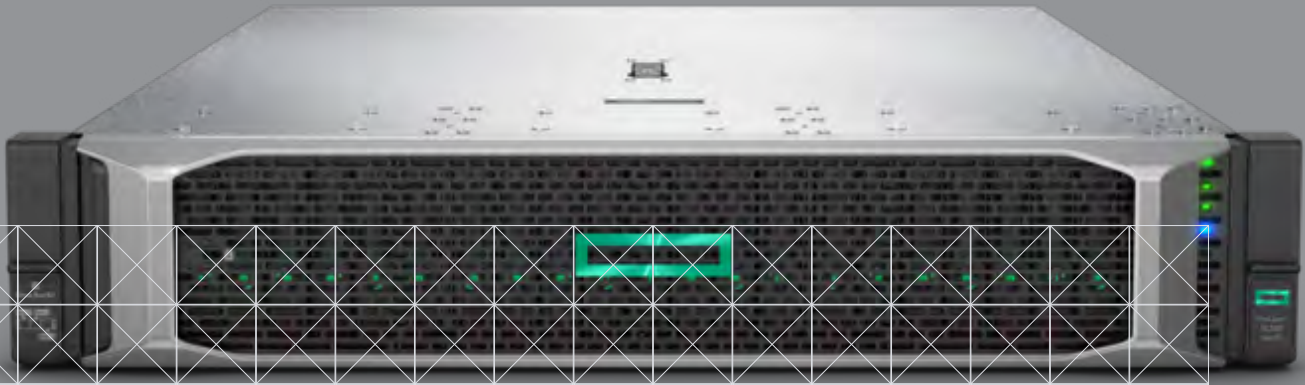


# MEOS™ CAPTURE HRDFEP



KONGSBERG

Photo courtesy HPE.com  
Image may differ from actual product.



## High Rate Demodulator & Front End Processor

The MEOS™ Capture HRDFEP is a high performance, fully programmable data receiver, acquisition and data processing system for the most demanding professional users. Developed to bring all your data safely home, always. This mission statement translates into the key properties of all MEOS™ Capture products: Performance, Reliability and Flexibility.

The MEOS™ Capture HRDFEP is a Software Defined Radio (SDR) with direct sampling of the input IF signal. This solution simplifies the analog part of the receiver and reduces implementation losses compared to other sampling strategies.

The MEOS™ Capture HRDFEP receives modulated IF signals and ECL / LVDS baseband signals. It outputs raw and processed data to disk, network and baseband outputs. It supports conventional satellite downlink standards as well as DVB-S2 and CCSDS SCCC.

*Get all data right from the start of every satellite contact.  
Make acquired data available for end users as fast as possible.*

### PERFORMANCE

- Low implementation loss:  
0.1 – 0.8 dB, typically <0.5 dB
- Conventional modulations and coding
- SCCC
- DVB-S2

	Bit Rate (Mbps)				
	100	250	500	1000	2700
BPSK	0.15	0.2	-	-	-
QPSK	0.2	0.3	0.5	-	-
8PSK	0.3	0.3	0.4	0.5	-
16QAM	0.3	0.3	0.4	0.5	-
SCCC	<0.3 dB	<0.3 dB	<0.4 dB	<0.5 dB	<0.8 dB

Implementation loss at BER 10<sup>-6</sup>

### RELIABILITY

*Reduce your operations cost by automated operations.*

- 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  
without operator intervention
- Robust server computer and data processing boards

### FLEXIBILITY & MODULARITY

*Keep your system continuously updated simply by downloading new software.*

- State of the art hardware; re-programmable and in-field upgradable. New versions and updates are provided as files.

## TECHNICAL SPECIFICATIONS

### MEOS™ CAPTURE HRDFEP

#### Demodulator (HRD)

- Fully programmable wideband digital demodulator for:
  - BPSK, xQPSK, 8PSK, 16QAM
  - SCCC according to CCSDS 131.2-B-1\*\*
  - DVB-S2 according to ETSI EN 302 307-1\*\*
- Dual input ports – female SMA connectors
- 720, 1200MHz (tunable within 700 MHz bandwidth)
- Input impedance: 50 ohms
- VSWR: < 1.5
- AGC range: -5 dBm to -50 dBm
- Demodulation type:
  - BPSK, CBPSK, QPSK, OQPSK, 1/2 UQPSK, 1/4 UQPSK, 1/8 UQPSK, 8PSK, 16QAM, SCCC\*, DVB-S2\*
- Matched filters: SRRC, Integrate & Dump
- Adaptive Equalizer
- Spectrum inversion correction
- Fast, wideband carrier acquisition (up to +/- 100 MHz range)
- Doppler on Carrier: 1500 kHz
- Max Carrier Doppler rate: 100 kHz/s max
- Reference oscillator input 10 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 length, 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:
    - 0 to 15 frames thresholds
    - Bit slips: Up to ± 4 bits
- Data PN de-randomization

#### CRC checking:

- CCSDS polynomial:  $G(X) = X^{16} + X^{12} + X^5 + 1$
- Programmable offsets

#### Decoding:

- Differential Decoding
  - PCM: NRZ-M, NRZ-S, NRZ-L
- Trellis Decoding 4D-TCM according to CCSDS 401.0-B:
  - Rate: 8/12, 9/12, 10/12, 11/12
- Viterbi decoding:
  - CCSDS compliant Viterbi polynomial
  - Rate 1/2, 2/3, 3/4, 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
- LDPC DVB-S2\*\*
- SCCC Turbo codes\*\*

#### Quality and Time Appending Frame sync status:

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

#### Time-stamping - 8 bytes time field:

- Day; millisec of day; microsec. of millisec

#### Processing

- Splitting and sorting of VCDUs
- Instrument Source Packet (ISP) service processing
- Supports part of the CCSDS AOS Path, Internet and Encapsulation services
- CFDP\*: CCSDS File Delivery Protocol, Class 1 & 2

#### Baseband Data Inputs\*

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

#### Baseband Data Output\*\*

- Playback of stored data (serial or parallel)
- Per channel: Two separate or merged (I+Q) synchronous clock/data outputs
- Configurable clock phase and data polarity
- Clock duty cycle: - 50% ± 10%
- External clock input
- Electrical standard: Differential ECL or LVDS
- Female SMA connectors
- Gigabit Ethernet (optional 10Gbit)

#### Distribution

- Near Real Time (NRT) distribution via TCP socket
  - Rate control
  - Compression
  - Encryption
  - XML meta data and checksums
- Post-pass file transfer protocols: FTP, SFTP, FTPS
- SLE: CCSDS Space Link Extension: RAF, RCF
- CFDP\*: Class 1 and Class 2

#### Special Features

- BER tester: 4 selectable standard polynomials
- Frame data pattern generator
- PN generator: 4 selectable standard polynomials
- Status report file generation

#### Automatic Storage Management

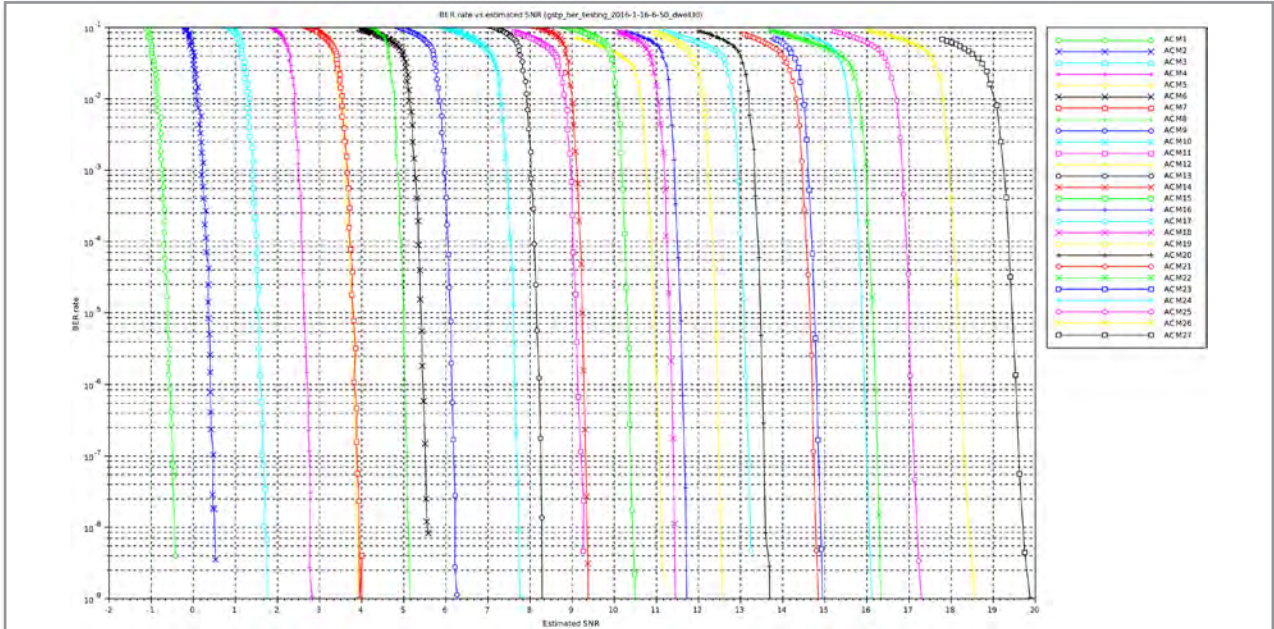
- Oldest data stored on disk will automatically be deleted when necessary
- User controlled locking of data

\* optional compact

\*\* optional Max

# TECHNICAL SPECIFICATIONS

## MEOS™ CAPTURE HRDFEP



Measurements performed with Arbitrary Waveform Generator (AWG) transmitter: BER vs SNR



MEOS™ CAPTURE HRDFEP Compact: 2 U unit that supports up to two channels conventional modes

Features	Compact	MAX
Allows seamless integration of user specific functionality	Standard	Standard
Extended storage (NAS)	Option	Option
Two demodulator channels*	Standard	Standard
Serial ECL/LVDS output	Option	Standard
Serial ECL/LVDS input	Option	Standard

Features	Compact	MAX
MODULATOR	Option	Option
DVB-S2	N.A.	Option
SCCC	N.A.	Option
CCSDS ISP reconstruction	Standard	Standard
SLE	Standard	Standard
CFDP	Option	Standard
BERT	Standard	Standard
Max symbol rate/channel Msymb/s	500	500
Data storage (Tbytes)	2,4	6
10 Gbits network	Option	Option
Moving Window Display	Option	Option
WEB reports	Standard	Standard
Preconfigured missions	Option	Standard
LDPC 7/8	Standard	Standard

**MEOS™ CAPTURE HRDFEP is available in two versions:**

MEOS™ CAPTURE HRDFEP Compact: 2 U unit that supports up to two channels conventional modes  
 MEOS™ CAPTURE HRDFEP Max: 5 U unit that supports up to two channels conventional modes, SCCC and DVB-S2  
 \* Single channel is an option for both versions

### External Interface

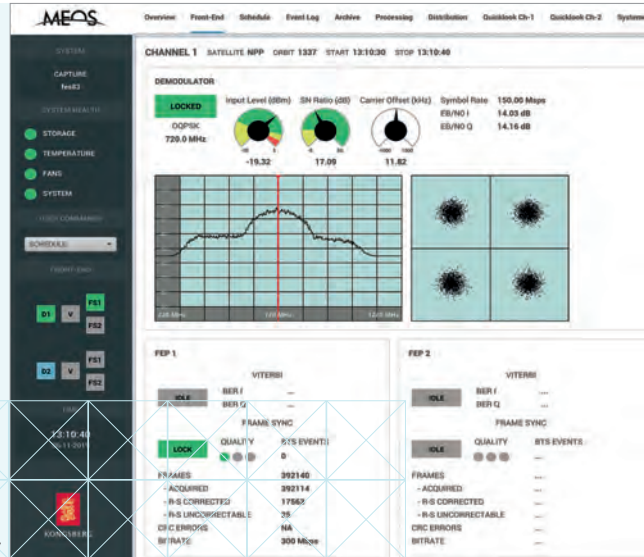
- TCP socket and XML based external interface with minimal bandwidth usage
- Access authentication
- MEOS™ Connect ready

### 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
  - Available through standard WEB browser

# FEATURES

- Real-time acquisition, processing and distribution
- Fast lock-in times: 0.01 - 0.1 sec. typically
- Data rates from 200 kbps to 2,7 Gbps per channel
- Up to 4 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
- Real time and offline status and plots available in GUI and remotely
- 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 operation and scheduling
- High rate Space Link Extension (SLE) support
- GUI is displayable on computers in LAN/WAN



MEOS™ HRDFEP Front-End view

## MEOS™ CAPTURE HRDFEP

### 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. Reception, processing and distribution configurations are preconfigured per mission and applied automatically.

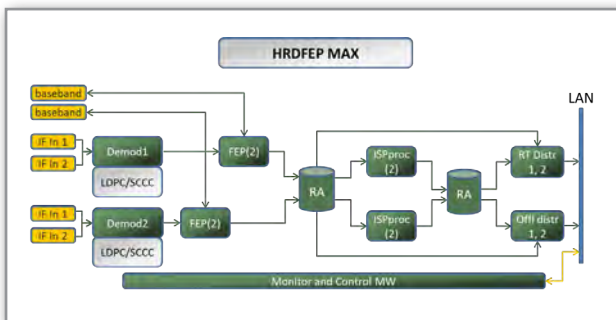
### CONFIGURATION EXAMPLE

The configuration shown below supports:

- 2 independent IF and ECL input channels
- 4 independent front-end processors FEPs
- 4 independent reconstructions of Instrument Source Packets
- 2 independent online distribution channels
- 2 independent offline distribution channels
- 2 ECL output channels

	Compact	MAX
Rack mountable chassis	Standard	Standard
Height x Width x Depth in cm:	9,5 x 48,26 x 73,22	21,8 x 48,26 x 73,22
73,22	21,8 x 48,26 x	appr. 40 kg
Weight:	appr. 24 kg	appr. 40 kg
Power:	100-240 volts, 50-60 Hz 500W	100-240 volts, 50-60 Hz 500W
Typical power consumption	< 500W	< 700W
Power supplies:	Dual	Dual
Temperature operating	10°C to 35°C	10°C to 35°C
Temperature non-operating	-30°C to 60°C	-30°C to 60°C
Relative Humidity operating	10 - 90 %	10 - 90 %
Relative Humidity non-operating	5 - 95 %	5 - 95 %
KVB	Option	Option

Physical



Specifications subject to change without any further notice.

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### GRAPHICAL USER INTERFACE

- Java based GUI application
- Stand alone or through remote web browser
- 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 Display)

