

Omnisat

Advanced Data Acquisition System
for Earth Observation and Science

Model HW-02193



Antwerp Space's Omnisat is the third generation of a modular solution for satellite earth observation and scientific data reception.

It performs frequency conversion, data demodulation and data acquisition in a cost-efficient single unit. The system is capable of receiving several channels in parallel, fully independent of each other. The Omnisat is developed by Antwerp space, a company with over 50 years of experience in satellite data reception.



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Omnisat



Main Functionality

- ▶ Handling the widest variety of satellite signals w.r.t. bit rates, modulation – and decoding schemes, data processing up to (unformatted) level
- ▶ Fully (user-)programmable to any number of missions
- ▶ Test modulator allows up-front verification of missions
- ▶ Internal real time spectrum analyzer and constellation diagram

Applications

- ▶ Reception of high bitrate payload telemetry in satellite groundstation
- ▶ Test transmitter for payload telemetry simulation
- ▶ SCOE for payload telemetry (PDD, PDHT, etc.)

Key Benefits

- ▶ Modular & flexible, allowing a customized solution with different building blocks
 - Up to 3 independent high speed Demodulators
 - Data Ingest & front-end processors (CCSDS and DVB-S)
 - Data storage
 - Real Time data distribution over Ethernet
 - Test modulator and built-in test & simulation facilities
 - Frequency down converter
- ▶ Numerous missions pre-stored with all parameters
- ▶ Upgradeable to all future satellite missions
- ▶ Operational reliability:
 - High MTBF
 - User replaceable parts (SDD, redundant PSU, fans, filters)
 - Functionality is in software and/or on reprogrammable digital hardware.
 - No tuning required



Features and Specifications

The Omnisat product is a modular system. The product can be customized according to the needs of the specific application for which it is being used.

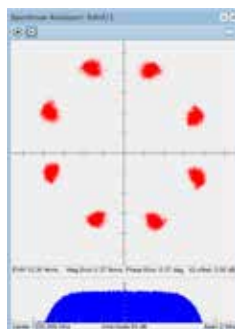
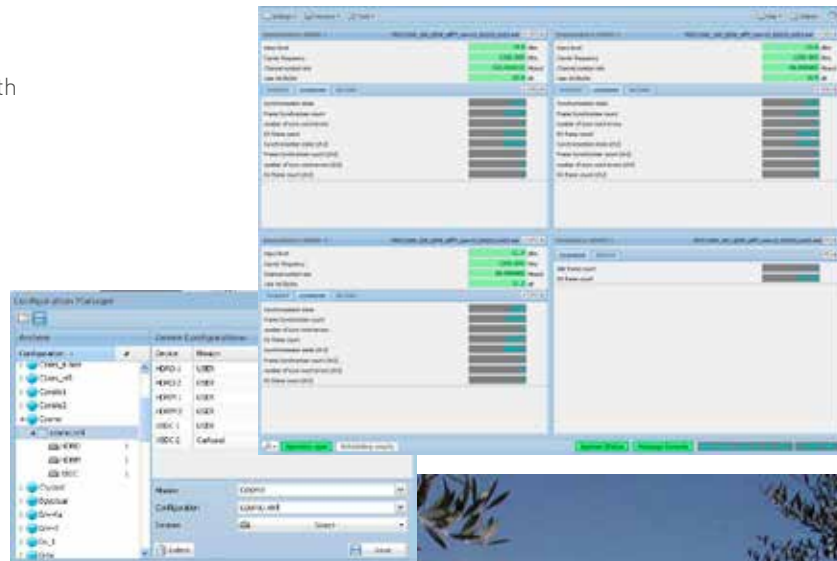
Following modules are available:

- ▶ High Data Rate Demodulator (HDRD)
- ▶ High Data Rate Test Modulator (HDRM)
- ▶ Built-in X-Band Down Converter (XBDC)

High Data Rate Demodulator HDRD

The HDRD is the core module which demodulates the received signals into data.

- ▶ Up to 3 HDRD can be fitted
- ▶ Modulation types
 - BPSK, QPSK, SQPSK, OQPSK, UQPSK, AQPSK, 4D-8PSK (TCM), GMSK



- ▶ Bit rates
 - BPSK, GMSK: 325Mbit/s [325MSymb/s]
 - (S/O/U/A)QPSK: 650Mbit/s [325MSymb/s]
 - 8PSK: 975Mbit/s [325MSymb/s]
- ▶ Differential decoding
 - QPSK: modulo-4 Gray decoding, 8 different codes possible
 - BPSK, SQPSK: modulo-2 decoding, i.e. NRZ-M or NRZ-S to NRZ-L conversion
 - 8PSK: 8 different codes possible
- ▶ Convolutional decoding (K=7), rates 1/2, 2/3, 3/4, 5/6, 7/8.
- ▶ CCSDS compatible 4D TCM (Trellis Coded Modulation)
- ▶ Reed-Solomon decoding (255,223), (255,239), (254,238) and shortened codes
- ▶ LDPC decoding (7/8)
- ▶ IF input frequency
 - Standard: 720±190MHz or 1200±350MHz
 - Optional: 375MHz (others on request). Limitations on bitrates may apply
- ▶ Frequency search range programmable, up to 1500kHz (step 1kHz)
- ▶ Input frequency change rate (Doppler rate) up to 35kHz/s
- ▶ Input signal level range (AGC): 40dB (-50 to -10dBm)
- ▶ Max. bit clock frequency offset 10^{-4} x bit clock frequency
- ▶ Power unbalance I/Q up to 10 dB (UQPSK)
- ▶ BER Data processing up to (unformatted) level 0
- ▶ BER degradation (QPSK): <1dB at 975Mbps at BER 10^{-6}
- ▶ Digital SRRC filter (roll-off 0.1 – 1), RC filter
- ▶ Acquisition time: typically 250 ms
- ▶ Acquisition threshold
 - BPSK $E_b/N_0 = 1$ dB
 - QPSK $E_s/N_0 = 4$ dB
- ▶ Adaptive equalizer to mitigate the effects of satellite transmitter imperfections and reception issues, in terms of compression, amplitude & phase slope and multipath effects
- ▶ BER counter
 - PN code $2^{31}-1$, $2^{23}-1$, $2^{15}-1$, $2^{11}-1$, $2^{10}-1$, 2^7-1
- ▶ Outputs
 - Two digital data outputs (ECL and/or LVDS) and two corresponding clock outputs directly accessible from the back panel of the equipment
 - Real Time Data Distribution over Ethernet
 - Other outputs on request
- ▶ Front-End Processing (FEP) functionality:
 - Automatic ambiguity and data polarity resolving
 - Real time ingest of data
 - Frame synchronization, descrambling and CRC in real time for all supported bitrates
 - Real time Reed-Solomon processing
 - Saving of ingested data to disk in real time before or after frame synchronization
 - Data distribution over the network using onboard LAN on standard file transfer protocols
 - Measurements of data/reception quality

Examples of satellite preloaded on the Omnisat:

Aqua DB/DD & DP	FY-3	Meteosat 3 rd generation	Sentinel
Aura	HY-1	Metop	SICH-2
CBERS	Icesat	Pleiades	SICH-3
Coriolis	Ikonos	Proba	SMOS
Cosmo Skymed	IRS P4	Quickbird	SPOT-2
Cryosat	IRS P6	Radarsat-1	SPOT-5
Enmap	IRS 1C/1D	Radarsat-2	SPOT VGT
Envisat	JEM	RazakSat	Terra Mode DB
EO-1	Kompsat-1	SAC-C	TerraSar
EROS	Kompsat-2	SAC-D	Topsat
ERS	Landsat-5	Saocom-1	and many more
Fórmosat (Rocsat)	Landsat-7	Saocom-2	

High Data Rate Modulator HDRM

The HDRM is a test modulator which allows loop-back tests of the equipment.

- ▶ IF output frequency, modulation types, coding, bit rates: same as for the HDRD
- ▶ Data source
 - Internal PRBS sequence generator with PN codes $2^{31}-1$, $2^{23}-1$, $2^{15}-1$, $2^{11}-1$, $2^{10}-1$, 2^7-1
 - External data : two digital data & clock inputs (ECL or LVDS) on the back panel, optional other connections
 - Data from disk
- ▶ Filtering: SRRC filter
- ▶ Output level range: -50 to -10dBm (step 1dB)
- ▶ Noise source: -132dBm/Hz to -93dBm/Hz (white noise) allowing BER measurements with the HDRD
- ▶ Doppler and fading simulator: frequency and amplitude ramp applied to the carrier.

X-band DownConverter

The X-band Down Converter converts the RF input to a fixed IF frequency of 750 MHz.

- ▶ RF input level: -80 to -40dBm
- ▶ RF input frequency: 7.9 to 8.4GHz
- ▶ RF input connector: SMA, on the back panel
- ▶ IF output level: 15 up to 45dB above RF input level
- ▶ IF output frequency: 750MHz
- ▶ Internal synthesizer reference can be locked onto an external reference

Overall System Functions

- ▶ Local monitoring and control via front panel TFT screen or remotely over Ethernet via a TCP/IP interface
- ▶ Continuous logging of all receiving parameters.
- ▶ Internal spectrum analyzer and constellation diagram.
- ▶ Capability to generate pdf reports.

Environmental & Power

- ▶ Operating temperature: +10°C to +40°C
- ▶ Storage temperature: -20°C to +60°C
- ▶ Relative humidity: 10% to 90% non condensing
- ▶ Operational altitude: -100m ... + 3000m (103kPa to 70kPa)
- ▶ The equipment is CE compliant and CB scheme tested
- ▶ Redundant Power supply : 90V-265V, 47-63Hz

Physical Dimensions

- ▶ The Omnisat equipment is a 4U high, 19" rack-mount Industrial PC with an LCD display, built-in slim drawer with keyboard and touch pad.
- ▶ Dimensions (WxHxD): 43.8 x 17.6 x 50.5 cm.
- ▶ Weight: 32kg max

Ordering Information

HW-02193 Omnisat

Please contact Antwerp Space for the variant that suits your needs in terms of number of reception chains, testmodulators, FEP functionality and bitrates.

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