R&S®AEM100
ATSC-M/H Emission Multiplexer
Compact solution for ATSC Mobile DTV

ROHDE & SCHWARZ

R&S®AEM100 ATSC-M/H Emission Multiplexer

At a glance

The R&S®AEM100 ATSC-M/H emission multiplexer is a key component for ATSC Mobile DTV (MDTV). Its compact dimensions make it the ideal way for network operators to expand existing ATSC transmitter networks quickly and reliably by adding mobile services, or to set up a new network. It provides the entire functionality specified in the A/153 standard.

The R&S®AEM100 uses an ATSC transport stream and new video/audio data to generate a multiplex for mobile reception. The new video/audio data streams are encoded in accordance with the standard and linked to the main ATSC content. The R&S®AEM100 enables users to set up powerful, frequency-efficient single frequency networks (SFN) and ensures excellent uptime owing to seamless redundancy.

This user-friendly instrument is only one height unit high. The user interface makes operation simple and convenient.

Key facts

❙ All the requirements laid out in the ATSC Mobile DTV A/153 standard are met, in particular:
  · Complete implementation of complex error protection algorithms (Reed-Solomon and turbo codes) that make the transport stream robust
  · Complete generation of the standard-specific signaling and optional service information required for operation (baseband signaling)
❙ Network-based clock synchronization
❙ ATSC time with high-precision profile
❙ Operation via web-based graphical user interface and SNMP
❙ Seamless redundancy

R&S®AEM100 ATSC-M/H Emission Multiplexer

Benefits and key features

Easy access to MDTV (A/153)
∎ Continued use of existing infrastructure
∎ New components for MDTV
  ‧ ATSC-M/H multiplexer
  ‧ Software-defined exciter
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Larger audience, efficient use of resources
∎ Increase in broadcast coverage by using single frequency networks for MDTV
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Simple and convenient operation
∎ Intuitive user interface design and overview of complete signal flow at a glance
∎ Graphic representation of the configuration for services and parades
∎ Monitoring functions
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Easy setup and uninterrupted availability
∎ Integration into IP networks
∎ ASI/Ethernet for flexible transport stream distribution
∎ Simple configuration transfer and duplication via hardlock
∎ High availability of ATSC MDTV emissions owing to seamless redundancy
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The graphical user interface of the R&S®AEM100 is clearly structured. The service slider presents an overview of all configured services. The service icons show important parameters such as the service type or name.

Easy access to MDTV (A/153)

Continued use of existing infrastructure

ATSC broadcasters can now also offer their customers mobile services. The MDTV products from Rohde & Schwarz make upgrading to the new A/153 standard easy. The broadcaster's existing infrastructure can still be used.

New components for MDTV

The transmission chain is extended by simply adding the R&S®AEM100 emission multiplexer, which processes the new mobile data. The multiplexer is inserted between the existing ATSC headend and the transmitter. In addition, the software-defined TV exciter from Rohde & Schwarz must be updated or replaced with a new exciter that has ATSC-M/H capabilities. The figure below shows all the components of an MDTV system.

Typical ATSC transmission system for single transmitters with integrated MDTV services
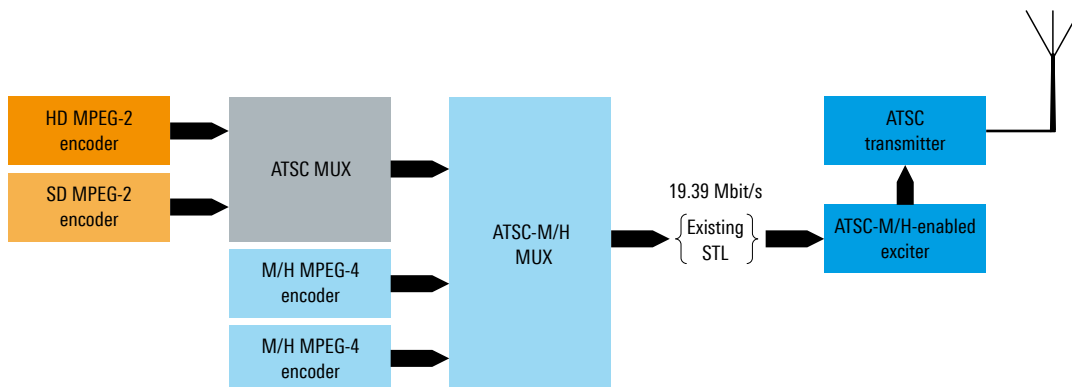
Larger audience, efficient use of resources

Increase in broadcast coverage by using single frequency networks for MDTV

In an SFN, two or more transmitters that cover overlapping areas simultaneously broadcast the same program on the same frequency. This approach increases the range for a specific frequency and allows a larger audience to be reached with the same broadcasting license. Transitions from one transmission cell to the next are seamless. This helps ensure gap-free coverage, even in metropolitan areas and mountainous regions.

The R&S®AEM100 supports the standardized MDTV SFN method in line with A110:2011 using dummy bytes for synchronization. The Rohde & Schwarz implementation can be used for ATSC and ATSC Mobile DTV. It is very efficient and preserves the valuable emission data rate because it does not require any special additional data packets.

NTP for extended use of IP-based clock synchronization

A GPS-synchronized NTP server provides the multiplexer with the highly accurate time signal that is required in an SFN for synchronization in all parts of the transmission chain. The NTP server can be located anywhere in the broadcaster's IP network and can therefore also be used for many other applications (e.g. for A/V encoder time control). This solution is cost-effective and simple.

Coverage of large, adjoining areas
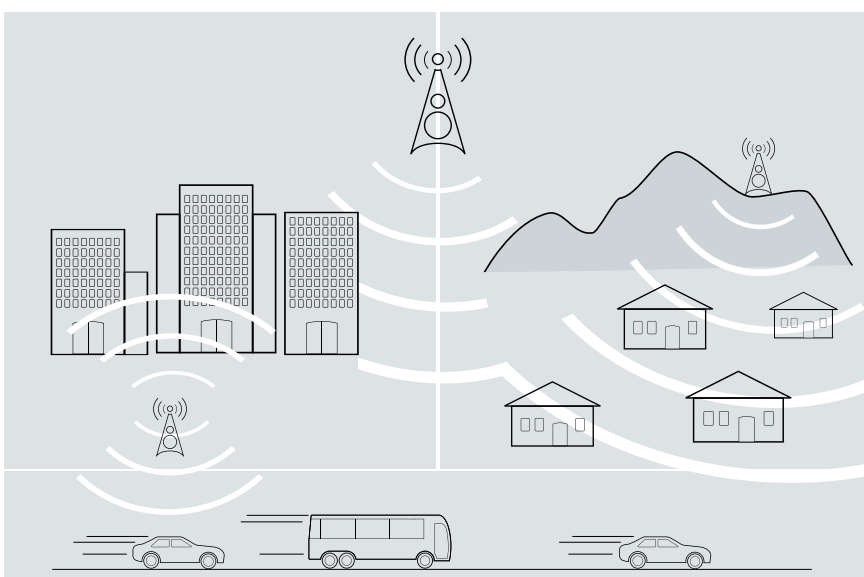
The synchronized services are broadcast by three transmitters on the same frequency, which enormously expands the reception area for the mobile services. The superposition of waves has a positive effect in SFNs.

Simple and convenient operation

Intuitive user interface design and overview of complete signal flow at a glance

The user interface is clearly structured and can be operated intuitively. The status page shows the entire signal flow as well as the status of the instrument and its input and output interfaces at a single glance.

Graphic representation of the configuration for services and parades

Services and parades can be generated via the graphical user interface or using XML. The configurations are managed using the configuration management page. This page displays the current configuration and the next one. The next configuration can be activated without interruption, either immediately or after a delay that has been scheduled using a timer. Reception of the ATSC and Mobile DTV programs continues uninterrupted.

Monitoring functions

The R&S®AEM100 offers diverse monitoring and analysis capabilities. For example, it monitors the data rate and the program clock reference (PCR) jitter of the incoming ATSC transport stream, as well as the packet losses of the incoming IP/RTP packet data stream. If necessary, the correct order of the IP/RTP packets is re-established. The monitoring data is classified according to services, parades, ensembles and complete configuration. Furthermore, the SDP files that can be uploaded for automatic configuration of the services are verified. In this way, users receive a comprehensive overview of their data flow.

Local/remote control from the transmitter world

The complete MDTV functionality can be configured, controlled and monitored via an Internet browser. The R&S®AEM100 supports a tried-and-tested local/remote concept that allows fast on-site access as well as secure operation with remote authentication. All commands for automatic monitoring and for instrument settings are also available via an SNMP interface.

Open interfaces to third-party instruments

The open-system concept allows the R&S®AEM100 to be used with existing components and also with preferred third-party components. The multiplexer operates with third-party encoders, signaling equipment and transmitters.
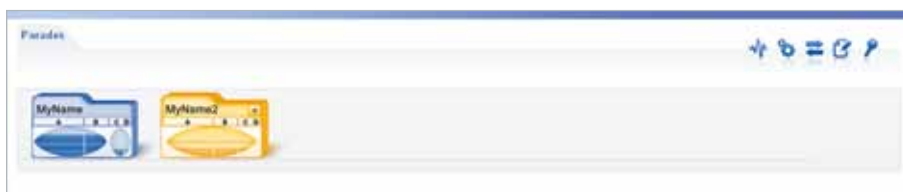
Parade slider.

Service slider.

Configuration management.

Easy setup and uninterrupted availability

Integration into IP networks

The R&S®AEM100 can be integrated into existing IP networks using the Ethernet interfaces. This is an inexpensive and modern option for device control via SNMP and HTTP without any additional cabling. The multiplexer's Ethernet interfaces support 10 Mbit/s, 100 Mbit/s and 1000 Mbit/s.

ASI/Ethernet for flexible transport stream distribution

The R&S®AEM100 has a standard ASI interface and two Ethernet interfaces for outputting the MDTV data. These additional Ethernet interfaces enable diverse redundancy solutions. By using Pro-MPEG CoP#3, additional error protection can be provided for the TSoverIP data stream.

Simple configuration transfer and duplication via hardlock

The R&S®AEM100BU hardlock automatically stores the entire multiplexer configuration as well as the software version that is currently installed. All the instrument settings can be transferred to another multiplexer by removing the hardlock and inserting it into the other device. This feature allows the user to create a backup quickly and easily. It also makes maintenance work easier.

High availability of ATSC MDTV emissions owing to seamless redundancy

The redundancy concept offered by the R&S®AEM100 is unique on the market: A bit-identical signal is applied synchronously to the outputs of two 1+1 redundant R&S®AEM100 multiplexers. If errors occur on one R&S®AEM100, the MDTV data stream is switched over seamlessly to the other multiplexer with no noticeable effect for the viewer.

Both multiplexers simultaneously receive the same signals. Each multiplexer processes the signals, bundles them into a single transport stream and sends this stream to its output. The two multiplexers communicate and check each other's results. If, due to an error, one of the multiplexers does not receive the input signals completely or processes them incorrectly, the error is immediately detected and eliminated. This ensures interruption-free transmission. Viewers receive their Mobile DTV program without any noticeable effect on transmission quality. Two identically functioning multiplexers (both with the R&S®AEM-K111 or R&S®AEM-K121 option) are required for the redundancy concept.

Rear view of the R&S®AEM100.

Models

The basic system consists of the R&S®AEM100BU base unit and the R&S®AEM-K111 MDTV encapsulator SFN option. This package restructures the transport data stream, ensures A/153-specific signaling and adds the data for the mobile services to the prepared transport stream. This data is multiplexed with the main ATSC data and fed into the transmitter.

The R&S®AEM-K111 option enables the setup of MDTV single frequency networks and the use of the ATSC time as stipulated by the standard. The R&S®AEM-K121 option is suitable for ATSC transmitters when operating single frequency networks in A/53 standard. In this case, the multiplexer operates as an SFN adapter. The R&S®AEM-K150 AEM100-Redundancy option offers seamless switchover between two multiplexers in the event of a fault.

Model overview
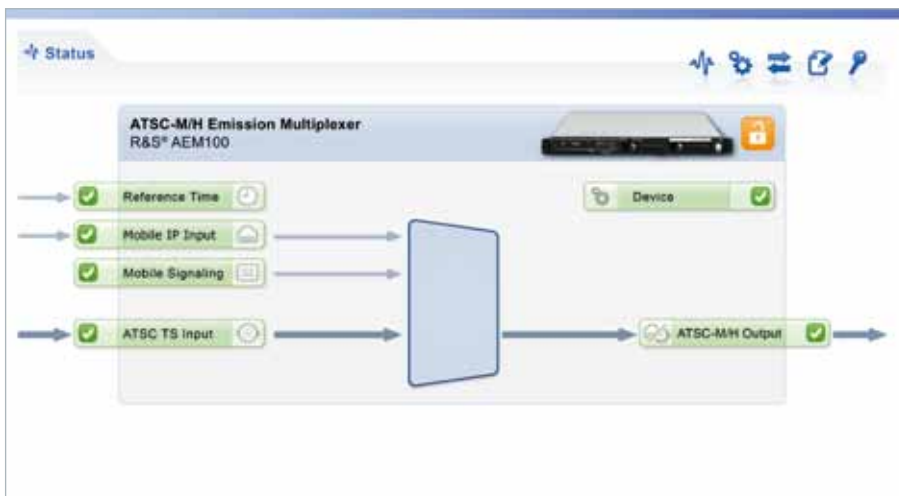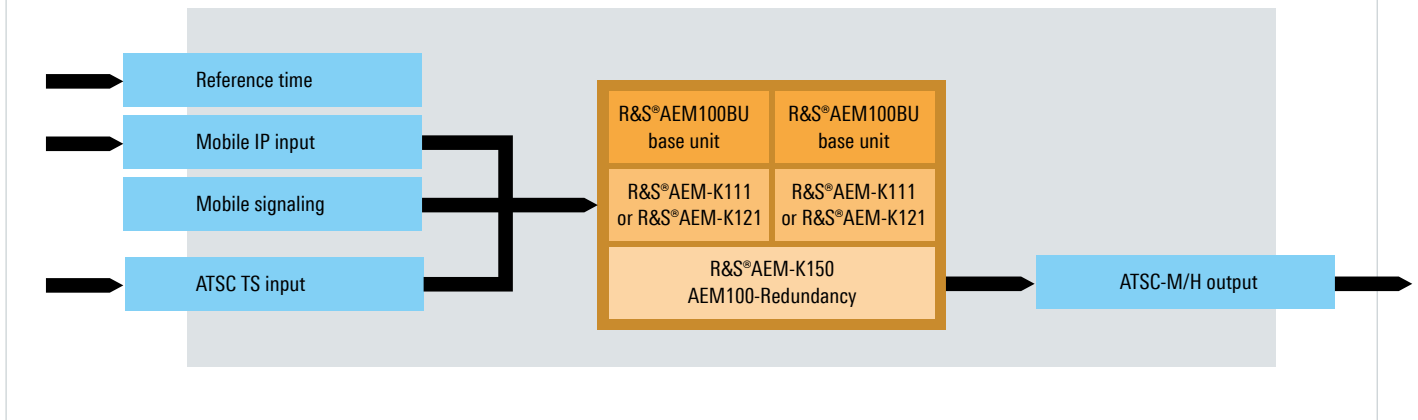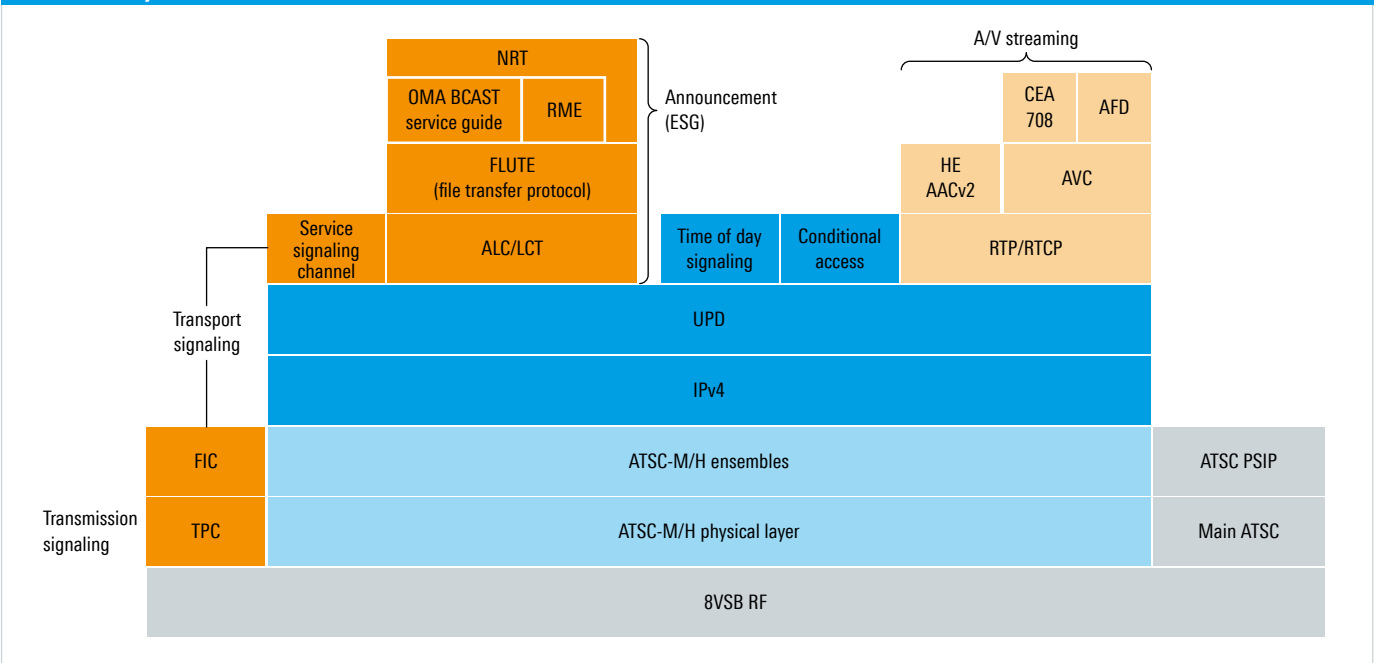

Status page of the R&S®AEM100.

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Technology

MDTV standard

The ATSC Mobile DTV (A/153) standard includes and enhances ATSC A/53 and is fully backward-compatible. It shares the same RF channel as the standard ATSC broadcast service described in ATSC A/53 and is coupled with a chain of extremely complex FEC mechanisms (Reed-Solomon and turbo codes) and training sequences for the receiver equalizer.

The standard is optimized for both stationary reception of high-quality services at home and robust mobile reception. In total, a data rate of 19.39 Mbit/s is available for dual transmission. The mobile video content is compressed using efficient H.264 (MPEG-4 AVC) video and HE-AACv2 audio coding. The video format is set to 416 pixel × 240 lines (16:9) to meet the requirements for mobile devices. Mobile data is transported using the Internet protocol (IP) mechanism.

Detailed layer model for the MDTV standard

Specifications in brief

Specifications in brief		
ATSC ASI input		
ASI		19.39 Mbit/s, ATSC A/53 transport stream
Program clock reference		correction of PCR after stream remultiplex
ATSC-M/H IP input		
IPv4		IP, UDP, RTP
Maximum transport unit		1500 byte
RTP reordering		according to RTP continuity counter
	maximum distance	all packets per M/H frame (max. 100)
Source IP address filtering		configurable for each service
Destination address translation		configurable for each service
RTP payload type correction		selectable for each service component
ATSC-M/H output		
ASI		19.39 Mbit/s, ATSC A/153 TS
MPEG-2 TS over IP		ATSC-M/H via unicast or multicast ▯ UDP ▯ RTP ▯ Pro-MPEG code of practice #3 release 2
ATSC-M/H error protection		
Reed-Solomon code modes		24 byte (211, 187), 36 byte (223, 187), 48 byte (235, 187)
SCCC code rates		½ or ¼ rate
SCCC block modes		10 SCCC blocks (separated), 5 SCCC blocks (combined)
ATSC-M/H signaling		
Transmission parameter channel (TPC)		built-in generator
Fast information channel (FIC)		built-in generator
Time-of-day signaling		internal NTPv4/SNTP broadcast, packet generator (IETF RFC 4330)
Service signaling channel (SSC)		built-in generator and interface for external signaling generator
Built-in and external	supported signaling tables	▯ service map table (SMT) ▯ service labeling table (SLT) ▯ guide access table (GAT) ▯ cell information table (CIT)
External		carouseling and encapsulation of externally provided signaling tables
Scheduling of signaling tables		seamless update; aligned with Reed-Solomon frame boundaries
General data		
Power supply		100 V to 127 V or 200 V to 240 V AC autosensing
Dimensions	W × H × D	440 mm × 43 mm × 560 mm (max. 711 mm) 17.32 in × 1.70 in × 22.01 in (max. 28.00 in) (19" cabinet, 1 height unit)
Weight		max. 12.7 kg (28.00 lb)

For data sheet, see PD 5214.1666.22 and www.rohde-schwarz.com

Ordering information

Designation	Type	Order No.
Base unit (including accessories supplied, such as power cord, manual, etc.)		
ATSC-M/H Emission Multiplexer Base Unit; channel coding and signaling; service and support for hardware limited to five years	R&S®AEM100BU	5302.8403.02
MDTV IP Encapsulator SFN; encapsulation of mobile services; for ATSC MDTV single frequency networks; in combination with the R&S®AEM100BU	R&S®AEM-K111	5302.9039.02
SFN Adapter; adapter for ATSC single frequency networks (A/53); in combination with the R&S®AEM100BU	R&S®AEM-K121	5302.9051.02
AEM100-Redundancy; redundancy set for R&S®AEM100 multiplexers, consisting of two hardlocks; only in combination with 2 × R&S®AEM100BU and R&S®AEM-Kxxx	R&S®AEM-K150	5302.8932.02
External accessories (PC software, additional devices, peripherals, etc.)		
Cisco Catalyst 2960G-24TC, fixed-configuration standalone switch, 20 Gbit Ethernet 10/100/1000 ports and 4 dual-purpose Gbit Ethernet 10/100/1000 uplink ports (BaseT or SFP), NAC, QoS, 1 HU, LAN base image installed	CC2960-24	5302.8661.00
Meinberg NTP time server with integrated GPS radio clock, 4 × LAN interfaces, RJ-45, LED status info of link, activity, speed (10/100 Mbit), OXCO HQ oscillator	LANTIME600	5302.8678.00

Your local Rohde & Schwarz expert will help you determine the optimum solution for your requirements.
To find your nearest Rohde & Schwarz representative, visit
www.sales.rohde-schwarz.com

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

▮ Energy-efficient products
▮ Continuous improvement in environmental sustainability
▮ ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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