number of padding columns of the MPE-FEC frame is shown here.

Number of Puncturing Bytes (N_{PB})

If FEC is activated, the number of puncturing bytes of the MPE-FEC frame is shown here.

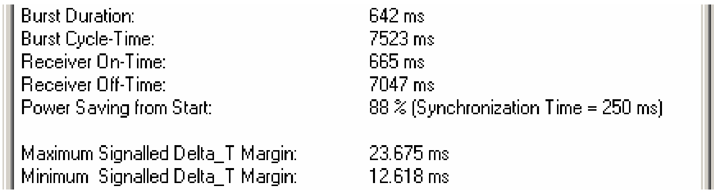
Burst FEC Code Rate (C_R)

If FEC is activated, the burst FEC code rate is shown here.



$$C_R = \frac{191 - N_{PC}}{255 - N_{PC} - N_{PB}}$$

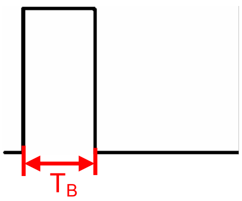
Power Save Function:



Burst Duration:	642 ms
Burst Cycle-Time:	7523 ms
Receiver On-Time:	665 ms
Receiver Off-Time:	7047 ms
Power Saving from Start:	88 % (Synchronization Time = 250 ms)
Maximum Signalled Delta_T Margin:	23.675 ms
Minimum Signalled Delta_T Margin:	12.618 ms

Burst Duration (T_B)

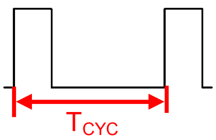
Burst duration in ms



Burst Cycle-Time (T_{CYC})

Burst cycle time in ms.

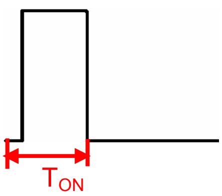
The burst cycle time (**T_{CYC}**) indicates the time interval between the starting points of two bursts.



Receiver On-Time (T_{ON})

Receiver on-time in ms.

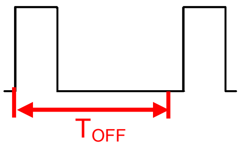
The receiver on-time (**T_{ON}**) is derived from the burst duration (**B_d**) and the current maximum delta_T_margin.



$T_{ON} = B_d$ + max Delta_T_Margin

Receiver Off-Time (T_{OFF})

Receiver off-time in ms.



The receiver off-time ($\mathbf{T_{OFF}}$) is derived from the burst cycle duration ($\mathbf{T_{CYC}}$) minus the receiver on-time ($\mathbf{T_{ON}}$).

$T_{OFF}=T_{CYC}-T_{ON}$

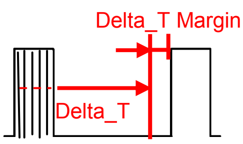
Power Saving from Start (Ps)

Power savings in % (synchronization time S_t = 250 ms), compared to a signal without time slicing.

$P_s=(1-((B_d+S_t+(3/4xD_j))xC_bx0.96)/B_s)x100\%$

Maximum Signalled Delta_T Margin

Maximum delta_T margin in ms.



The delta_T margin marks the space between the signaled delta_T instant and the actual start of a burst.

Minimum Signalled Delta_T Margin

Minimum delta_T margin in ms.

See the above graph.

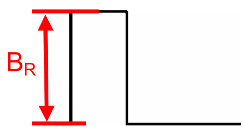
Bandwidth:

Burst Bit Rate:	2995.431 kbit/s
Burst Peak Bit Rate:	3158.400 kbit/s
Constant Bit Rate:	248.686 kbit/s
Burst Total Size:	240264 Bytes
Burst IP Payload:	166408 Bytes
DVB-H Encapsulation Overhead:	31 %

Burst Bit Rate (B_R)

Mean burst bit rate ($\mathbf{B_R}$) in kbit/s

.



Burst Peak Bit Rate (P_R)

Peak bit rate ($\mathbf{P_R}$) in kbit/s. The time required to determine this value is 10 ms.

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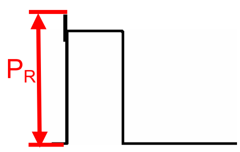
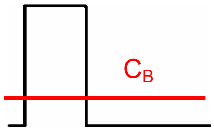


Constant Bit Rate (C_B)

Mean bit rate in kbit/s



The equivalent bit rate (**C_B**) for a continuous data stream.

Burst Total Size (B_T)

Total burst size in bytes.

$$\mathbf{B_T = B_R \times T_B}$$

Burst IP Payload (B_{IP})

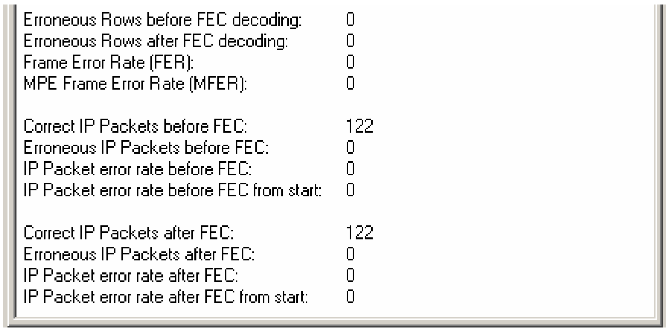
Size of the burst's IP payload in bytes.

DVB-H Encapsulation Overhead (E_{OV})

Overhead in % resulting from DVB-H encapsulation.

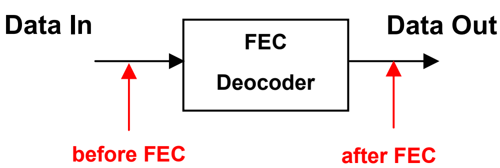
$$E_{OV} = \frac{B_T - B_{IP}}{B_T} \times 100\%$$

Transmission:



Erroneous Rows before FEC decoding:	0
Erroneous Rows after FEC decoding:	0
Frame Error Rate (FER):	0
MPE Frame Error Rate (MFER):	0
Correct IP Packets before FEC:	122
Erroneous IP Packets before FEC:	0
IP Packet error rate before FEC:	0
IP Packet error rate before FEC from start:	0
Correct IP Packets after FEC:	122
Erroneous IP Packets after FEC:	0
IP Packet error rate after FEC:	0
IP Packet error rate after FEC from start:	0

In order to determine the transmission path quality, the R&S®DVM provides a function to analyze various data structures for errors and to indicate whether or not an error correction function can remove the errors.



General definition of the error rate: $e = \frac{IU_{erroneous}}{IU_{total}}$;

where IU = units of information

Erroneous Rows before FEC decoding	Number of erroneous MPE-FEC rows before FEC decoding
Erroneous Rows after FEC decoding	Number of erroneous MPE-FEC rows after FEC decoding
Frame Error Rate from Start	Frame error rate from the start of the measurement, before FEC decoding
MPE Frame Error Rate from Start	Frame error rate from the start of the measurement, after FEC decoding
Correct IP Packets before FEC	Number of error-free IP packets before FEC decoding
Erroneous IP Packets before FEC	Number of erroneous IP packets before FEC decoding
IP Packet Error Rate before FEC	IP packet error rate before FEC decoding
Correct IP Packets after FEC	Number of error-free IP packets after FEC decoding
Erroneous IP Packets after FEC	Number of erroneous IP packets after FEC decoding
IP Packet Error Rate after FEC	IP packet error rate after FEC decoding

8 Multiprotocol Encapsulation (MPE) – R&S®DVM Data Broadcast Analysis

The data broadcast analysis provides versatile features for the analysis of the data transmitted via MPE; the various steps of analysis correspond to the individual encapsulation steps.

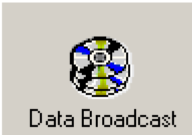


Fig. 13: Data broadcast analysis

When the user clicks a data DVB-H service, various transmission parameters/data are displayed, depending on which area was selected for analysis.

Data broadcast analysis – GUI

The Protocol (➊), Content (➋), and Content Details (➌) panes are displayed in all analysis areas, i.e. Overview, Interpreter, Raw Data, and Carousel Timing.

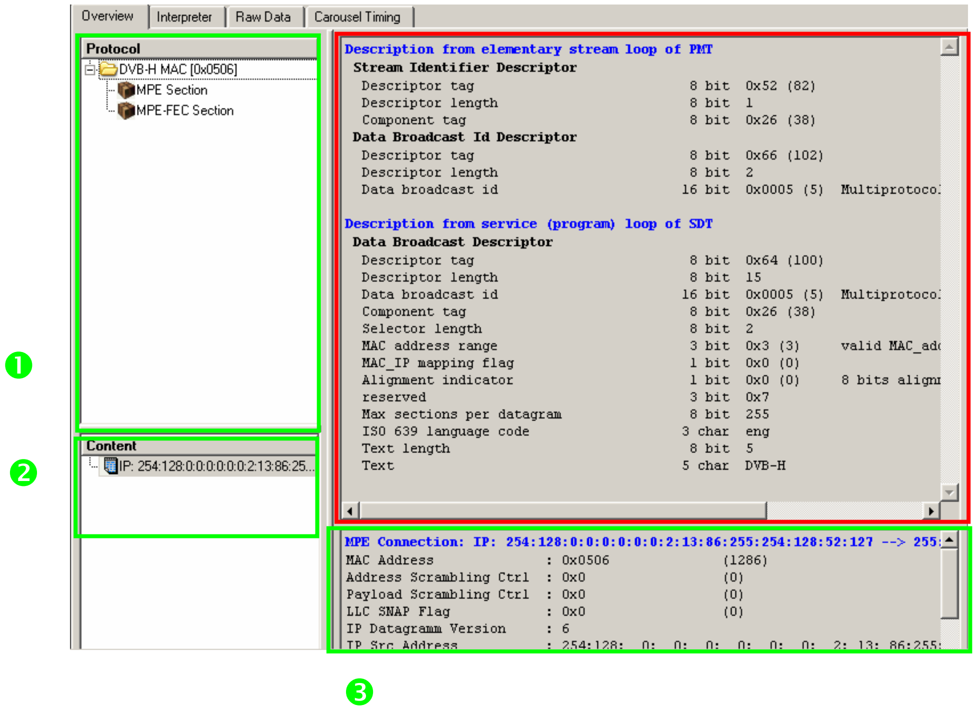


Fig. 14: Data broadcast analysis, GUI

Protocol (❶)

The Protocol pane of the data broadcast analysis shows the data transmission protocol. For DVB-H analysis, a folder structure labeled "DVB-H MAC" is displayed. In the contents of the folder, the DSM-CC sections are grouped into "MPE Section" and "MPE FEC Section".

Content (❷)

The Content pane shows the content of the data transmitted via the DSM-CC sections. DVB-H data is transported via IP packets, and therefore specific packets are displayed here. IP packets are identified by originating and destination IP address (in accordance with Ipv6).

Content Details (❸)

The lower section of the screen shows further details with respect to the transported IP content and correlating, DVB-H-specific information.

The following sections will discuss in detail the various analysis features of the R&S®DVM, which are available in the Overview, Interpreter, and Raw Data views.

Data broadcast analysis features

The analysis window, shown in red in the picture on page 21, provides the user with various analysis functions for the DVB-H elementary stream.

Overview

Description from elementary stream loop of PMT			
Stream Identifier Descriptor			
Descriptor tag	8 bit	0x52 (82)	
Descriptor length	8 bit	1	
Component tag	8 bit	0x26 (38)	
Data Broadcast Id Descriptor			
Descriptor tag	8 bit	0x66 (102)	
Descriptor length	8 bit	2	
Data broadcast id	16 bit	0x0005 (5)	Multiprotocol Encapsulation
Description from service (program) loop of SDT			
Data Broadcast Descriptor			
Descriptor tag	8 bit	0x64 (100)	
Descriptor length	8 bit	15	
Data broadcast id	16 bit	0x0005 (5)	Multiprotocol Encapsulation
Component tag	8 bit	0x26 (38)	
Selector length	8 bit	2	
MAC address range	3 bit	0x3 (3)	valid MAC_address byte are bytes 6 to 4
MAC_IP mapping flag	1 bit	0x0 (0)	
Alignment indicator	1 bit	0x0 (0)	8 bits alignment
reserved	3 bit	0x7	
Max sections per datagram	8 bit	255	
ISO 639 language code	3 char	eng	
Text length	8 bit	5	
Text	5 char	DVB-H	

Fig. 15: Data broadcast analysis, Overview view

The view shows the references within the transport stream which point to the active DVB-H elementary stream. That allows a quick overview of the signaling of the elementary stream.

Interpreter

```
Table: datagram_section (MPE) for DVB-H
 table_id                            8 bit  0x3E        DSM_CC sections with private data
 section_syntax_indicator            1 bit  1
 private_indicator                   1 bit  0
 reserved                            2 bit  0x3
 section_length                     12 bit  1377
 Section (MPE) for DVB-H
  MAC_address_6                      8 bit  0x06
  MAC_address_5                      8 bit  0x05
  reserved                           2 bit  0x3
  payload_scrambling_control         2 bit  0
  address_scrambling_control         2 bit  0
  LLC_SNAP-flag                      1 bit  0
  current_next_indicator             1 bit  1
  section_number                     8 bit  0
  last_section_number                8 bit  0
  delta_t                           12 bit  769         in units of 10 ms
  table_boundary                     1 bit  0
  frame_boundary                     1 bit  0
  address                           18 bit  0x00000     FEC
  IP_datagram                    1364 bytes shown in Raw Data
  CRC_32                            32 bit  0xED5601F5  CRC32 ok
```

Fig. 16: Data broadcast analysis, Interpreter view

When the corresponding section (MPE or MPE-FEC) is selected, the DSM-CC header for DVB-H can be displayed. The individual sections can be differentiated as follows:

MPE: table_id = 0x3E (IP data)

MPE-FEC: table_id = 0x78 (Reed-Solomon data)

As was described in Section 4, realtime parameters (green) are transmitted in the sections. They tell the receiver when it can go off-line:

- delta_t: Time to start of next burst from 1st byte of this DSM-CC section
- table_boundary: If FEC in use, this is set to 1 for the last sectio of MPE data; i.e. all further sections in this burst must be FEC data
- frame_boundary: If FEC in use, then set to 1 for the last FEC section in this burst
- address: row.column address of the section data in the application data table

Raw data


```
  0: 0xBC 0x97 0xE7 0x6A 0x26 0x1E 0xAE 0x3B 0x3B 0x06 ...j;.
 10: 0xAA 0x0E 0x4B 0x5F 0xF9 0x41 0x67 0x87 0x5A 0x14 ..K_.Ag.Z.
 20: 0xB5 0xE3 0x67 0x0D 0xA3 0x9D 0xA1 0x33 0xED 0xE5 ..g....3..
 30: 0x47 0xCA 0xE0 0x7B 0x32 0xF3 0xB2 0x14 0x39 0x85 G..{2...9.
 40: 0xFF 0xF9 0x7B 0x6D 0xEE 0x41 0x6A 0xB8 0xC7 0x90 ..{m.Aj...
 50: 0x65 0x1E 0xCD 0x5F 0x14 0x13 0x42 0x68 0x71 0xF9 e.._..Bhq.
 60: 0x4F 0x51 0x0B 0xDC 0x1E 0x6F 0xA7 0x4D 0x9D 0xD8 OQ...o.M..
 70: 0x0A 0xB0 0x5E 0xCA 0x0F 0xED 0xA4 0x8C 0xD1 0x59 ..^......Y
 80: 0x26 0x9C 0x6B 0x15 0x19 0xD4 0xFC 0xF1 0x75 0x3B
 90: 0x25 0xEC 0xF1 0x05 0x74 0x54 0x10 0x4A 0xD3 0x63 %...tT.J.c
100: 0x2F 0x0E 0xC6 0x1F 0xE8 0x0E 0xDB 0xD1 0x0B 0x69 /........i
110: 0xFF 0x01 0xF4 0x97 0x3D 0x85 0xD4 0xC1 0x45 0x10 ....=...E.
120: 0x77 0xCC 0x23 0xE4 0x98 0x25 0x11 0x03 0x3F 0x83 w.#..%..?.
130: 0xD3 0xD0 0xE3 0x28 0xEB 0x16 0x91 0x39 0xD8 0x81 ...(...9..
140: 0xEF 0x40 0xC7 0xC1 0x8A 0x80 0xD5 0xFE 0x83 0x92 .@........
150: 0x66 0xB8 0x46 0x8B 0x72 0x7E 0xAC 0xF8 0x91 0x3F f.F.r~...?
160: 0x17 0x6D 0x41 0x3B 0x57 0x9E 0x4D 0x26 0x3E 0xE7 .mA;W.M&>.
170: 0xFA 0x12 0x2B 0x7E 0x79 0x53 0xC7 0x2F 0xE1 0x56 ..+~yS./.V
180: 0xE2 0xDF 0x46 0x91 0x46 0xCA 0xF7 0x43 0x49 0x5A ..F.F..CIZ
190: 0x0E 0x59 0x67 0x04 0x28 0x41 0xF6 0x10 0x06 0x74 .Yg.(A...t
200: 0x45 0xE5 0x9B 0xF5 0xC4 0xA6 0x4A 0x8D 0x09 0x5D E.....J..]
210: 0xF1 0xF5 0xC3 0xBA 0x6D 0x8C 0x54 0xA9 0xA5 0xD9 ....m.T...
220: 0x74 0xA2 0x57 0x0A 0xA0 0x97 0xAB 0x7C 0xD9 0xDF t.W....|..
230: 0x31 0x89 0xAB 0x2B 0x89 0xAC 0x6A 0x69 0x09 0xBF 1..+..ji..
```


Fig. 17: Raw Data view

The Raw Data view shows the payload of the DSM-CC sections in ASCII format.

9 Abbreviations

ASCII	American Standard Code for Information Interchange
BAT	Bouquet Association Table
COFDM	Coded Orthogonal Frequency Division Multiplexing
DSM-CC	Data Storage Media Command and Control
DVB-H	Digital Video Broadcasting for Handhelds
DVB-T	Digital Video Broadcasting for Terrestrial Applications
EN	European Norm
ES	Elementary Stream
ETSI	European Telecommunications Standards Institute
FEC	Forward Error Correction
GUI	Graphical User Interface
IEC	International Electrotechnical Commission
INT	IP/MAC Notification Table
IP	Internet Protocol
ISO	International Organization for Standardization
MAC	Media Access Control
MPE	Multi Protocol Encapsulation
MPEG	Moving Pictures Experts Group
NIT	Network Information Table
PID	Packet Identifier
PMT	Program Map Table
PSI	Program Specific Information
RF	Radio Frequency
RS	Reed-Solomon
SFN	Single Frequency Network
SI	System Information
TS	Transport Stream
UDP	User Datagram Protocol

10 Bibliography

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11 Additional Information

Our application notes are revised and updated from time to time. To check if a new version is available, please visit http://www.rohde-schwarz.com.

Please direct any comments or suggestions concerning these application notes to Broadcasting-TM-Applications@rsd.rohde-schwarz.com.

12 Ordering Information

R&S® DVM50	**MPEG-2 Monitoring System**	**2085.1900.02**
R&S® DVM-K1	Additional TS Input	2085.5211.02
R&S® DVM50-K10	In-Depth Analysis	2085.5434.02
R&S® DVM-K11	Data Broadcast Analysis	2085.5311.02
R&S® DVM100	**MPEG-2 Monitoring System**	**2085.1600.02**
R&S® DVM120	**MPEG-2 Monitoring System**	**2085.1700.02**
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R&S® DVM-K1	Additional TS Input	2085.5211.02
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R&S® DVM-K2	TS Capture	2085.5234.02
R&S® DVM-K11	Data Broadcast Analysis	2085.5311.02
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R&S® DVM400-B3	Upgrade TS Recorder up to 90 Mbit/s	2085.5528.02
R&S® DVM400-B4	Upgrade TS Recorder up to 214 Mbit/s	2085.5534.02
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