MODEL HW-02193

OMNISAT

ADVANCED DATA ACQUISITION SYSTEM FOR EARTH OBSERVATION AND SCIENCE MISSIONS

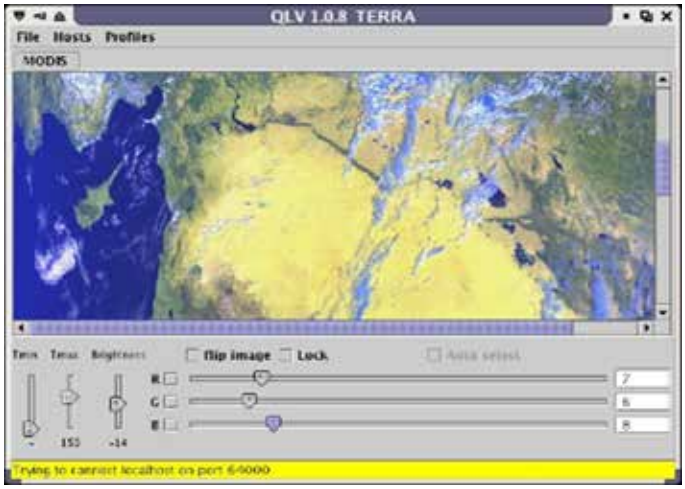
CelestiAntwerp
Celestia Technologies Group Company

OMNISAT

The 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.

MAIN FUNCTIONALITY

- Handling the widest variety of satellite signals w.r.t. bit rates, modulation – and decoding schemes, data processing up to (unformatted) level L0
- 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 test equipment for payload telemetry (PDD, PDHT, etc.)

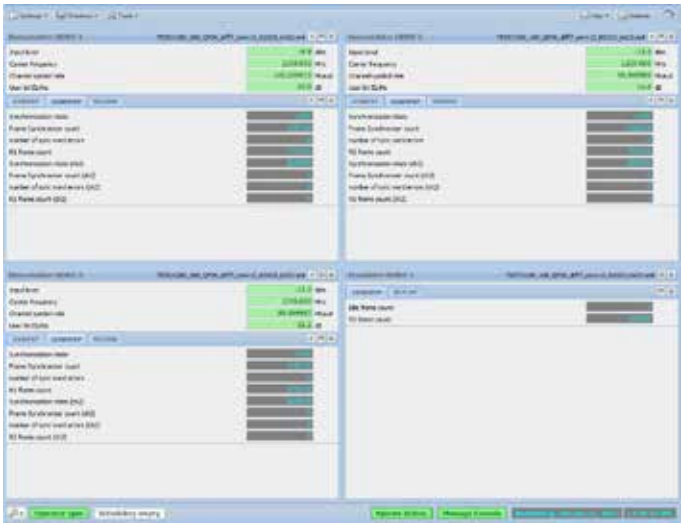
KEY BENEFITS

- Modular & flexible, allowing a customized solution with different building blocks
  - Up to 4 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 in XML files
- 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:

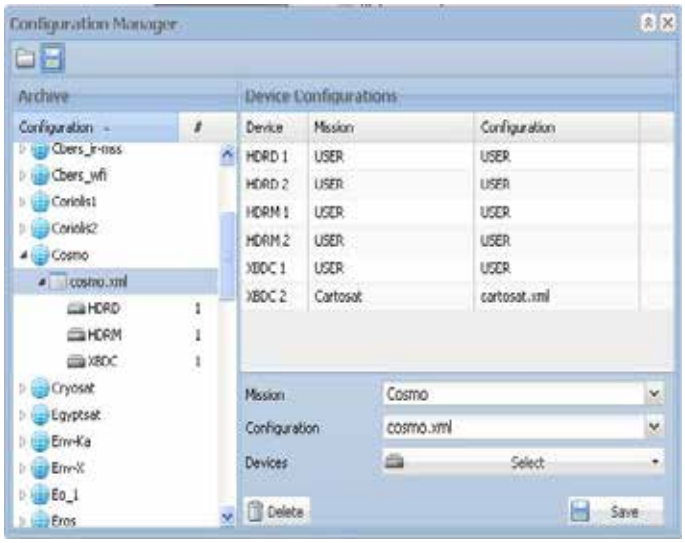
- High Data Rate Demodulator (HDRD)
- High Data Rate Test Modulator (HDRM)
- Built-in X-Band Down Converter (XBDC)



HIGH DATA RATE DEMODULATOR HDRD

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

- Up to 4 HDRD can be fitted
- Modulation types
  - BPSK, QPSK, SQPSK, OQPSK, UQPSK, AQPSK, 4D-8PSK (TCM), GMSK
- Bit rates
  - BPSK, GMSK: 1 to 325 Mbit/s (325 MSymb/s)
  - (S/O/U/A)QPSK: 2 to 650 Mbit/s (325 MSymb/s)
  - 8 PSK: 3 to 975 Mbit/s (325 MSymb/s)
- Differential decoding
  - QPSK: modulo-4 Gray decoding, 8 different codes possible
  - BPSK, SQPSK: NRZ-L/M/S
  - 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 ± 190 MHz or 1200 ± 350 MHz (so contiguous IF Frequency from 530 to 1550 MHz)
  - Optional: 375 MHz (others on request). Limitations on bitrates may apply
- Frequency search range programmable, up to 1500 kHz (step 1 kHz)
- Input frequency change rate (Doppler rate) up to 35 kHz/s
- Input signal level range (AGC): 40 dB (- 50 to -10 dBm)
- Max. bit clock frequency offset 10^{-4} x bit clock frequency
- Power unbalance I/Q up to 10 dB for UQPSK
- BER degradation (QPSK): < 1 dB at 975 Mbps at BER 10^{-6}
- Digital SRRC filter (roll-off 0.1 – 1), RC filter
- Acquisition time: typically 250 ms
- Acquisition threshold
  - BPSK Es/No = 1 dB
  - QPSK Es/No = 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
  - Storage to file and retrieval 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



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 or square filter
- Output level range: - 50 to - 10 dBm (step 1 dB)
- Noise source: - 132 dBm/Hz to - 93 dBm/Hz (white noise) allowing BER measurements with the HDRD
- Doppler simulator: configurable frequency sweep ramp applied to the carrier.

OVERALL SYSTEM FUNCTIONS

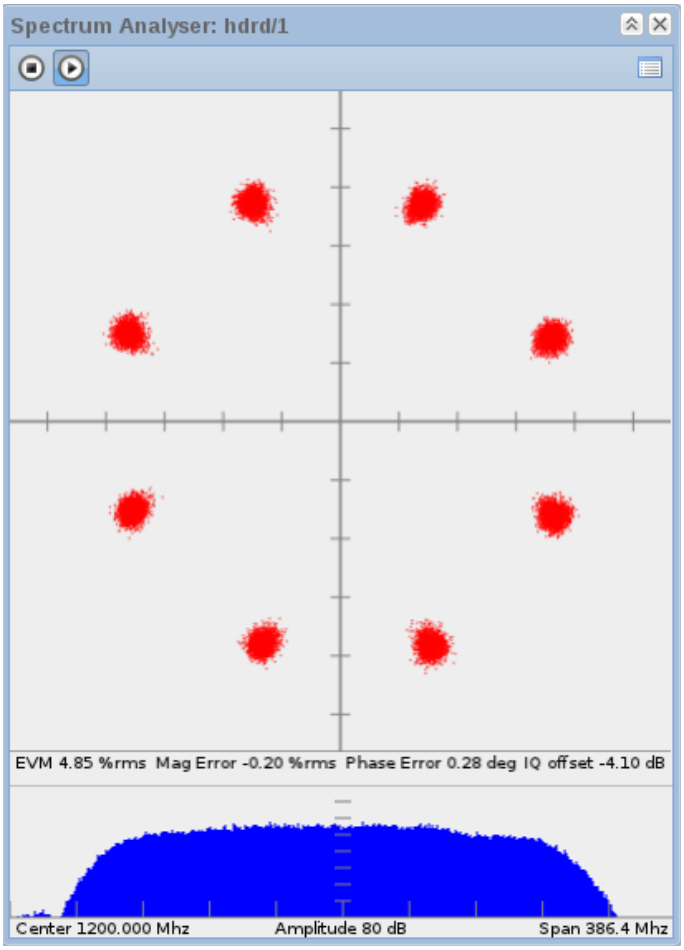
- Local monitoring and control via front panel TFT screen or remotely over Ethernet via a TCP/IP interface
- Continuous logging of all parameters.
- Internal spectrum analyzer and constellation diagram.
- Unlimited amount of configuration files can be stored for missions

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 … + 3000 m (103 kPa to 70 kPa)
- The equipment is CE compliant and CB scheme tested
- Redundant Power supply : 90 V - 265 V, 47 - 63 Hz
- Power Consumption (Configuration: 2HDRD + 1 HDRM:
  - Full operational: 300W
  - Standby: 10W

PHYSICAL DIMENSIONS

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



EXAMPLES OF SATELLITE CONFIGURATIONS ON THE OMNISAT

AQUA	IRS P6	RAZAKSAT	FORMOSAT (ROCSAT)
ICESAT	RADARSAT-1	TERRA	LANDSAT-8 (LDCM)
PLEIADES	SPOT-6	EO-1	SAOCOM-2
SICH-2	COSMO SKYMED	KOMPSAT-2	FY-3
AURA	IRS 1C/1D	SAC-C	METEOSAT 3RD
IKONOS	RADARSAT-2	TERRASAR	GENERATION
PROBA 1, 2, V, 3	SPOT VGT	EROS	SARSAT
SICH-3	CRYOSAT	LANDSAT-5	HY-1
CBERS	JEM	SAC-D	METOP
IRS P4	RAPID EYE	TOPSAT	SENTINEL
QUICKBIRD	SUOMI NPP	ERS	AND MANY MORE
SMOS	ENMAP	LANDSAT-7	
CORIOLIS	KOMPSAT-1	SAOCOM-1	

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