A-Series AX-60-S02190
Space Mission Ground Modem

IQ SPACECOM

powered by
WORK MICROWAVE

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-S02190 Space Mission Ground Modem** is the ground station counterpart for IQ Spacecom's XLink space terminal. Development and verification go hand in hand between space and ground segment to ensure compatibility for the mission phase. The established A-Series device platform enables seemless 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**

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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
Clock stability:	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
		w/ options EXT or RI
Symbol rate:	Range CCSDS 231.0:	10 ksps ... 5 Msps
	Range DVB-S2X:	10 ksps ... 75 Msps **depending on license TXS***
	Step size:	1 sps
CCSDS 231.0 Modulation / Coding:	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
DVB-S2X Modulation / Coding: **w/ license DAE**	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
DVB-S2 Modulation / Coding: **w/ license DAE**	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
Signal spectrum mask:	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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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
Symbol rate:	Range CCSDS 131.0:	100 ksps ... 60 Msps *depending on license RXS**
	Range DVB-S2X:	100 ksps ... 75 Msps *depending on license RXS**
	Acquistion bandwidth:	see Doppler compensation
	Tolerance:	± 1% of selected symbol rate
Doppler compensation:		Doppler compensation is directly related to signal bandwidth.
	Max. absolute rate:	± 0.2 * symbol rate in Hz or ± 1.8 MHz
		whatever limit applies first
	Max. change of rate:	± 0.0012 * symbol rate in Hz/s
CCSDS 131.0 Modulation / Coding:	Modulation:	BPSK
		QPSK
		OQPSK
		Contact factory for 4D-8PSK TCM support.
	Randomizer:	on / off
	Coding:	Reed-Solomon 223/255 or 239/255
		Convolutional 1/2, 2/3, 3/4, 5/6, 7/8
		separate or concatenated
		Contact factory for support of LDPC or Turbo codes.
	Transfer frame lengths:	100...2048 Bytes
		all according to CCSDS 131.0-B-3

<table>
<tr><td>DVB-S2X Modulation / Coding:
w/ license DAD</td><td>ModCods:
(normal FEC frame)</td><td>QPSK
8PSK
16APSK
32APSK
64APSK
128PSK
256PSK</td><td>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</td></tr>
<tr><td></td><td>ModCods:
(short FEC frame)</td><td>QPSK
8PSK
16APSK
32APSK</td><td>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</td></tr>
<tr><td></td><td>ModCods linear:
(normal FEC frame)</td><td>16APSK
32APSK
64APSK
256PSK</td><td>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</td></tr>
<tr><td>DVB-S2 Modulation / Coding:
w/ license DAD</td><td>ModCods:
(normal and short FEC frame;
9/10 normal FEC frame only)</td><td>QPSK
8PSK
16APSK
32APSK</td><td>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</td></tr>
<tr><td></td><td>Pilot insertion:
Physical layer scrambling:</td><td colspan="2">on / off
N = 0...262141
all according to ETSI EN 302307-1</td></tr>
<tr><td>Signal spectrum mask:</td><td colspan="3">α = 0.35, 0.25, 0.20, 0.15, 0.10, 0.05 according to ETSI EN 302307</td></tr>
</table>

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Data Processing and Device Specifications

Device connectors:	Data network:	1x Ethernet RJ-45, 10/100/1000Base-T auto sensing
	M&C network:	1x Ethernet RJ-45, 10/100/1000Base-T auto sensing
	10 MHz reference input:	BNC female, 50 Ohm *w/ option RI*
	Alarm:	DSUB-9 female *w/ option RI*
Network operation: *w/ licenses DAE and DAD*	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
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
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
	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
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:	SNMP
	Connection:	UDP/IP over Ethernet/RJ-45 or in-band via satellite link
	Protocol:	HTTP web browser interface
	Connection:	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:
    AX-60-S02190   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