A-Series AX-60
Satellite Modem

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 **AX-60 Satellite Modem** is the baseline device for full IP connectivity over DVB links. Operators can serve all applications from very low up to extremely high throughput. Real-time monitoring and control together with powerful IP processing capabilities allow integration into almost any network.

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**

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TX Signal Specifications

Signal output L-band:	Frequency:	950...2150 MHz	
	Connector:	N female	
	Impedance:	50 Ohm	
	Return Loss:	> 16 dB	
	Output power:	-30...0 dBm 0.1 dB steps, ±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	
Signal output 70/140 MHz: ***w/ options IF50 or IF75***	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, ±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	
Clock stability:	Standard:	±2 x 10^-7 after warm up, aging: ±2 x 10^-8 per day, ±1 x 10^-6 per year	
	Extended:	±2 x 10^-8 after warm up, aging: ±1 x 10^-9 per day, ±1 x 10^-7 per year ***w/ options EXT or RI***	
Symbol rate:	Range:	100 ksps ... 75 Msps ***depending on license TXS****	
	Step size:	1 sps	
DVB-S2X Modulation / Coding:	ModCods: (normal FEC frame)	QPSK 8PSK 16APSK 32APSK 64APSK 128PSK 256PSK	13/45, 9/20, 11/20 23/36, 25/36, 13/18 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 32/45, 11/15, 7/9 11/15, 7/9, 4/5, 5/6 3/4, 7/9 32/45, 3/4
	ModCods: (short FEC frame)	QPSK 8PSK 16APSK 32APSK	11/45, 4/15, 14/45, 7/15, 8/15, 32/45 2/15, 8/15, 26/45, 32/45 7/15, 8/15, 26/45, 3/5, 32/45 2/3, 32/45
	ModCods linear: (normal FEC frame)	16APSK 32APSK 64APSK 256PSK	1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L 2/3-L 32/45-L 29/45-L, 2/3-L, 31/45-L, 11/15-L
		all according to ETSI EN 302307-2	
DVB-S2 Modulation / Coding:	ModCods: (normal and short FEC frame; 9/10 normal FEC frame only)	QPSK 8PSK 16APSK 32APSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 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	
Carrier ID:	DVB-CID according to ETSI TS 103129		
Signal spectrum mask:	α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05 according to ETSI EN 302307		
Predistortion:	***Contact factory for details.***		

Specifications are subject to change

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RX Signal Specifications

Signal input L-band:	Frequency:	950...2150 MHz 680...2300 MHz ***w/ licenses RXL680 and RXL2300***	
	Connector:	1x F female	
	Impedance:	75 Ohm	
	Return Loss:	> 13 dB	
	Input power:	-70...-10 dBm total aggregate power	
	LNB DC-Feed	13.5 V or 18 V switchable 450 mA max. current, short circuit protected 22 kHz tone on/off, DISEqC 1.1	
Signal input 70/140 MHz: ***w/ options IF50 or IF75***	Frequency:	50...180 MHz	
	Connector:	1x BNC female	
	Impedance:	50 Ohm / 75 Ohm switchable	
	Return Loss:	> 13 dB	
	Input power:	-60...15 dBm total aggregate power	
Symbol rate:	Range:	100 ksps ... 75 Msps ***depending on license RXS****	
	Acquistion bandwidth:	± selected symbol rate / 2	
	Tolerance:	± 1% of selected symbol rate	
DVB-S2X Modulation / Coding:	ModCods: (normal FEC frame)	QPSK 8PSK 16APSK 32APSK 64APSK 128PSK 256PSK	13/45, 9/20, 11/20 23/36, 25/36, 13/18 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 32/45, 11/15, 7/9 11/15, 7/9, 4/5, 5/6 3/4, 7/9 32/45, 3/4
	ModCods: (short FEC frame)	QPSK 8PSK 16APSK 32APSK	11/45, 4/15, 14/45, 7/15, 8/15, 32/45 2/15, 8/15, 26/45, 32/45 7/15, 8/15, 26/45, 3/5, 32/45 2/3, 32/45
	ModCods linear: (normal FEC frame)	16APSK 32APSK 64APSK 256PSK	1/2-L, 8/15-L, 5/9-L, 3/5-L, 2/3-L 2/3-L 32/45-L 29/45-L, 2/3-L, 31/45-L, 11/15-L
		all according to ETSI EN 302307-2	
DVB-S2 Modulation / Coding:	ModCods: (normal and short FEC frame; 9/10 normal FEC frame only)	QPSK 8PSK 16APSK 32APSK	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 3/4, 4/5, 5/6, 8/9, 9/10
	Auto detection:	Modulation- and FEC-type pilots on / off CCM / VCM / ACM	
	Physical layer scrambling:	N = 0...262141	
		all according to ETSI EN 302307-1	
Signal spectrum mask:	α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05 according to ETSI EN 302307		

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Data Processing and Device Specifications

Device connectors:	Data network:	1x Ethernet RJ-45, 10/100/1000 Mbps auto sensing
	M&C network:	1x Ethernet RJ-45, 10/100/1000 Mbps auto sensing
	10 MHz reference input:	BNC female, 50 Ohm ***w/ option RI***
	Alarm:	DSUB-9 female ***w/ option RI***
Network operation:	IP network connectivity:	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 ***Contact factory for customized IP-to-baseband data handling.*** ***Contact factory for customized ACM messaging formats.***
	IP Traffic shaping/QoS:	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
	Baseband traffic shaping/QoS:	configurable baseband channel limits based on symbol rate guaranteed and limited bandwidth individually configurable
	Data encapsulation:	Generic Stream Encapsulation (GSE) according to ETSI TS 102606 Multiprotocol Encapsulation (MPE) according to ETSI EN 301192 ***Contact factory for other encapsulation formats.***
	IP data rate limits:	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)
Stream inputs:	Interfaces:	2x RTP/UDP/IP over Ethernet according to IETF RFC 2250 Multicast and IGMPv3 support
	Baseband data:	2 streams for direct input of baseband frames individually assignable to baseband channels configurable UDP/IP-based flow control ***w/ license BBI***
Stream outputs:	Interfaces:	1x RTP/UDP/IP over Ethernet according to IETF RFC 2250
	Baseband data:	direct output of baseband data w/o filtering padding selectable ***w/ license BBO***
	Transport stream:	transport stream from DVB carriers 1 ISI selectable from DVB-S2 multistream carriers ***w/ license TSO***
	IQ data:	raw IQ data after demodulation signed 8-bit I and Q values for each symbol decimator selectable to reduce bandwidth occupation ***w/ license IQ***
	CCSDS CADU frames:	extraction of CCSDS CADU frames from DVB-S2 automatic detection of frame length ***w/ license CCSDS131.3***
Frontpanel interface:	LCD-Display 2x40 characters, 4 cursor keys, 4 function keys VFD-Display 2x40 characters, 4 cursor keys, 4 function keys ***w/ option EXT***	
Remote monitoring and control:	Protocol: Connection:	SNMP UDP/IPover Ethernet/RJ-45 or in-band via satellite link
	Protocol: Connection:	HTTP web browser interface TCP/IP over Ethernet/RJ-45 or in-band via satellite link
Temperature range:	Operating:	0°C...50°C -30°C...60°C ***w/ option EXT***
	Storage:	-30°C...80°C
	Relative humidity:	< 95% non condensing
Mains power:	Input:	100...240 V AC nominal, 90...264 V AC max, 50...60 Hz
	Consumption:	65 VA / 45 W typical
	Connector:	IEC C14
	Fuse:	2x 3.15 A time-lag fuse
Dimension and weight:	483 x 44 x 505 mm³ (WxHxD), 1 RU 19" up to approx. 10 kg depending on device type	

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Order information:

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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 and IF input, 50 Ohm version
IF75	additional IF output and IF input, 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
RXSxx	symbol rate based reception license for xx Msps select from: **RXS15, RXS30, RXS45, RXS60, RXSmax** RXSmax supports full throughput according to specification or device limits
RXDxx	data rate based reception license for xx Mbps select from: **RXD10** (default), **RXD30, RXD100, RXD160, RXDmax** RXDmax 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
BBO	direct baseband frame output streaming over IP
TSO	transport stream over IP output
TAB	DVB table insertion for MPE encapsulation
RXL680	extended L-band input down to 680 MHz
RXL2300	extended L-band input up to 2300 MHz
IQ	IQ constellation data output over IP
CCSDS131.3	decapsulation of CCSDS CADU frames from DVB-S2/S2X signals
XMON	extended demodulator signal monitoring