

# A-Series AT-60 Satellite Modulator



www.work-microwave.com



The A-Series is a family of next generation satellite modem platforms built on versatile FPGA- and software-based architecture. The AX-60 product line supports the full range of DVB-S2X/S2/S standards. Exceptional analog and digital engineering provides teleport-grade devices with future-proof expandability.

Beyond DVB waveforms, A-Series devices can be extended to customized signal and data processing. Through an all-IP structure, the platform supports both native network operation as well as data streaming over IP. Built-in encapsulators provide support for a

wide range of formats plus specialized streaming like transparent baseband data, raw IQ information, space data formats and more.

The **AT-60 Satellite Modulator** provides IP connectivity over DVB uplinks, in particular as integral part of VSAT hub stations. Operators can serve all applications from very low up to extremely high throughput. Real-time monitoring and control open to extensions with custom protocols allows integration into any system.

## Key Features

- DVB-S2X - ETSI EN 302 307-2
- DVB-S2 - ETSI EN 302 307-1
- DVB-S2X modulations:  
QPSK to 256APSK normal, short, linear
- DVB-S2 modulations:  
QPSK to 32APSK; normal, short
- Symbol rates from 100 ksps to 75 Msps
- Data rate up to 360 Mbit/s integrated
- Roll-Off: 35%, 25%, 20%, 15%, 10%, 5%
- Exceptionally clean signal output and internal processing
- Predistortion for automatic group delay and nonlinearity compensation
- Operates as layer 3 bridge or layer 3 router including traffic shaping / QoS functionality
- ACM controller open to various ACM systems
- GSE and MPE encapsulation integrated
- Customizable processing infrastructure for easy integration into large communication systems
- Flexible software architecture for easy extension and future virtualization of functionality
- **3 years warranty**

# A-Series AT-60 Satellite Modulator

## TX Signal Specifications

<b>Signal output L-band:</b>	Frequency: 950...2150 MHz Connector: N female Impedance: 50 Ohm Return Loss: > 16 dB Output power: -30...0 dBm 0.1 dB steps, $\pm 0.5$ dB accuracy Output power muted: < -85 dBm 10 MHz reference: 1.5 dB +/- 1.5 dB, switchable Phase Noise: -45 dBc/Hz @ 10 Hz -75 dBc/Hz @ 100 Hz -88 dBc/Hz @ 1 kHz -90 dBc/Hz @ 10 kHz -100 dBc/Hz @ 100 kHz -115 dBc/Hz @ 1 MHz Signal related spurs: < -67 dBc, unmodulated carrier, 950...1900 MHz < -55 dBc, unmodulated carrier, 1900...2150 MHz < -45 dBc, unmodulated carrier harmonics, out of band						
<b>Signal output 70/140 MHz:</b> <i>w/ options IF50 or IF75</i>	Frequency: 50...180 MHz Connector: BNC female Impedance: 50 Ohm or 75 Ohm Return Loss: > 16 dB Output power: -25...5 dBm 0.1 dB steps, $\pm 0.5$ dB accuracy Output power muted: < -85 dBm Phase Noise: -45 dBc/Hz @ 10 Hz -80 dBc/Hz @ 100 Hz -88 dBc/Hz @ 1 kHz -90 dBc/Hz @ 10 kHz -100 dBc/Hz @ 100 kHz -115 dBc/Hz @ 1 MHz Signal related spurs: < -67 dBc, unmodulated carrier, 50...80 MHz or 100...180 MHz < -45 dBc, unmodulated carrier harmonics, out of band						
<b>Clock stability:</b>	Standard: $\pm 2 \times 10^{-7}$ after warm up, aging: $\pm 2 \times 10^{-8}$ per day, $\pm 1 \times 10^{-6}$ per year Extended: $\pm 2 \times 10^{-8}$ after warm up, aging: $\pm 1 \times 10^{-9}$ per day, $\pm 1 \times 10^{-7}$ per year <i>w/ options EXT or RI</i>						
<b>Symbol rate:</b>	Range: 100 ksps ... 75 Msps <i>depending on license TXS*</i> Step size: 1 sps						
<b>DVB-S2X Modulation / Coding:</b>	<table border="0"> <tr> <td>ModCods: (normal FEC frame)</td> <td>           QPSK 13/45, 9/20, 11/20            8PSK 23/36, 25/36, 13/18            16APSK 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90            32APSK 32/45, 11/15, 7/9            64APSK 11/15, 7/9, 4/5, 5/6            128PSK 3/4, 7/9            256PSK 32/45, 3/4         </td> </tr> <tr> <td>ModCods: (short FEC frame)</td> <td>           QPSK 11/45, 4/15, 14/45, 7/15, 8/15, 32/45            8PSK 2/15, 8/15, 26/45, 32/45            16APSK 7/15, 8/15, 26/45, 3/5, 32/45            32APSK 2/3, 32/45         </td> </tr> <tr> <td>ModCods linear: (normal FEC frame)</td> <td>           16APSK 1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L            32APSK 2/3-L            64APSK 32/45-L            256PSK 29/45-L, 2/3-L, 31/45-L, 11/15-L            all according to ETSI EN 302307-2         </td> </tr> </table>	ModCods: (normal FEC frame)	QPSK 13/45, 9/20, 11/20 8PSK 23/36, 25/36, 13/18 16APSK 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 32APSK 32/45, 11/15, 7/9 64APSK 11/15, 7/9, 4/5, 5/6 128PSK 3/4, 7/9 256PSK 32/45, 3/4	ModCods: (short FEC frame)	QPSK 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 8PSK 2/15, 8/15, 26/45, 32/45 16APSK 7/15, 8/15, 26/45, 3/5, 32/45 32APSK 2/3, 32/45	ModCods linear: (normal FEC frame)	16APSK 1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L 32APSK 2/3-L 64APSK 32/45-L 256PSK 29/45-L, 2/3-L, 31/45-L, 11/15-L all according to ETSI EN 302307-2
ModCods: (normal FEC frame)	QPSK 13/45, 9/20, 11/20 8PSK 23/36, 25/36, 13/18 16APSK 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 32APSK 32/45, 11/15, 7/9 64APSK 11/15, 7/9, 4/5, 5/6 128PSK 3/4, 7/9 256PSK 32/45, 3/4						
ModCods: (short FEC frame)	QPSK 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 8PSK 2/15, 8/15, 26/45, 32/45 16APSK 7/15, 8/15, 26/45, 3/5, 32/45 32APSK 2/3, 32/45						
ModCods linear: (normal FEC frame)	16APSK 1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L 32APSK 2/3-L 64APSK 32/45-L 256PSK 29/45-L, 2/3-L, 31/45-L, 11/15-L all according to ETSI EN 302307-2						
<b>DVB-S2 Modulation / Coding:</b>	<table border="0"> <tr> <td>ModCods: (normal and short FEC frame; 9/10 normal FEC frame only)</td> <td>           QPSK 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10            8PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10            16APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10            32APSK 3/4, 4/5, 5/6, 8/9, 9/10         </td> </tr> <tr> <td>Pilot insertion:</td> <td>on / off</td> </tr> <tr> <td>Physical layer scrambling:</td> <td>N = 0...262141 all according to ETSI EN 302307-1</td> </tr> </table>	ModCods: (normal and short FEC frame; 9/10 normal FEC frame only)	QPSK 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 8PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 16APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 32APSK 3/4, 4/5, 5/6, 8/9, 9/10	Pilot insertion:	on / off	Physical layer scrambling:	N = 0...262141 all according to ETSI EN 302307-1
ModCods: (normal and short FEC frame; 9/10 normal FEC frame only)	QPSK 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 8PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 16APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 32APSK 3/4, 4/5, 5/6, 8/9, 9/10						
Pilot insertion:	on / off						
Physical layer scrambling:	N = 0...262141 all according to ETSI EN 302307-1						
<b>Carrier ID:</b>	DVB-CID according to ETSI TS 103129						
<b>Signal spectrum mask:</b>	$\alpha = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05$ according to ETSI EN 302307						
<b>Predistortion:</b>	<b>Contact factory for details.</b>						

Specifications are subject to change

# A-Series AT-60

## Satellite Modulator

### Data Processing and Device Specifications

<b>Device connectors:</b>	Data network: M&C network: 10 MHz reference input: Alarm:	1x Ethernet RJ-45, 10/100/1000 Mbps auto sensing 1x Ethernet RJ-45, 10/100/1000 Mbps auto sensing BNC female, 50 Ohm <i>w/ option RI</i> DSUB-9 female <i>w/ option RI</i>
<b>Network operation:</b>	IP network connectivity:  IP Traffic shaping/QoS:  Baseband traffic shaping/QoS:  Data encapsulation:  IP data rate limits:	Layer 3 Bridge or Router for IPv4 packet transmission, IPv6 on request 256 IP/subnet routes towards satellite 64 baseband channels with independent DVB-S2X and encapsulation settings ACM MODCOD range and Es/N0 sensitivity independent per channel <b>Contact factory for customized IP-to-baseband data handling.</b> <b>Contact factory for customized ACM messaging formats.</b> 255 independent rules Guaranteed and limited bandwidths Fixed or dynamically integrated into ACM by binding to MODCOD Match criteria: source/destination IP subnet, source MAC, UDP/TCP port ranges, TOS/DS field, packet size configurable baseband channel limits based on symbol rate guaranteed and limited bandwidth individually configurable Generic Stream Encapsulation (GSE) according to ETSI TS 102606 Multiprotocol Encapsulation (MPE) according to ETSI EN 301192 <b>Contact factory for other encapsulation formats.</b> 360 Mbps or 80000 pps rx+tx processing, subject to prevailing modem limits maximum rates can vary in combination with complex internal processing (i.e. traffic shaping)
<b>Stream inputs:</b>	Interfaces:  Baseband data:  Transport stream:	2x RTP/UDP/IP over Ethernet according to IETF RFC 2250 Multicast and IGMPv3 support 2 streams for direct input of baseband frames individually assignable to baseband channels configurable UDP/IP-based flow control <i>w/ license BBI</i> 1 stream selectable from the inputs, manually or automatic automatic redundancy based on timeouts or SMPTE 2022-7 seamless reconstruction jitter compensation up to 500ms PCR correction, null packet deletion and insertion <i>w/ license TSI</i> for IP input
<b>Frontpanel interface:</b>	LCD-Display 2x40 characters, 4 cursor keys, 4 function keys VFD-Display 2x40 characters, 4 cursor keys, 4 function keys	<i>w/ option EXT</i>
<b>Remote monitoring and control:</b>	Protocol: Connection: Protocol: Connection:	SNMP UDP/IP over Ethernet/RJ-45 or in-band via satellite link HTTP web browser interface TCP/IP over Ethernet/RJ-45 or in-band via satellite link
<b>Temperature range:</b>	Operating: Storage: Relative humidity:	0°C...50°C -30°C...60°C <i>w/ option EXT</i> -30°C...80°C < 95% non condensing
<b>Mains power:</b>	Input: Consumption: Connector: Fuse:	100...240 V AC nominal, 90...264 V AC max, 50...60 Hz 65 VA / 45 W typical IEC C14 2x 3.15 A time-lag fuse
<b>Dimension and weight:</b>	483 x 44 x 505 mm <sup>3</sup> (WxHxD), 1 RU 19" up to approx. 10 kg depending on device type	

Specifications are subject to change

# A-Series AT-60 Satellite Modulator

## Order information:

**AT-60** Satellite Modulator

## Hardware options:

Hardware options have to be defined with the order and are not field-upgradable. Not all device types may support all combinations. Please contact factory with specific requests.

**IF50** additional IF output, 50 Ohm version  
**IF75** additional IF output, 75 Ohm version  
**RI** external 10 MHz reference input  
**EXT** extended operating temperature range of -30°C...60°C

## License based throughput:

License based throughput performance is field-upgradable by uploading a license file to the device. Either a symbol rate or a data rate based license has to be selected. License model can be changed in field.

**TXSxx** symbol rate based transmission license for xx Msps  
select from: **TXS15, TXS30, TXS45, TXS60, TXSmax**  
TXSmax supports full throughput according to specification or device limits  
**TXDxx** data rate based transmission license for xx Mbps  
select from: **TXD10** (default), **TXD30, TXD100, TXD160, TXDmax**  
TXDmax supports full throughput according to specification or device limits

## License based functions:

License based functions are field-upgradable by uploading a license file to the device.

**BBI** direct baseband frame input streaming over IP  
**TSI** transport stream over IP input  
**TAB** DVB table insertion for MPE encapsulation