MEOS™ Capture HRDFEP

KONGSBERG

High-Rate Demodulator & Front-End Processor V12 Max 1200 X4

The MEOS™ Capture HRDFEP V12 Max 1200 X4 is a high performance, fully programmable data receiver, acquisition and data processing system for the most demanding professional users. It offers full bandwidth exploitation in Ka-band by a symbol rate up to 2 x 1200 Msps, for an aggregate bitrate of 10+ Gbps. MEOS™ Capture HRDFEP V12 offers unmatched Performance, Reliability and Flexibility.

MEOS™ Capture HRDFEP V12 Max 1200 X4 is a 4-channel version of the MEOS™ Capture HRDFEP V12 product. It performs demodulation of IF signals down-converted from RF by the ground antenna. Multiple RF frequency bands can be used; e.g. S-, X-, Ka-band, etc. It records raw and processed data to internal disk in parallel with data outputs to external network (LAN/WAN).

Max 1200 X4 supports conventional satellite downlink standards as well as ETSI DVB-S2/S2X* and CCSDS SCCC**. The number of supported ModCods is growing. Please contact KONGSBERG for an updated list.

Max 1200 X4 is a Software Defined Radio (SDR) with direct sampling of the input IF signal. This solution simplifies the analogue part of the receiver and reduces implementation losses compared to other sampling strategies.

Max 1200 X4 makes full use of a 1.5 GHz bandwidth as in e.g. Ka-band in 2 or 4 independent receiver channels each supporting symbol rates up to 1200 or 600 Msps, respectively, defined by software-controlled configuration.

RELIABILITY

- Fully automated operations end-to-end
- Automatic recovery in case of network problems
- Automated storage management using RAID
- Hot swap disks
- Dual power supplies, hot swappable
- Monitoring of HW resources
- Stable Linux system supporting 24/7 operations
- Robust server computer and data processing boards

PERFORMANCE

- 1200 Msps x 2 channels and 600 Mbps x 4 channels: 10+ Gbps total
- Low implementation loss: 0.1 – 0.8 dB, typically <0.5 dB
- Conventional modulations and coding, DVB-S2(X)*, CCSDS SCCC**

FLEXIBILITY & MODULARITY

- Selectable number of demodulator channels and symbol rates
- Independent demodulator channels to maximize operational flexibility
- Real-time data distribution during contacts
- Scalable internal data storage capacity
- Re-programmable / in-field upgradable FPGA technology
- Keep the HRDFEP V12 continuously updated by downloading new software under maintenance support

FEATURES

- Real-time data acquisition, processing and distribution
- Fast lock-in times: 0.01 – 0.1 sec. typically
- Data rates from 400 kbps up to 6.2 Gbps per channel
- Up to 8 Front-End Processors
- Receiver implementation loss typically less than 0.5 dB
- Receiver Adaptive Equalizer compensates for bandwidth mismatch, group delay, ISI, spectrum tilt and multipath
- Cross-Channel Interference Cancellation
- Real time and offline status and plots available
- WEB and PDF quality reports
- CFDP (CCSDS File Delivery Protocol), Class 1 and 2
- CCSDS AOS Instrument Source Packets reconstruction
- Real-time buffered distribution, automatic recovery
- SUSE Enterprise Linux, redundant power and SAS RAID disks
- Automatic scheduling
- Autonomous operation
- Space Link Extension (SLE)
- HTML GUI (web browser)

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* ETSI EN 302 307-1
** CCSDS 131.2-B-2

DUAL DEMODULATOR CHANNELS – PER CHANNEL:

- Programmable, wideband digital demodulator:
  - BPSK, xQPSK, 8PSK, 16QAM
  - SCCC per CCSDS 131.2-B-1
  - DVB-S2 per ETSI EN 302 307-1
- Dual input ports – female SMA connectors
- Tunable Carrier frequencies: 720/1200/2400 MHz
- Input impedance: 50 ohms
- VSWR: < 1.5
- AGC range: 0 dBm to –50 dBm
- Demodulation type:
  - BPSK, CBPSK, QPSK, OQPSK, AQPSK (LS-7), UQPSK (3, 6, 9 dB), 8PSK, 16QAM
  - DVB-S2(X): QPSK, 8PSK, 16APSK, 32APSK, 64APSK
  - SCCC: QPSK, 8PSK, 16APSK, 32APSK, 64APSK
- SRRC Matched Filter with tunable rolloff factor
- Adaptive Equalizer
- XPIC (Cross Polar Interference Cancellation) Filter
- Spectrum inversion correction
- Improved carrier acquisition speed for low symbol rates (from ~10 MHz and below)
- Carrier Doppler tracking range: 8 MHz (±4 MHz)
- Max Carrier Doppler rate: 100 kHz/s
- Reference oscillator input: 10 MHz, 100 MHz
- Time reference input IRIG-B, 1 PPS

FRONT-END PROCESSOR (FEP)

Two FEPs per demodulator – fully independent I/Q processing.

Frame Processing

- Frame synchronization, derandomization, error correction and time tagging
- Automatic data ambiguity resolution

Advanced frame synchronization:

- Sync options: CCSDS AOS/PT, TDM
- Fixed & variable length, adaptive modes
- Frame length: Up to 64 kBytes
- Sync pattern: Up to 64 bits
- Bit error tolerance: Up to 16 bit errors
- Search-Check-Lock-Flywheel strategy:
  - Thresholds 0 to 15 frames
  - Bit slips: ± 4 bits

CRC checking:

- CCSDS polynomial: $G(X) = X^{16} + X^{12} + X^{16} + 1$
- Programmable offsets

Decoding:

- Differential Decoding
- PCM: NRZ-M, NRZ-S, NRZ-L
- Trellis Decoding 4D-TCM according to CCSDS 401.0-B-32:
  - Rate: 8/12, 9/12, 10/12, 11/12
- Viterbi decoding: CCSDS compliant polynomial
  - Rate 1/2, 3/4, 2/3, 5/6, 7/8
  - 7 bits constraint length
  - Viterbi BER estimation

Forward Error Correction and Detection:

- R-S (10, 6), R-S (255, 239), R-S (255, 223)
  - Codeword interleaving: 1 to 16
  - Codeword length: 33 to 255
- LDPC 7/8
  - Configurable max number of iterations
- Filtering of uncorrectable frames
- BCH/LDPC for DVB-S2
- SCCC Turbo codes

Quality and Frame Sync Status Appending:

- Up to 4 bytes of Frame Sync status appended to the frames
- Reed-Solomon status: Up to 32 bytes appended to the frames (including frame counter, error status, and user defined fields)

MEOS
MULTI-MISSION EARTH OBSERVATION SYSTEM

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Time-stamping - 8 bytes time field:

- Day; millisec of day; microsec of millisec

PROCESSING

- VCDU demultiplexing by VCID
- Space Packet (SP; AP/ISP) service processing
- CCSDS AOS Path, Internet, Encapsulation services (partly)
- CFDP: CCSDS File Delivery Protocol, Class 1 & 2

BASEBAND DATA INPUTS/OUTPUTS

Differential ECL or LVDS: Optional

- Per channel: Two separate or merged (I+Q) synchronous clock/data inputs
- Data rates: Up to 1 Gbps per channel
- Electrical standard: Differential ECL or LVDS

10 Gbps Ethernet

DISTRIBUTION

- Post-pass & near real-time (NRT) protocols: TCP socket, FTP, SFTP, FTPS
- Rate control
- Compression
- Encryption
- XML meta data and checksums
- SLE: CCSDS Space Link Extension: RAF, RCF
- CFDP: Class 1 and Class 2

SPECIAL FEATURES

- PN generator & BER testers: Selectable standard polynomials PN9, PN15, PN20, PN23
- Status report file generation

AUTOMATIC STORAGE MANAGEMENT

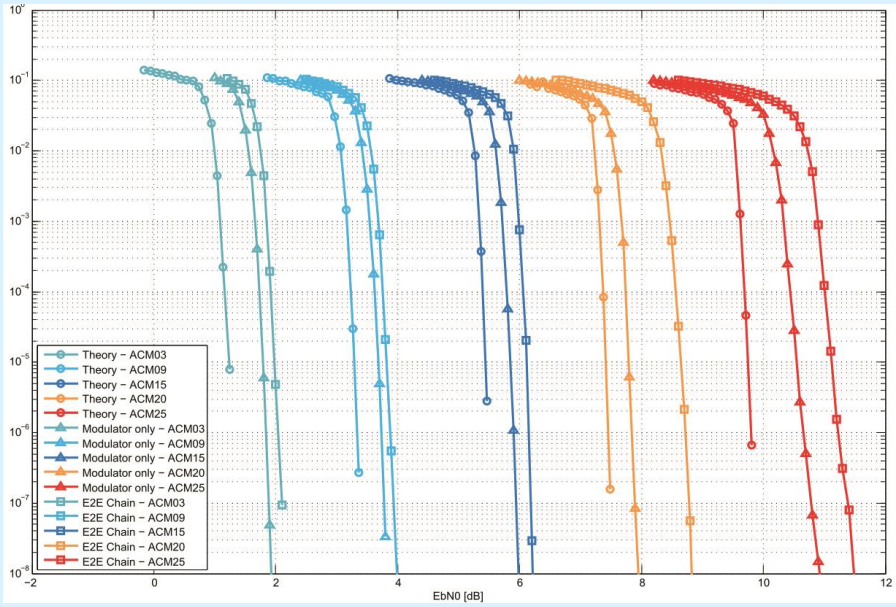
- Oldest data stored on disk will automatically be deleted when necessary
- User controlled locking of data

EXTERNAL INTERFACE

- TCP socket and XML based external interface with minimal bandwidth usage
- Access authentication

REPORTING

- Status and statistics from previous activities, sorted on satellite and orbit.
- Numeric values and graphs.
- Automatic generation of WEB reports, including status and statistics, plots, events and data analysis, video of signal spectrum and vector diagram; Available through standard WEB browser.



MEOS HRDFEP END to END measurements performed with space transmitter, TWTA, downconverter and MEOS Capture HRDFEP receiver: BER vs Eb/N0

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AUTOMATIC COMMANDING

This feature is based on orbit prediction for user selected missions. Candidate list of satellite missions to receive and process is generated automatically. The list is editable by the operator.

DATA DRIVEN OPERATIONS

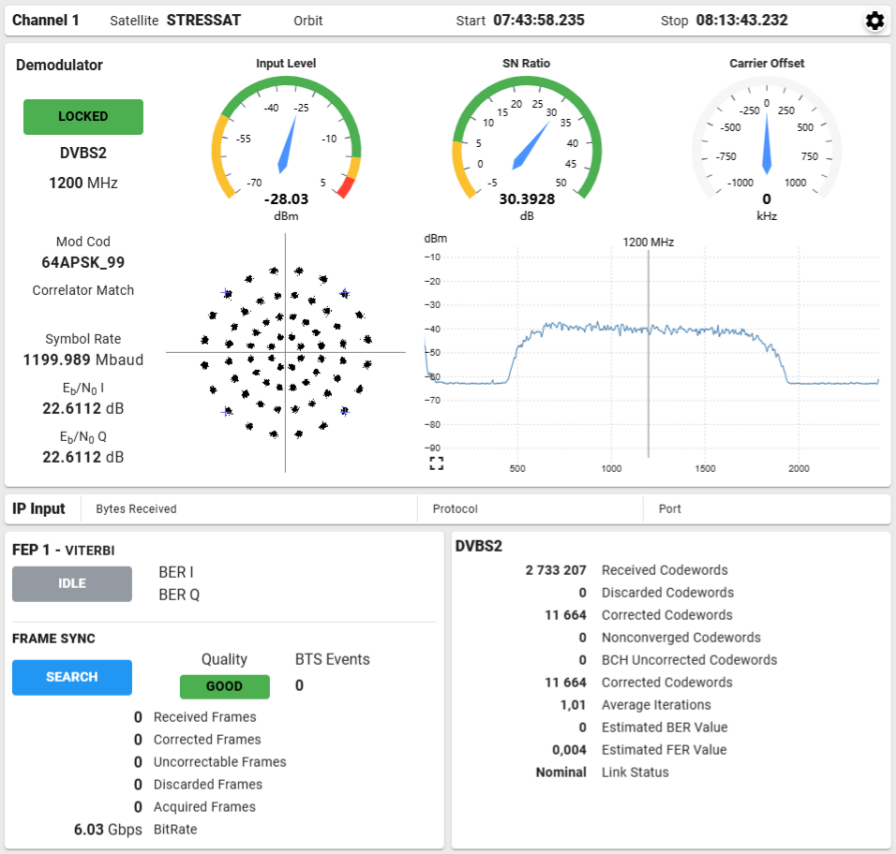
Fully automatic reception, processing and distribution of satellite data based on intelligent algorithms.

GRAPHICAL USER INTERFACE

- Real time visualization of quality/quantity status
- Real time vector and signal spectrum plots
- Real-time visualization of acquired data from optical satellite instruments (Moving Window)

Implementation Losses (dB)						
Modulation	Gbit Rates per Channel					
	0.1	0.25	0.5	1.0	2.7	6.2
BPSK	0.15	0.2	0.3	0.4		
QPSK	0.2	0.3	0.5	0.6		
8PSK	0.3	0.3	0.4	0.5	0.7	
160AM	0.3	0.3	0.4	0.5	0.7	
DVB-S2(X)	< 0.3	< 0.3	< 0.4	< 0.5	< 0.8	
SCCC	< 0.3	< 0.3	< 0.4	< 0.5	< 0.8	< 1.0

Chassis Specifications	
Rack Mountable chassis	Standard
Height x Widt x Depth in cm	8.73 x 44.54 x 67.94 cm
Weight	Approx. 20 kg
Temperature operating	10°C to 35°C
Power supply	100-240 V / 50-60 Hz / 800 W
Number of power supplies	2
Temperature non-operating	-30°C to 60°C
Relative Humidity operating	10-80%
Relative Humidity non operating	5-95%



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