

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



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Specifications apply under the following conditions: 3 minutes warm-up time at ambient temperature and specified environmental conditions met. Data without tolerances: typical values only. Data designated "nominal" applies to design parameters and is not tested.

This equipment is designed for reliable operation up to an altitude of 910 m above sea level, and for transport up to an altitude of 2130 m above sea level.

Data without tolerance limits is not binding.

## Input

### Interfaces

ASI	1 × BNC, 0 bit/s to 214 Mbit/s, 188 byte, 800 mV ( $V_{pp}$ ), impedance 75 $\Omega$	EN 50083-9
Network (NIC2)	1 × Ethernet (8-pin RJ-45 connector, bandwidth 1000/100/10 Mbit/s, level 2 V ( $V_{pp}$ ))	IEEE 802.3

### Protocols

Network	IPv4	IETF RFC 791
	IPv6 <sup>1</sup>	IETF RFC 2460
	UDP	IETF RFC 768
	RTP	IETF RFC 3550
ASI	ATSC digital television standard	A/53
	ISO/IEC MPEG-2 systems standard	ISO/IEC IS 13818-1:2000

## Output

### Interfaces

ASI <sup>2</sup>	1 × BNC, 0 bit/s to 214 Mbit/s, 800 mV ( $V_{pp}$ ), impedance 75 $\Omega$	EN 50083-9
Network (NIC3, NIC4)	1 × Ethernet (8-pin RJ-45 connector, bandwidth 1000/100/10 Mbit/s, level 2 V ( $V_{pp}$ ))	IEEE 802.3

### Protocols

Network	IPv4	IETF RFC 791
	IPv6 <sup>1</sup>	IETF RFC 2460
	UDP	IETF RFC 768
	RTP	IETF RFC 3550
	MPEG-2 transport stream over IP	Pro-MPEG code of practice #3 release 2/SMPTE 2022
ASI	ATSC digital television standard	A/53
	ATSC Mobile DTV standard (ATSC-M/H)	A/153
	ISO/IEC MPEG-2 systems standard	ISO/IEC IS 13818-1:2000

<sup>1</sup> Optional solution on request.

<sup>2</sup> In case of failure, there is a **hardware** bypass from the ASI input to the ASI output.

## Control

### Interfaces

Network	1 × Ethernet (8-pin RJ-45 connector, bandwidth 1000/100/10 Mbit/s, level 2 V (V <sub>pp</sub> ))	IEEE 802.3
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### Protocols

Network (NIC1)	IPv4	IETF RFC 791
	UDP	IETF RFC 768
	TCP	IETF RFC 793
	HTTP	IETF RFC 2616
	NTP	IETF RFC 1305
	SNMPv2c	IETF RFC 1441 to IETF RFC 1452

## Hardware

### Data processor

Server		IBM x306m
Processor		Intel Pentium Dual-Core, 3.2 GHz
RAM		1 Gbyte
Drives		CD/DVD
Hard disk		2 × > 80 Gbyte SATA (RAID1 for redundancy)
Network		4 × Gbit Ethernet
Cooling		air-cooled by 6 fans

### Interfaces

Serial	not to be used, for service purposes only	1 × D-Sub, male, 9-pin, RS-232-C
Monitor	not to be used, for service purposes only	1 × D-Sub, mini, female, 15-pin, VGA (HD15)
Keyboard/mouse	not to be used, for service purposes only	2 × PS/2, female
USB 2.0	used for local login and AutoUSBSetup	2 × A, female, front

### EMC

Electromagnetic compatibility		in line with EMC Directive 2004/108/EC
Emissions		in line with EN 55022, class A, FCC 047 part 15, subpart B, class A, CISPR 22, class A
Immunity		in line with EN 55024
Harmonic current emissions (backlash)		in line with EN 61000-3-2:2000

### Safety

Electrical and mechanical safety	CE	in line with LVD 2006/95/EC, EN 60950-1:2001
	UL	in line with UL 60950-1:2003, CSA C22.2 No. 60950-1-03
		in line with Battery Directive 91/157/EC, 93/86/EC, 98/101/EC
Electrical protection		class I (earthed)

## General data

Environmental conditions		
Operating temperature range		+10 °C to +35 °C
Storage temperature range		-40 °C to +60 °C
Humidity		8 % to 80 %
MTBF		> 10 years, +20 °C
Power supply		100 V to 127 V or 200 V to 240 V AC autosensing
Frequency		50/60 Hz
Power consumption	active power	300 W
	apparent power	100 W
Noise emission		in line with ISO 7779 and 9296
	declared active acoustic power	6.5 B $L_{WAd}$
	declared active sound pressure	58 dB(A) $L_{pAm}$
Failsafe operation	ASI input to ASI output bypass	hardware watchdog
Dimensions	W × H × D	440 mm × 43 mm × 559 mm, max. 711.4 mm (17.32 in × 1.70 in × 22.01 in, max. 28.00 in) (19" cabinet, 1 height unit)
Weight		max. 12.7 kg (28.0 lb)

## ATSC-M/H multiplexer

### 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)
Encapsulated IP streams		up to 128
Source IP address filtering		configurable for each service
Destination address translation		configurable for each service component
RTP payload type correction		selectable for each service component
ATSC-M/H buffer model		correction of NTP timestamp according to buffer model for each A/V service

### ATSC-M/H ASI output

ASI		19.39 Mbit/s, ATSC A/153 transport stream
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### ATSC-M/H IP output

MPEG TS over IP		ATSC-M/H via unicast or multicast <ul style="list-style-type: none"> <li>• UDP</li> <li>• RTP</li> <li>• Pro-MPEG code of practice #3 release 2</li> </ul>
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### ATSC-M/H structure

M/H parades	in line with A/153	1 to 16
M/H groups per M/H subframe and parade	in line with A/153	1 to 8
M/H ensembles	in line with A/153	1 to 32 (primary and secondary Reed-Solomon frame mode)
M/H ensembles per parade	in line with A/153	1 to 2
M/H services		1 to 64
M/H components		1 to 128

### 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)
Auto forward error correction (FEC)	depending on payload data rate	selectable for each M/H parade, increases FEC optimally
Affected FEC parameters	for all auto FEC enabled parades	
Reed-Solomon code	for all auto FEC enabled parades	selectable
SCCC code rate	for all auto FEC enabled parades	selectable
SCCC block mode	for all auto FEC enabled parades	selectable

## 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	<ul style="list-style-type: none"> <li>• service signaling table (SMT)</li> <li>• service labeling table (SLT)</li> <li>• guide access table (GAT)</li> <li>• cell information table (CIT)</li> </ul>
	supported ATSC-M/H service descriptors	<ul style="list-style-type: none"> <li>• M/H rights issuer descriptor</li> <li>• M/H original service identification descriptor</li> <li>• protection descriptor</li> <li>• user-defined descriptor (any; octet string in hex notation)</li> </ul>
	supported ATSC-M/H component descriptors	<ul style="list-style-type: none"> <li>• H.264/AVC (partially from SDP file)</li> <li>• HE AACv2 (partially from SDP file)</li> <li>• SVC enhancement layer</li> <li>• FLUTE</li> <li>• STKM</li> <li>• LTKM</li> <li>• OMA-RME DIMS</li> <li>• NTP time base</li> <li>• dynamic range type</li> <li>• user-defined descriptor (any; octet string in hex notation)</li> </ul>
	service types	<ul style="list-style-type: none"> <li>• unspecified</li> <li>• basic TV</li> <li>• basic radio</li> <li>• rights issuer service</li> <li>• service guide</li> </ul>
External		carouseling and encapsulation of externally provided signaling tables
Scheduling of signaling tables		seamless update; aligned with Reed-Solomon frame boundaries
Repetition cycles		definable per ensemble
Signaling tables		definable per ensemble
Interface		<ul style="list-style-type: none"> <li>• download of the R&amp;S®AEM100 configuration as XML via HTTP GET</li> <li>• announcement of configuration changes to external signaling generator via SNMP trap</li> <li>• upload of external signaling data to the R&amp;S®AEM100 as XML via HTTP POST</li> <li>• structure and validity check of externally provided signaling</li> <li>• open interface from Rohde &amp; Schwarz (described in manual)</li> </ul>

## ATSC-M/H configuration sets

Configuration sets		current (fixed), next (adjustable) next configuration via GUI and/or upload of XML or ZIP
Settings		<ul style="list-style-type: none"> <li>parade setting with number of groups (NoG) per M/H subframe and FEC</li> <li>configuration of ensembles, services and components</li> <li>import of session description protocol files (SDP, IETF RFC 2327) for rapid definition of services</li> <li>configuration of additional SSC information for built-in signaling generator</li> </ul>
Reconfiguration		seamless; without any impact of ATSC and ATSC-M/H services
Activation		<ul style="list-style-type: none"> <li>immediate</li> <li>timer based on UTC time zone</li> </ul>

## Transmission parameters

MFN mode	internal oscillator	<ul style="list-style-type: none"> <li>short-term stability of the TS data rate is <math>\pm 2.8</math> ppm</li> <li>long-term stability of the TS data rate is <math>\pm 2.8</math> ppm</li> </ul>
	external time reference (NTP)	<ul style="list-style-type: none"> <li>nominal short-term stability of the TS data rate is <math>\pm 0.5</math> ppm</li> <li>long-term stability of the TS data rate is <math>\pm 2.8</math> ppm</li> <li>automatic calibration of internal oscillator</li> </ul>
SFN mode	external time reference (NTP)	<ul style="list-style-type: none"> <li>in line with A/110:2011, use of dummy data bytes channel information for synchronization</li> <li>for ATSC and ATSC Mobile DTV</li> <li>nominal short-term stability of the TS data rate is <math>\pm 0.5</math> ppm</li> <li>long-term stability of the TS data rate is at least <math>10^{-11}</math></li> <li>maximum displacement of emission time signaling is <math>\pm 30</math> ms</li> </ul>

## ATSC time

ATSC time	with external time reference (NTP)	in line with A/153
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## External time reference (NTP requirements)

NTP		built-in NTP client
Configurable NTP server connections		1 to 10
Stratum level	recommended	= 1 (directly connected to reference clock source, e.g. GPS NTP server)
Reference clock source accuracy	recommended	at least $10^{-11}$ (GPS)
Maximum time offset	recommended	< 1 ms (1 pps phase of UTC)
Maximum IP round-trip delay	symmetric paths recommended	< 10 ms $\pm$ 2 ms
Leap second		supported, can be updated by file upload

## WebGUI

WebGUI		local/remote access (as of version 2.1); configuration, control and monitoring; intuitive handling
Resolution	status page all other pages	optimized for 1024 × 768 pixel or higher optimized for 1280 × 1024 pixel or higher
Browsers		
Recommended	Internet Explorer Mozilla Firefox	version 7.0 or later (Java script enabled) version 3.0 or later (Java script enabled)
Also supported	Safari Opera Chrome	version 3.2.1 (Java script enabled) version 9.63 (Java script enabled) version 12.0 (Java script enabled)

## SNMP

SNMP agent		configuration and monitoring using SNMPv2c
Trap target		any valid IP address, two addresses possible
Trap repetition		traps will be sent once per second; if a value changes, the trap will be sent twice to provide simple redundancy

## Monitoring

Device overview		summary of device components and current states via WebGUI and SNMP
TS input	input monitoring with	<ul style="list-style-type: none"> <li>realtime monitoring</li> <li>data rate analysis of ATSC</li> <li>free data rate analysis</li> <li>quality measurement of ATSC in and ATSC payload out</li> <li>state of input stream (error, warning, ready)</li> <li>ATSC TS identifier</li> </ul>
TS output	output monitoring and configuration with	<ul style="list-style-type: none"> <li>realtime monitoring</li> <li>TS data rate and statistics</li> <li>TS output mode and parameter reconfiguration</li> <li>state of output stream (error, warning, ready)</li> </ul>
File record	live record of ATSC-M/H TS with	<ul style="list-style-type: none"> <li>one file up to 700 Mbyte (5 min)</li> <li>download via web interface</li> </ul>
M/H service status	M/H service description with	<ul style="list-style-type: none"> <li>service configuration (name and type of service)</li> <li>IP address configuration</li> <li>data rate</li> <li>lost packets (RTP IP streams)</li> <li>state of stream (error, warning, ready)</li> </ul>
Device logbook	event description with	<ul style="list-style-type: none"> <li>date/time</li> <li>event source</li> <li>severity (error, warning, info)</li> <li>textual information</li> </ul>

## Redundancy

Redundancy	two paired R&S®AEM100 multiplexers	<ul style="list-style-type: none"> <li>• hot standby</li> <li>• seamless A/V switching in redundancy case</li> <li>• redundancy delay: additionally one second</li> </ul>
TS output connection	recommended	<ul style="list-style-type: none"> <li>• directly through network interface connectors NIC3 and NIC4 (using only one network interface connector is possible, but reduces cable redundancy)</li> <li>• direct connection of devices, not via network switch</li> </ul>
Configuration	prerequisite	both R&S®AEM100 multiplexers must have an identical device configuration and ATSC-M/H configuration
	both multiplexers checked for	<ul style="list-style-type: none"> <li>• identical device configuration <ul style="list-style-type: none"> <li>– TS output configuration (network mode, max. transport delay, etc.)</li> </ul> </li> <li>• identical ATSC-M/H configuration <ul style="list-style-type: none"> <li>– parades</li> <li>– services</li> </ul> </li> </ul>
Redundancy cases	covered	<ul style="list-style-type: none"> <li>• cable failures (if both NICs are used)</li> <li>• status changes to error: <ul style="list-style-type: none"> <li>– ASI input status</li> <li>– IP input status</li> <li>– NTP server connection status</li> <li>– internal/external signaling status</li> <li>– ATSC-M/H output status</li> </ul> </li> </ul>

## Ordering information

Designation	Type	Order No.
ATSC-M/H Emission Multiplexer; IP encapsulation for MDTV single frequency networks; seamless redundancy switching service and support for hardware limited to five years	R&S® AEM100BU	5302.8403.02
<b>Accessories</b>		
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

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