Quest™
Onboard Smallsat Modem

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Our revolutionary high-data-rate Quest™ DVB-S2/ S2X and CCSDS-compliant Software Defined Radio has been designed specifically for smallsats and airborne applications.

It forms part of our comprehensive, off-the-shelf, end-to-end satellite communications solution covering not only the onboard satellite comms but also ground station satellite modems and network management systems.

Support for numerous electrical interfaces and communications protocols ensure the QuestTM modem is compatible with all of the popular CubeSat/smallsat ecosystems.

Users can extend the smallsat's functionality by developing and integrating their own software applications for running onboard the modem, using our Software Development Kit.

SPECIFICATIONS

- Data rates up to 1Gbps
- Modulations up to 1024QAM
- Direct VHF/UHF/IF/L/S/C-band support
- DVB-S2 & DVB-S2X waveforms
- CCSDS Viterbi-RS & CCSDS DVB-S/S2/S2X
- H.265 image & video compression
- 128GB payload mass storage option
- Data interfaces: Gigabit Ethernet, LVDS, SDI/ ASI, USB3, SpaceWire, RS485, UART, CAN, I2C & SPI
- Can host third-party apps (5G/IoT/edge computing/cloud computing, etc.)
- Radiation tolerant option
- Unique DVB-S2/S2X OQPSK option for low transmit power
- Transmit predistortion (reduces required power)
- -40°C to +85°C operation

Benefits

DVB-S2/S2X is the most spectrally-efficient waveform available. It provides between two and three times the throughput of Viterbi/Reed - Solomon (or, alternatively, the same throughput but at a much lower transmit power level).
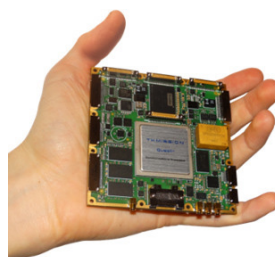
Both our Viterbi/Reed-Solomon and our DVB-S2/ S2X support the CCSDS protocol, meaning that existing CCSDS solutions can be upgraded to use DVB-S2/S2X without having to change any of the data processing on the satellite or on the ground.

For applications with imaging payloads, the efficiency of data downloads can be dramatically increased using our onboard hardware H.265 image/video compression engine.

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Key Features

Primary Function	Software Defined Radio (SDR) for smallsat & airborne applications
Secondary Functions	• Can host third-party software applications • Can host flight computer (OBC) function • Can host payload processor (incl. support for mass storage device & sensor interfaces)
Waveforms	DVB-S2 (EN 302 307-1) DVB-S2X (EN 302 307-2) CCSDS DVB-S2 (CCSDS 131.3-B-1) CCSDS DVB-S2X (proprietary CCSDS extension) CCSDS Viterbi/Reed-Solomon (CCSDS 131.0-B-1) CCSDS 4TCM (CCSDS 401)
Data Rate (Tx & Rx)	DVB-S2/DVB-S2X: 50kbps to 1Gbps Viterbi/Reed-Solomon: 9.6kbps to 50Mbps
Symbol Rate (Tx & Rx)	DVB-S2/DVB-S2X: 100ksps to 119Msps Viterbi/Reed-Solomon: 9.6ksps to 40Msps Maximum occupied carrier bandwidth : 125MHz
Frequency Range	VHF/UHF/IF/L/S/C-band (75MHz to 6GHz) SMA connectors (Other frequencies via external up/down conversion)
Data Interfaces	Gigabit Ethernet, LVDS, SDI/ASI, USB3, SpaceWire, RS485, UART, CAN, I2C, SPI
Spectral Roll-off	Standard: Root-raised cosine filter provides choice of 5%, 10%, 15%, 20%, 25% & 35% carrier roll-off factors Option: Extended roll-offs of 40%, 50% & 60% (reduces peak-to-average power ratio & amplifier back-off)
DVB-S2/S2X ACM	Varies data rate with satellite position during a satellite pass, maximising throughput for the strength of signal being received
Adaptive Tx Predistorter	Corrects for linear & non-linear distortion in the RF chain; maximises linear output power & minimises required back-off; up to 2dB performance gain
Real-time Video Compression	Hardware compression of sensor image & video data to the H.264/H.265 (HEVC) standards at 4K/Ultra High Definition resolutions & 60Hz frame rate, massively reducing storage requirements & data download
Mass Storage	Option to fit 32GB or 128GB SSD drive for storing sensor data
Radiation Tolerance	Standard: • High-reliability lockstep processors • Automatic memory error correction & scrubbing • Software & PSU integrity maintained by watchdog Options: • Key components for detecting & recovering from a radiation upset are radiation hardened (watchdog timer, watchdog timer PSU, flash memory) • Radiation absorbent conformal coating
Output Power	-5 to –40dBm

General Description

- High-performance, low-SWaP modem suitable for satellite & airborne applications
- Powerful 1.5GHz multi-core processing engine
- Optimised for low power operation; various power saving modes
- SDK available for developing onboard apps

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Mechanical / Environmental

Size	90mm x 90mm x 20mm
Weight	< 120g (excludes enclosure)
Power Consumption	5W to 30W depending on data rate & options
Input Voltage	5V (non-regulated)
Emissions & Immunity	Emissions: EN 55032:2015 Immunity: EN 55024:2010, A1
Enclosure	Option: Clamshell enclosure (aluminium; provides 2mm of shielding; weight: < 0.25kg)
Conformal Coating	Option: Space-compliant PCB conformal coating
Testing	Environmental testing: functional, electrical, vibration, shock, thermal, vacuum, EMC (including ionising dose)

Waveforms / Forward Error

DVB-S2X (EN 302 307-2)	Normal Frame: QPSK 13/45, 9/20, 11/20 8PSK 23/36, 25/36, 13/18 8APSK-L 5/9, 26/45 16APSK 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90 16APSK-L 5/9, 8/15, 1/2, 3/5, 2/3 32APSK 32/45, 11/15, 7/9 32APSK-L 2/3 64APSK 11/15, 7/9, 4/5, 5/6 64APSK-L 32/45 128APSK 3/4, 7/9 256APSK 32/45, 3/4 256APSK-L 29/45, 2/3, 31/45, 11/15 Short Frame: QPSK 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 8PSK 7/15, 8/15, 26/45, 32/45 16APSK 7/15, 8/15, 26/45, 3/5, 32/45 32APSK 2/3, 32/45
DVB-S2 (EN 302 307-1)	Normal/Short Frames: 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 Note: rate 9/10 is not valid for short frames
Proprietary Extension to DVB-S2/S2X	OQPSK 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (OQPSK reduces peak-to-average-power ratio of the transmitted signal compared to QPSK, reducing the required back-off & allowing a higher transmit power without impairing the signal)
CCSDS- compliant Viterbi & Reed-Solomon (CCSDS 131.0- B-1)	Viterbi: BPSK, QPSK & OQPSK 1/2, 2/3, 3/4, 5/6, 7/8 Reed-Solomon: Symbols per codeword: 255 Error correction values: 8 & 16 Codes include (255, 233) & (255, 239) plus shortened codeblocks Interleaver depth: 1, 2, 3, 4, 5 & 8
CCSDS- compliant 4TCM (CCSDS 401)	CCSDS 4D 8PSK TCM 3/4, 8/9, 9/10, 10/11, 11/12

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Telemetry, Tracking & Command (TT&C)

SSH/Telnet/ Serial	A command line interface can be used to securely log in to the satellite modem over the TT&C uplink. This can be used to monitor & configure every aspect of the modem
Web User Interface	The satellite modem supports a built-in web server that serves web pages to any web browser for TT&C purposes. This may be useful for both pre-deployment testing & in-orbit operational use
MissionSpan™ NMS	As part of the ground station control network, it allows all modems (in orbit & on the ground) to be monitored & controlled through a single application

Ordering information

Features		Options	Description
Hardware Platform	Select 1 option	A (High Performance)	Provides radiation tolerance, video compression & 128GB mass storage; meets all other specifications provided the relevant feature options are selected
		B (Low Cost)	No radiation hardening, no video compression & only 32GB mass storage; meets all other specifications provided the relevant feature options are selected
RF	Select 1 option	None	Provides a high-speed digital I/O interface to
		VHF/UHF/IF/L/ S/C-band	All frequencies between 75MHz & 6GHz are supported through a plug-in mez-zanine card (requires external power amplification); other frequencies (X, Ku, Ka, etc. require external up/down frequency conversion & amplification)
Data Rate	Select 1 option	100Mbps	Tx & Rx data rates to 100Mbps (50Msps)
		300Mbps	Tx & Rx data rates to 300Mbps (100Msps)
		500Mbps	Tx & Rx data rates to 500Mbps (119Msps)
		1Gbps	Tx & Rx data rates to 1Gbps (119Msps)
Data Rate	Select at least 1 option	DVB-S2	DVB-S2 QPSK, 8PSK, 16APSK & 32APSK operation per EN 302 307-1. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs
		DVB-S2X	DVB-S2X QPSK, 8PSK, 8APSK, 16APSK, 32APSK, 64APSK, 128APSK & 256APSK operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs
		CCSDS DVB-S2/S2X	Note: requires the selection of the DVB-S2 and/or the DVB-S2X option CCSDS DVB-S2 per CCSDS 131.3-B-1
		CCSDS Viterbi/RS	CCSDS Viterbi/Reed-Solomon (CCSDS 131.0-B-1)
		DVB-S2/S2X OQPSK	Proprietary extension to DVB-S2/S2X to provide OQPSK modulation
		CCSDS 4TCM	CCSDS 4D 8PSK TCM (CCSDS 401)
		1024QAM	Proprietary 1024QAM (compatible with Connect™ Ground Station Modem)
ACM		DVB-S2/S2X ACM	Adaptive Coding & Modulation (ACM) mode for use with DVB-S2 & DVB-S2X
Compression		Video Compression	H.264/H.265 (HEVC) hardware image & video compression (included as standard when Hardware Platform A is selected)
Predistortion		Adaptive Tx Predistorter	Predistorts the Tx output in order to compensate for linear & non-linear distor- tion in the received signal
Enclosure		Clamshell Enclosure	Aluminium; provides 2mm of shielding; weight: < 0.25kg
Extended Roll-off		Extended Roll-off	Extends carrier roll-offs to include 40%, 50% & 60%

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