

# TXMISSION

## Quest™ Onboard Smallsat Modem

### Overview

Our revolutionary high data rate Quest™ DVB-S2/S2X and CCSDS-compliant Software Defined Radio has been designed specifically for smallsats. It forms part of our comprehensive, off-the-shelf, end-to-end satellite communications solution covering not only the satellite comms subsystem but also ground station satellite modems and network management systems.

Support for numerous electrical interfaces and communications protocols ensure the Quest™ modem is compatible with all of the popular CubeSat/smallsat ecosystems. It can also be used in a protocol-agnostic mode where any type of data in any format can be sent transparently to and from the satellite.

### Benefits

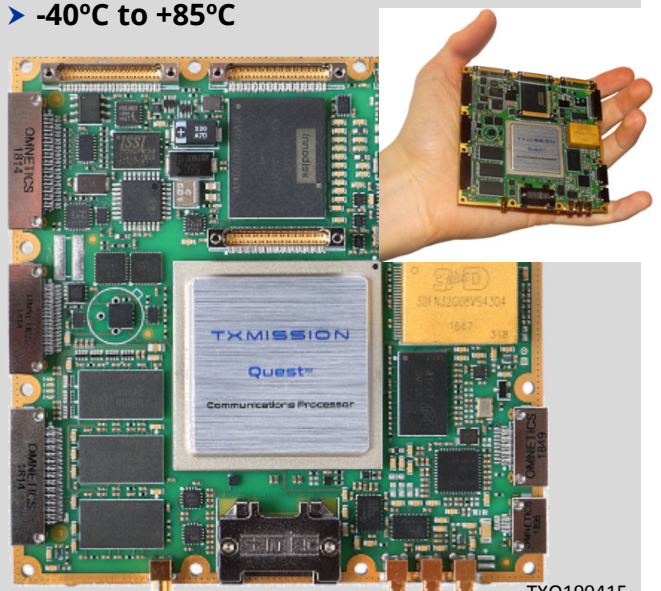
DVB-S2/S2X is the most spectrally-efficient waveform available. It provides between two and three times the throughput of Viterbi/Reed-Solomon (or, alternatively, the same throughput but at a much lower transmit power level).

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 further dramatically increased using our onboard hardware H.265 image/video compression engine.

### Features

- ▶ Data rates up to 500Mbps (over 100Msps)
- ▶ S-band & X-band RF hardware options
- ▶ DVB-S2 & DVB-S2X waveforms
- ▶ CCSDS telemetry standard with Viterbi-RS & DVB-S/S2/S2X
- ▶ H.265 image & video compression
- ▶ Option to host flight computer
- ▶ 128GB payload mass storage option
- ▶ Data interfaces: Gigabit Ethernet, LVDS, SDI/ASI, USB3, SpaceWire, RS485, UART, CAN, I2C & SPI
- ▶ Radiation tolerant option
- ▶ Power saving modes
- ▶ Unique DVB-S2/S2X OQPSK option for low transmit power
- ▶ Transmit predistortion (reduces required power)
- ▶ -40°C to +85°C



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## Key Features

|                             |  |
|-----------------------------|--|
| Primary Function            | CubeSat/smallsat onboard satellite communications subsystem  |
| Secondary Functions         | <ul style="list-style-type: none"> <li>Option to host flight computer (OBC)</li> <li>Option to host payload processor (includes mass storage device &amp; sensor interfaces)</li> </ul>  |
| Waveforms                   | DVB-S2 (EN 302 307-1)<br>DVB-S2X (EN 302 307-2)<br>CCSDS DVB-S2 (CCSDS 131.3-B-1)<br>CCSDS DVB-S2X (proprietary CCSDS extension)<br>CCSDS Viterbi/Reed-Solomon (CCSDS 131.0-B-1)<br>CCSDS 4TCM (CCSDS 401)   |
| Data Rate (Tx & Rx)         | DVB-S2/DVB-S2X: 50kbps to 500Mbps<br>Viterbi/Reed-Solomon: 9.6kbps to 50Mbps   |
| Symbol Rate (Tx & Rx)       | DVB-S2/DVB-S2X: 100ksps to 125Msps<br>Viterbi/Reed-Solomon: 9.6ksps to 40Msps  |
| Frequency                   | Onboard option:<br>Tx/Rx IF/L-band/S-band (75MHz to 6GHz)<br>SMA connectors<br><br>Offboard option (additional RF card):<br>Tx/Rx X-band (7.25GHz to 8.4GHz)   |
| Data Interfaces             | Gigabit Ethernet, LVDS, SDI/ASI, USB3, SpaceWire, RS485, UART, CAN, I2C, SPI   |
| Spectral Roll-off           | Root-raised cosine filter provides choice of 5%, 10%, 15%, 20%, 25%, 35% & 40% carrier roll-off factors  |
| 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 and 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 and 60Hz frame rate, massively reducing storage requirements and size of data download                                       |
| Radiation Tolerance         | <ul style="list-style-type: none"> <li>High-reliability lock-step processors</li> <li>Automatic memory error correction</li> <li>Radiation hardened PSU</li> <li>Radiation hardened flash memory</li> <li>Radiation absorbent conformal coating</li> </ul> |

## General Description

- High-performance Software Defined Radio (SDR) powered by TXMission's own system-on-a-chip; supports multiple modem communication standards; software upgradeable via the TT&C uplink, allowing addition of new functionality
- Powerful 1.5GHz multi-core processing engine
- Optimised for low power operation; various power saving modes

## Waveforms / Forward Error Correction

|  |   |
|--|---|
| DVB-S2X (EN 302 307-2)                                   | <p>Normal Frame:</p> <p>QPSK 13/45, 9/20, 11/20<br/>8PSK 23/36, 25/36, 13/18<br/>8APSK-L 5/9, 26/45<br/>16APSK 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90<br/>16APSK-L 5/9, 8/15, 1/2, 3/5, 2/3<br/>32APSK 32/45, 11/15, 7/9<br/>32APSK-L 2/3<br/>64APSK 11/15, 7/9, 4/5, 5/6<br/>64APSK-L 32/45</p> <p>Short Frame:</p> <p>QPSK 11/45, 4/15, 14/45, 7/15, 8/15, 32/45<br/>8PSK 7/15, 8/15, 26/45, 32/45<br/>16APSK 7/15, 8/15, 26/45, 3/5, 32/45<br/>32APSK 2/3, 32/45</p>   |
| DVB-S2 (EN 302 307-1)                                    | <p>QPSK 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br/>8PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10<br/>16APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br/>32APSK 3/4, 4/5, 5/6, 8/9, 9/10</p>  |
| Proprietary Extension to DVB-S2/S2X                      | <p>OQPSK 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10<br/>(OQPSK reduces the peak-to-average-power ratio of the transmitted signal compared to QPSK, reducing the required back-off and allowing a higher transmit power to be used without impairing the signal)</p> <p>Viterbi:<br/>BPSK, QPSK &amp; OQPSK 1/2, 2/3, 3/4, 5/6, 7/8</p> <p>Reed-Solomon:<br/>Symbols per codeword: 255<br/>Error correction values: 8 &amp; 16<br/>Codes include (255, 233) &amp; (255, 239) plus shortened codeblocks<br/>Interleaver depth: 1, 2, 3, 4, 5 &amp; 8</p> |
| CCSDS-compliant Viterbi & Reed-Solomon (CCSDS 131.0-B-1) | <p>CCSDS 4D 8PSK TCM 3/4, 8/9, 9/10, 10/11, 11/12</p>   |
| CCSDS-compliant 4TCM (CCSDS 401)                         | <p>CCSDS 4D 8PSK TCM 3/4, 8/9, 9/10, 10/11, 11/12</p>   |

## Telemetry, Tracking and Command (TT&C)

|                    |  |
|--------------------|--|
| Telnet             | 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 and 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 and in-orbit operational use |
| MissionSpan NMS    | This application forms part of the ground station control network. It allows all modems (in orbit and on the ground) to be monitored and controlled through a single application               |

## Mechanical/Environmental

|                      |   |
|----------------------|---|
| Size                 | 90mm x 90mm x 18mm (excludes mezzanine card)  |
| Weight               | < 120g (excludes mezzanine card & enclosure)  |
| Power Consumption    | 5W to 15W depending on data rate & options  |
| Input Voltage        | 5V (non-regulated)  |
| Emissions & Immunity | Emissions: EN 55032:2015<br>Immunity: EN 55024:2010, A1   |
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| Conformal Coating    | Space-compliant PCB conformal coating   |
| Testing              | Environmental testing: functional, electrical, vibration, shock, thermal, vacuum, EMC (including ionising dose) |

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**Ordering Information: Please select from the following options when placing an order**

| Feature           |                             | Options                  | Description  |
|-------------------|-----------------------------|--------------------------|--|
| Hardware Platform | 1 option<br>Select          | 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 tolerance, no video compression & only 32GB mass storage; meets all other specifications provided the relevant feature options are selected |
| RF                | 1 option<br>Select          | None                     | Provides a high-speed digital I/O interface to the user's own RF solution  |
|                   |                             | S-band                   | S-band support is provided through a plug-in mezzanine card  |
|                   |                             | X-band                   | X-band support is provided through a plug-in mezzanine card  |
| Data Rate         | 1 option<br>Select          | 100Mbps                  | Tx and Rx data rates to 100Mbps (50Msps)   |
|                   |                             | 300Mbps                  | Tx and Rx data rates to 300Mbps (100Msps)  |
|                   |                             | 500Mbps                  | Tx and Rx data rates to 500Mbps (125Msps)  |
| Waveforms         | 1 option<br>Select at least | DVB-S2                   | DVB-S2 QPSK, 8PSK, 16APSK & 32APSK operation per EN 302 307-1. Includes 5%, 10%, 15%, 20%, 25%, 35% & 40% spectral roll-offs                             |
|                   |                             | DVB-S2X                  | DVB-S2X QPSK, 8PSK, 8APSK, 16APSK, 32APSK & 64APSK operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25%, 35% & 40% spectral roll-offs             |
|                   |                             | CCSDS DVB-S2/S2X         | Note: requires the selection of the DVB-S2 and/or the DVB-S2X option<br>CCSDS DVB-S2 per CCSDS 131.3-B-1<br>CCSDS DVB-S2X (proprietary CCSDS extension)  |
|                   |                             | 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)  |
| ACM               |                             | DVB-S2/S2X ACM           | Adaptive Coding and Modulation (ACM) mode for use with DVB-S2 and DVB-S2X  |
| Compression       |                             | Video Compression        | H.264/H.265 (HEVC) hardware image and 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 and non-linear distortion in the received signal   |

For more information, including pricing, or to place an order, please contact us directly at:

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