



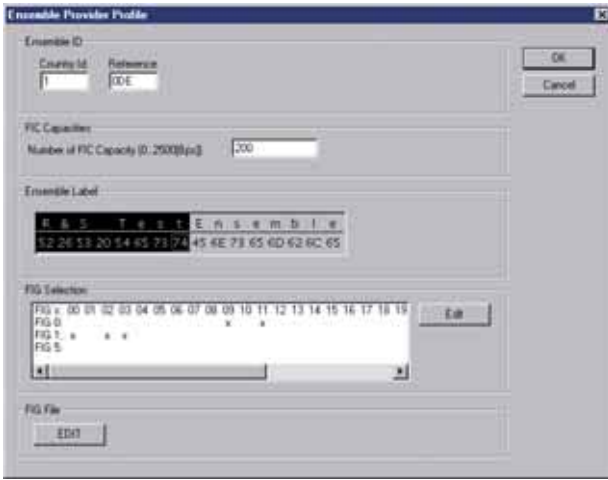
DAB STI Ensemble Multiplexer R&S® DM001

With redundancy and professional management

- ◆ Full DAB implementation
- ◆ Compatible with all relevant DAB standards:
 - EN 300 401 (DAB general)
 - ETS 300 799 (ETI)
 - EN 300 797 (STI)
- ◆ Highest STI layer in accordance with TS 101 860
- ◆ Implementation in accordance with DAB guidelines in TR 101 496 1-3
- ◆ Modular design with four, eight or twelve inputs
- ◆ Internal buffer for asynchronous signals
- ◆ Input signals, physical: V.11/X.21, G.703, WG1/2
- ◆ Input signals, logical: STI(PI, G.704/2), STI(PI, V.11), STI(PI, G.703), STI(PI, WG1/2), ETI(NI)
- ◆ DAB MPEG audio via G.704, X.21, WG1/2
- ◆ ETI output signals: ETI(NA, G.704)₅₅₉₂, ETI(NA, G.704)₅₃₇₆, ETI(NI, G.703)
- ◆ STI back channel: STI(PI, G.704/2), STI-C(TA) with RS-232-C, STI-C(TA) via IP
- ◆ Processing of all defined fast information groups
- ◆ Support of all types of uninterrupted reconfigurations
- ◆ Versatile clock synchronization capabilities
- ◆ Alarm signalling contacts
- ◆ Easy monitoring via GUI
- ◆ Redundancy system with frame-synchronous maintenance switchover
- ◆ Professional management for operation monitoring
- ◆ Time synchronization of different ensembles
- ◆ Optional SNMP support



ROHDE & SCHWARZ



Input mask for configuring the R&S DM001 with ensemble controller

Characteristics and applications

The DAB STI Ensemble Multiplexer R&S DM001 is part of the DAB transmission chain from Rohde&Schwarz. It is the result of a cooperation with Deutsche Telekom and Fraunhofer Institute for Integrated Circuits. The R&S DM001 has been continuously improved and now offers full DAB implementation in accordance with EN300401.

The multiplexer forms an integral part of the DAB network and combines incoming audio and data channels to form the ensemble transport interface (ETI), which in turn drives the subsequent COFDM modulators and the entire transmitter network.

The 19" multiplexer of three height units (HU) includes up to three input boards with a maximum of twelve physical inputs and a DSP board. The ETI and STI output boards generate the ETI ensemble and the STI-C back channel.

The multiplexer has a flexible structure of up to 30 logical input channels suitable for various data formats and protocols. The R&S DM001 provides a large buffer for signals that are not locked to the network clock in order to compensate for their asynchronous behaviour.

Each DAB ensemble is a program and data multiplex. With conventional analog broadcasting, the service provider (SP) was able to offer only one program service, but can now generate a dedicated service multiplex from different program and data services. Configuration is dynamically adaptable.

The DAB standard STI (service transport interface) allows optimum use of the ensemble since several service providers are managed within one ensemble. Each service provider is fully flexible within the

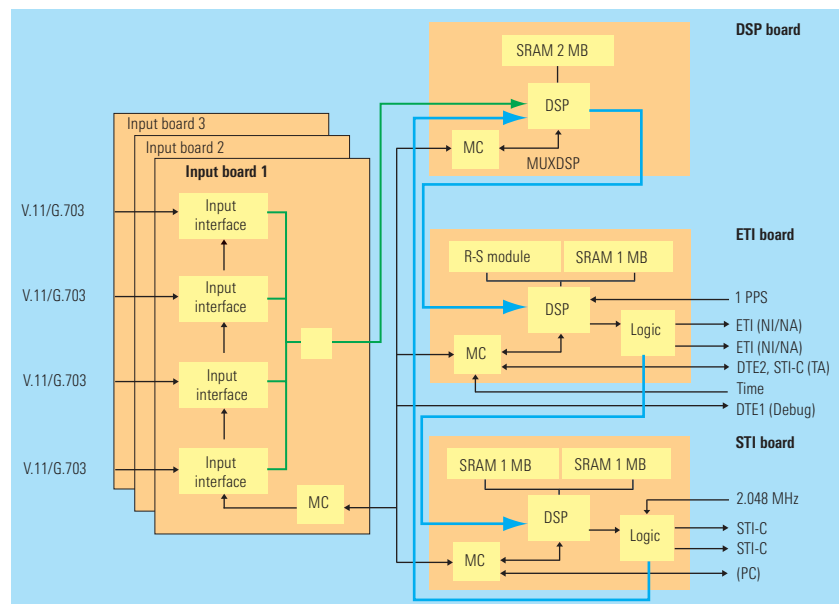
resources it has been assigned, i.e. it can always completely change its configuration, independently of other service providers. The R&S DM001 can manage up to eight service provider profiles (SPP).

The multiplexer supports time-synchronized dynamic reconfigurations in a six-second frame. For this purpose, it is locked to a reference time and reference clock.

Static service information can be easily saved; the R&S DM001 automatically performs DAB-conformant transmission.

Professional Management Software R&S DM001-P is optionally available, ensuring easy handling and straightforward monitoring during regular operation. Monitoring includes the ensemble multiplexer as well as distribution to the DAB transmitters (ETI) and the service providers (STI-C back channel).

To ensure maximum reliability, a redundancy system is available (R&S DM001-R). It expands professional management software by a standby multiplexer; in the case of failure, operation is switched to this standby multiplexer.



Block diagram of the DAB STI Ensemble Multiplexer R&S DM001

In the case of maintenance, frame-synchronous multiplexer switchover is possible.

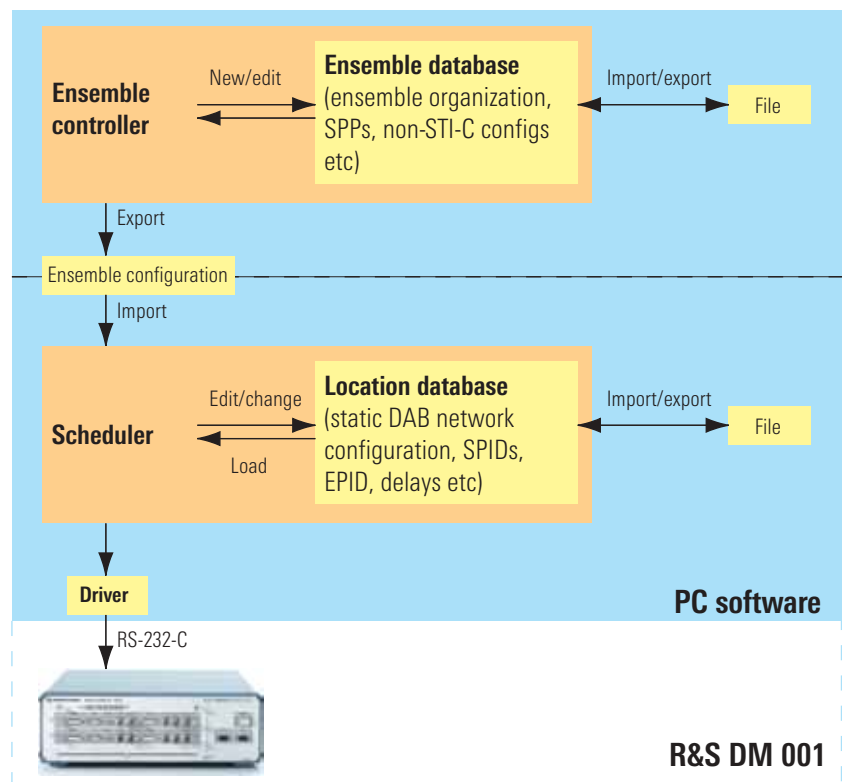
Configuration

The R&S DM001 is configured via an external PC. Ensemble controller user software (R&S DM001-EC) runs under Windows NT/2000 or XP; it permits configuration of DAB ensembles. Basic R&S DM001 status information can be queried and displayed via the controller.

The ensemble controller software can be used to perform the requested configuration in the offline mode, i.e. without being connected to the R&S DM001. The configurations can easily be generated in the office and exported as a file (*.cfg), which will then be loaded in combination with an R&S DM001 via the software scheduler. The scheduler controls the time when the configurations are transmitted to the R&S DM001. Configuration-specific data is expanded by statistical information from the location database.

Statistical information therefore needs to be entered only during initial setup.

The R&S DM001 performs reconfigurations during operation without any interruption.



Function of Software R&S DM001-EC

The current configuration of a location can be exported at any time via the scheduler and is thus easy to restore, independently of the control PC. The scheduler manages several location configurations in its database; switching between them is easy.

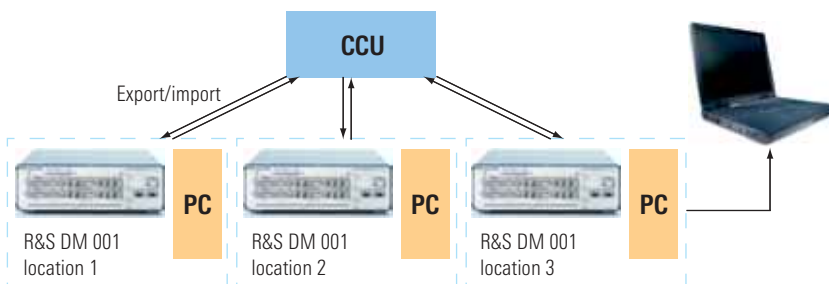
It also checks whether the ensemble configuration saved to the location configuration is actually loaded in the connected R&S DM001. This ensures that the location database is always up to date.

Professional Management Software R&S DM001-P

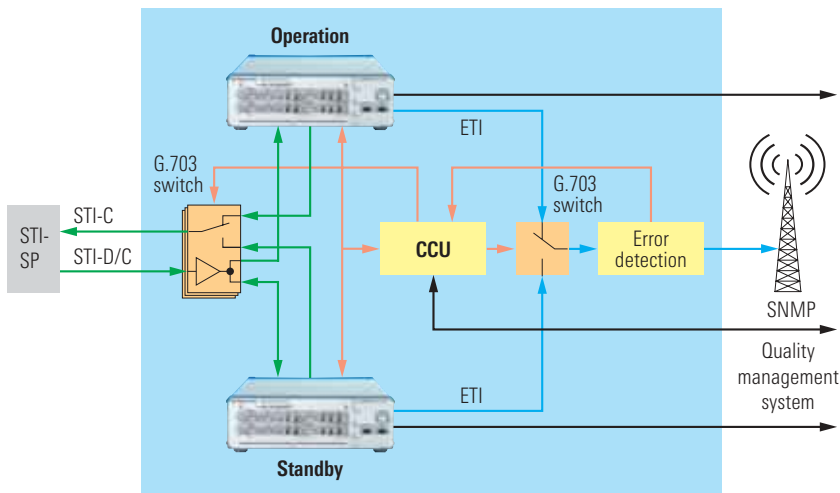
For easy operation and maintenance of the R&S DM001, Professional Management Software R&S DM001-P is available as an option; it monitors the R&S DM001 and provides clear and straightforward display of the status information on a graphical user interface.

Both the R&S DM001 and the control PC provide relay contacts via the I/O board for remote monitoring. Professional remote monitoring of the R&S DM001-P is optionally possible via SNMP (option R&S DM001-T).

All messages are saved to a dedicated logbook. Moreover, all entries are backed up in the Windows event display for permanent archiving.



Central configuration and data backup



System concept of the Redundancy DAB Ensemble Multiplexer R&S DM001-R

Redundancy DAB Ensemble Multiplexer R&S DM001-R

Maintenance work or failure of the ensemble multiplexer will disturb the entire DAB ensemble. The complementary R&S DM001-R redundancy solution increases the availability of the multiplexer and ensures easy and straightforward monitoring.

The system consists of two R&S DM001 units as a 1+1 hot standby configuration. The basic system also includes the central control unit (CCU) control software as well as accessories for integrating additional equipment. If the CCU detects an error, it automatically switches to the standby multiplexer.

Distributors on the R&S DM001-R input side distribute the incoming signal to both R&S DM001 units. Distributors adapted to G.703/G.704 or V.11/WG1/2 allow any configuration possible on a single multiplexer to be run also in redundancy. The system is of modular design and can always be adapted to varying demands.

The distributors and the two multiplexers transmit the status information to the control software and display it. In the case of maintenance, switchover between the two multiplexers is frame-synchronous. Thus, a multiplexer can be

replaced without interfering with the transmit signal.

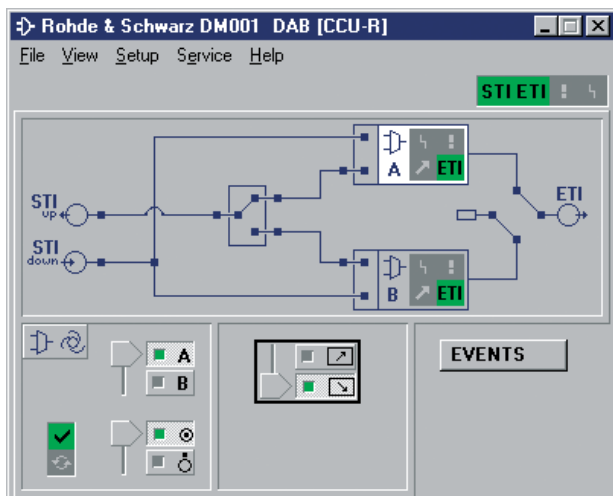
The entire R&S DM001-R system is connected like a single multiplexer. It can be expanded by the functionality provided by Professional Management Software R&S DM001-P, i.e. integration of the output signal distribution.

Since signal distribution may also cause errors in a DAB network, this considerably increases the reliability of the entire system.

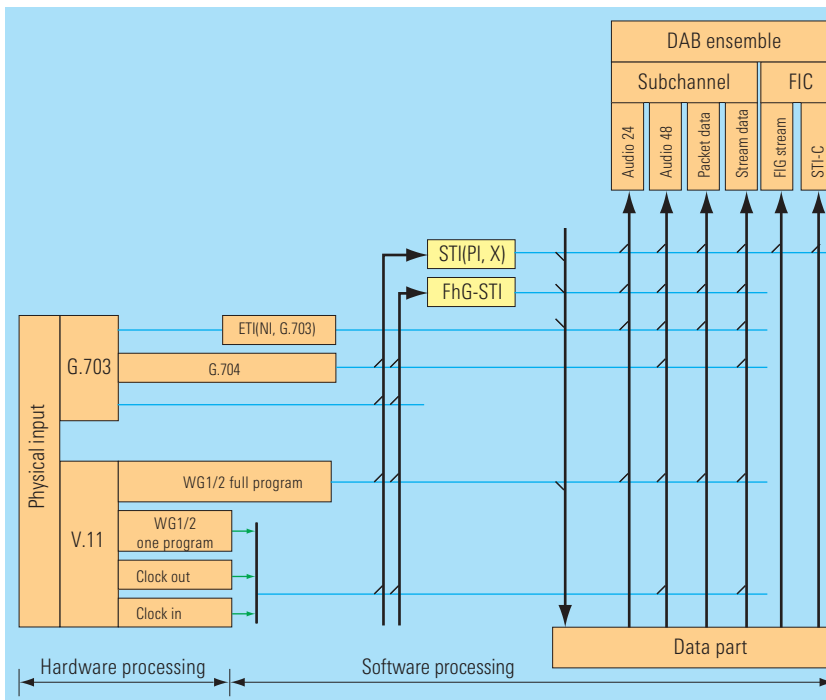
Remote monitoring and backup are similar to the R&S DM001-P.

Input interfaces

- ◆ Physical
 - V.11/X.21
 - G.703
- ◆ Logical
 - WG1/2 with the same channel in all timeslots (one program)
 - WG1/2 with different channels in the timeslots (full program)
 - ETI(NI, G.703)
 - Service transport interface (STI) available as STI(PI, G.704/2), STI(PI, V.11), STI(PI, G.703), STI(PI, WG1/2)
 - Proprietary format STI(FhG)
 - MPEG audio (MUSICAM) via X.21, G.704



GUI of the R&S DM001-R



Possible combination of input signals and DAB services

Output interfaces

- ◆ Ensemble transport interface (ETI) available as ETI(NA, G.704)₅₅₉₂, ETI(NA, G.704)₅₃₇₆, ETI(NI, G.703)
- ◆ STI-C back channel available as STI(PI, G.704/2), STI-C(TA) via RS-232-C

Additional interfaces

- ◆ RS-232-C for PC control (PC) and GPS time (TIME)
- ◆ Relay contacts (dry contacts) for error messages (QSS)

Synchronization

The multiplexer processing clock and the ETI output signal can be synchronized to the following signals:

- 2.048 MHz external clock, sinewave or TTL
- Internal crystal oscillator (accuracy 25 ppm)

With single-frequency network operation, dynamic delay adjustment is possible by inserting a time stamp (TIST). The R&S DM001 can insert the TIST independently in the ETI(NI) layer and in the ETI(NA) layer. Synchronization requires the second pulse of an external GPS receiver.

In redundancy and professional systems, the ETI output signal is also time-synchronized. If the entire delay, up to the transmitter output, is correctly specified, the following condition is complied with at the transmitter output:

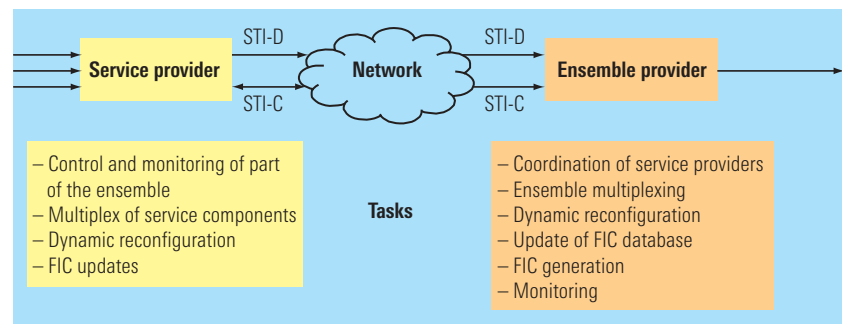
- 12.00.00(UTC) = CIF = 0 and FP = 0
- Max. deviation (<1 μs)

This function permits the ensembles to be time-synchronized "on the air", thus facilitating quick switchover between the different ensembles in the receiver.

STI functions

The STI standard offers an open and standardized interface to all service providers that is independent of the service type. The multiplexer can be fed all program and data services. It is also possible to apply highly dynamic fast information groups (FIG) for insertion in the fast information channel (FIC). Defining STI layers ensures the interoperability between different STI-capable instruments. The R&S DM001 complies with the standards of the highest layer 3.

STI enables the service provider to flexibly access the resources of the ensemble provider. Independently of the ensemble provider, the service provider has access to all resources in the DAB ensemble it has been assigned. It can reconfigure without interference. This permits dynamic bit rate management during operation in compliance with the requirements.



DAB ensemble management

Static service information such as label and frequency lists can be saved to the multiplexer as FIG files; it is then inserted in the FIC in addition to the FIGs that are dynamically applied via STI. The R&S DM001 automatically inserts the FIGs with the repetition rates recommended by the DAB guidelines. Once the overall capacity has been reached, the repetition rates are automatically reduced. The capacities assigned in the service provider profile are taken into account, preventing mutual interference.

Dynamic FIGs such as TMC can be inserted as a FIG stream.

Service provider operating without STI

The R&S DM001 has been fully developed as an STI ensemble multiplexer. This ensures full compatibility with existing network structures. By means of the supported interfaces, DAB MPEG audio data streams and DAB packet data streams or stream data streams can be directly connected.

Features of STI support

- ◆ Interface between service and ensemble provider for STI(PI, G.704/2), STI(PI, G.703) and STI(PI, V.11) signals with joint or separate feeding of STI-D and STI-C
- ◆ Start of uninterrupted dynamic reconfiguration via STI-C
- ◆ Input of all audio-relevant parameters, MCI parameters and generation of FIGs at the service provider
- ◆ Generation of fast information groups for service providers and ensemble with the aid of the FIG encoder
- ◆ Input of service provider profiles and generation of ensemble configurations with the aid of ensemble controller software under Windows
- ◆ Up to eight service providers per ensemble
- ◆ Backup of FIG files in the R&S DM001, cyclic FIG insertion in the FIC
- ◆ Dynamic application of service information and fast information data channel (FIDC) via FIG streams
- ◆ Support of previously used non-STI feed formats for audio and data channels and simulation of the service provider function in the ensemble controller



Rear view of the R&S DM001

Abbreviations

| | |
|---------|--|
| CCU | Central control unit |
| CIF | Common interleaved frame |
| COFDM | Coded orthogonal frequency division multiplexing |
| DAB | Digital audio broadcasting |
| DSP | Digital signal processor |
| DTE | Data terminal equipment |
| EC | Ensemble controller |
| EPID | Ensemble provider ID (identification) |
| ETI | Ensemble transport interface |
| FhG-STI | Fraunhofer Gesellschaft-STI |
| FIC | Fast information channel |
| FIDC | Fast information data channel |
| FIG | Fast information groups |
| FP | Frame phase |
| MC | Microcontroller |

| | |
|---------|--|
| MCI | Microcontroller information |
| MUXDSP | Multiplex digital signal processor |
| SNMP | Simple network management protocol |
| SP | Service provider |
| SPID | Service provider ID (identification) |
| SPP | Service provider profile |
| SRAM | Static RAM (random access memory) |
| STI | Service transport interface |
| STI-C | Service transport interface – control |
| STI-D/C | Service transport interface – data/control |
| STI-SP | Service transport interface – service provider |
| TIST | Timestamp |
| TMC | Traffic message channel |
| UTC | Coordinated universal time |

Specifications

| Signal inputs | |
|-------------------------------------|--|
| G.703 (inputs 1 to 12) | G.703/G.704, 2.048 Mbit/s, BNC, 75 Ω |
| V.11 (inputs 1 to 12) | symmetrical clock, data, sync pulse, RS-422, 15-contact sub-D male, 110 Ω |
| 1 PPS | time reference pulse, e.g. for GPS (1 pps), triggered on positive edge, TTL, BNC, 75 Ω |
| 2.048 MHz | sinewave 2.048 MHz, <5 V (V _{pp}), BNC, 50 Ω |
| Signal outputs | |
| ETI | G.703 OUT 1/2, ETI(NI), ETI(NA) |
| STI | G.703 OUT 1/2, STI(PI, G.704/2) |
| Serial interfaces | |
| | asynchronous with handshake 19200/ 38400 (DTE2) baud, 8 data bits, 1 start/stop bit, no parity |
| PC | R&S DM001 connected to control PC |
| TIME | GPS timestring |
| DTE1 | service |
| DTE2 | STI-C-(TA) back channel |
| Parallel interfaces | |
| Alarm interface | 2 × 15-contact sub-D female |
| Relay contacts for error signalling | 6 × SP alarm, A alarm, B alarm, power failure |

General data

| | |
|--|--|
| Operating temperature range (specifications complied with) | +5 °C to +45 °C |
| Permissible temperature range | 0 °C to +50 °C |
| Storage temperature range | -40 °C to +85 °C |
| Max. permissible humidity | 95% at +25 °C |
| Installation altitude | ≤2000 m above sea level |
| EMC | EN50081-1: 1992, EN50082-2: 1995, EN61000-3-2: 1994 |
| Power supply | 100 V to 127 V (AC), 220 V to 240 V (AC), 50 Hz to 60 Hz |

| | |
|------------------------|--|
| Power consumption | 70 VA to 140 VA, depending on configuration |
| Electrical safety | in accordance with EN60950: 1992 + A1: 1993 + A2: 1993 + A3: 1995 + A4: 1997 |
| Dimensions (W × H × D) | 427 mm × 132 mm × 460 mm (19" desktop model of 3 HU) |
| Weight | 10 kg to 15 kg, depending on configuration |

Ordering information

Order designation Type Order No.

| DAB STI Ensemble Multiplexer | | |
|---|--------------|--------------|
| Base unit with 4 inputs and output ETI(NI/NA), STI-C | R&S DM001 | 2058.5408.41 |
| Base unit with 8 inputs and output ETI(NI/NA), STI-C | R&S DM001 | 2058.5408.42 |
| Base unit with 12 inputs and output ETI(NI/NA), STI-C | R&S DM001 | 2058.5408.43 |
| Accessories | | |
| Input Board with 4 inputs | R&S DM001-I | 2073.7608.03 |
| Product Training on DAB and R&S DM001 | R&S DM001-S | 2073.9581.00 |
| Professional Management Software | R&S DM001-P | 3542.2305.02 |
| Redundancy DAB Ensemble Multiplexer | R&S DM001-R | 3541.4504.02 |
| SNMP Option for R&S DM001-R and R&S DM001-P | R&S DM001-T | 3541.4756.00 |
| DAB Ensemble Controller PC, 19" plug-in unit | R&S DM001-PC | 0794.5737.00 |

Other DAB products from Rohde & Schwarz

DAB Transmitter Family R&S NA/NL6000 (for medium transmit power)
DAB Transmitter Family R&S NA7000 (for high transmit power)
DAB Test Transmitter R&S SDB601
Digital Sound Broadcast Data Inserter R&S DSIP020
WebCarousel™ R&S DTVCAR
DAB-MOTStreamer R&S MOTCAR





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