

# A-Series AX-62 Space Mission Ground Modem



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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-62 Space Mission Ground Modem** is the essential ground station element for New Space. With CCSDS waveforms as baseline, it can additionally be equipped with DVB-S2X support, leveraging a commercially established platform for integrated support of multiple space missions from a single device. The software radio approach allows quick and easy extension of waveforms. Teleport-grade interfaces enable seamless integration into global ground station systems.

## Key Features

- CCSDS 231.0-B-3 TC uplinks
- CCSDS 131.0-B-3 TM downlinks
- DVB-S2X - ETSI EN 302 307-2
- DVB-S2 - ETSI EN 302 307-1
- CCSDS 131.3-B-1 CADU frames over DVB-S2
- Symbol rates from 10 ksps to 75 Msps
- Exceptionally clean signal output and internal processing
- 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 AX-62

## Space Mission Ground Modem

### 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, ±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>Clock stability:</b>	Standard: ±2 x 10 <sup>-7</sup> after warm up, aging: ±2 x 10 <sup>-8</sup> per day, ±1 x 10 <sup>-6</sup> per year Extended: ±2 x 10 <sup>-8</sup> after warm up, aging: ±1 x 10 <sup>-9</sup> per day, ±1 x 10 <sup>-7</sup> per year <i>w/ options EXT or RI</i>						
<b>Symbol rate:</b>	Range CCSDS 231.0: 10 ksps ... 5 Msps Range DVB-S2X: 10 ksps ... 75 Msps <i>depending on license TXS*</i> Step size: 1 sps						
<b>CCSDS 231.0 Modulation / Coding:</b>	Modulation: BPSK QPSK Carrier modulation mode: PLOP-1 PLOP-2 Randomizer: on / off Coding: BCH 56/64 LDPC 64/128 or 256/512 all according to CCSDS 231.0-B-3						
<b>DVB-S2X Modulation / Coding:</b> <i>w/ license DAE</i>	<table> <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
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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> <i>w/ license DAE</i>	<table> <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>Signal spectrum mask:</b>	α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05 according to ETSI EN 302307						

Specifications are subject to change

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## Space Mission Ground Modem

### RX Signal Specifications

<b>Signal input L-band:</b>	Frequency: Connector: Impedance: Return Loss: Input power: LNB DC-Feed	950...2150 MHz 680...2300 MHz <i>w/ licenses RXL680 and RXL2300</i> 1x F female 75 Ohm > 13 dB -70...-10 dBm total aggregate power 13.5 V or 18 V switchable 450 mA max. current, short circuit protected 22 kHz tone on/off, DISEqC 1.1
<b>Symbol rate:</b>	Range CCSDS 131.0: Range DVB-S2X: Acquisition bandwidth: Tolerance:	64 ksps ... 60 Msps <i>depending on license RXS*</i> 100 ksps ... 75 Msps <i>depending on license RXS*</i> see Doppler compensation $\pm 1\%$ of selected symbol rate
<b>Doppler compensation:</b>	Max. absolute rate: Max. change of rate:	Doppler compensation is directly related to signal bandwidth. $\pm 0.2 * \text{symbol rate in Hz}$ or $\pm 1.8 \text{ MHz}$ whatever limit applies first $\pm 0.0012 * \text{symbol rate in Hz/s}$ <b>Contact factory for support of Doppler rates outside of this spec.</b>
<b>CCSDS 131.0 Modulation / Coding:</b>	Modulation: Randomizer: Coding: Transfer frame lengths:	BPSK QPSK OQPSK <b>Contact factory for 4D-8PSK TCM support.</b> on / off Reed-Solomon 223/255 or 239/255 Convolutional 1/2, 2/3, 3/4, 5/6, 7/8 separate or concatenated <b>Contact factory for support of LDPC or Turbo codes.</b> 100...2048 Bytes all according to CCSDS 131.0-B-3
<b>DVB-S2X Modulation / Coding:</b> <i>w/ license DAD</i>	ModCods: (normal FEC frame)  ModCods: (short FEC frame)  ModCods linear: (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  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  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> <i>w/ license DAD</i>	ModCods: (normal and short FEC frame; 9/10 normal FEC frame only)  Pilot insertion: Physical layer scrambling:	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 on / off N = 0...262141 all according to ETSI EN 302307-1
<b>Signal spectrum mask:</b>	$\alpha = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05$ according to ETSI EN 302307	

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## Space Mission Ground Modem

### Data Processing and Device Specifications

<b>Device connectors:</b>	Data network: M&C network: 10 MHz reference input: Alarm:	1x Ethernet RJ-45, 10/100/1000Base-T auto sensing 1x Ethernet RJ-45, 10/100/1000Base-T auto sensing BNC female, 50 Ohm <i>w/ option RI</i> DSUB-9 female <i>w/ option RI</i>
<b>Network operation:</b> <i>w/ licenses DAE and DAD</i>	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
<b>Stream inputs:</b>	Interfaces: Baseband data:	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
<b>Stream outputs:</b>	Interfaces: Baseband data: IQ data:  CCSDS CADU frames:	1x RTP/UDP/IP over Ethernet according to IETF RFC 2250 direct output of baseband data w/o filtering padding selectable raw IQ data after demodulation signed 8-bit I and Q values for each symbol decimator selectable to reduce bandwidth occupation <i>w/ license IQ</i> extraction of CCSDS CADU frames from DVB-S2 automatic detection of frame length
<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 AX-62

## Space Mission Ground Modem

### Order information:

**AX-62** Space Mission Ground Modem

### Hardware options:

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

**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

**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

### License based functions:

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

**RXL680** extended L-band input down to 680 MHz  
**RXL2300** extended L-band input up to 2300 MHz  
**DAE** DVB-S2X transmission and network operation  
**DAD** DVB-S2X reception and network operation  
**IQ** IQ constellation data output over IP