MEOS™ CAPTURE HRTG V12

KONGSBERG

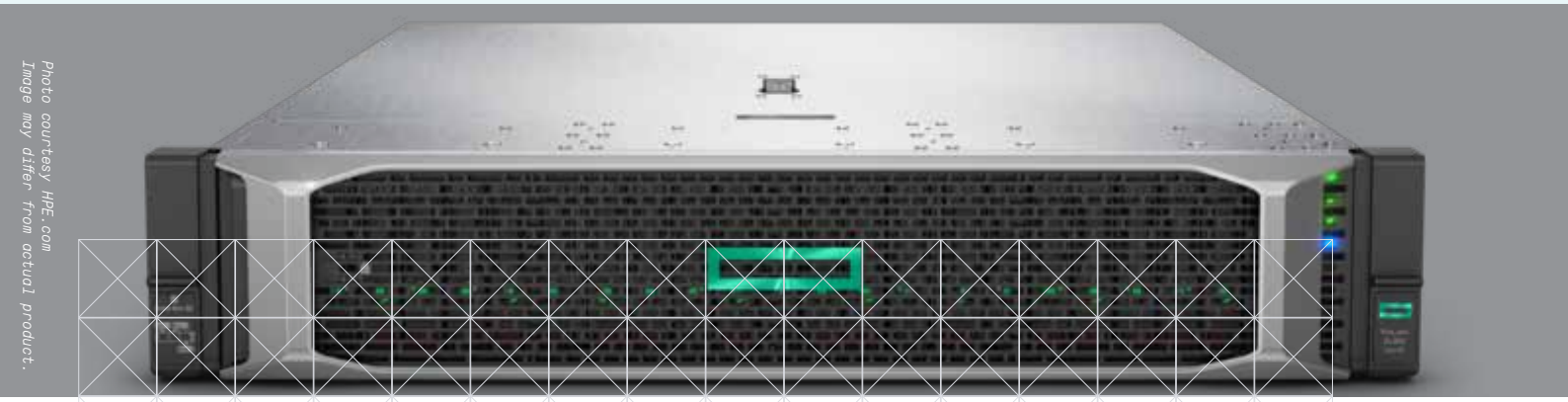

Photo courtesy HPE.com
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High-Rate Test Data Generator & Transmitter V12

The MEOS™ Capture HRTG is a multi-purpose test tool for testing and verification of satellite-to-ground data receivers, RF chains and entire ground systems. Full technical compliance with the MEOS Capture HRDFEP V12 implies full bandwidth exploitation of Ka-band. A suite of channel emulation capabilities representing real-world challenges enables the creation of realistic test scenarios. Completed with an optional set of data generator tools the HRTG V12 is ideal for cost effective system level testing and verification.

The MEOS™ Capture HRTG is a test data transmitter with capabilities for data formatting, encoding and modulation. The generated signal can be adjusted and modified by a wide range of signal processing functions to resemble actual satellite-to-ground downlinks. Hence the HRTG can be used as a cost-effective alternative to using far more expensive solutions, like dedicated Satellite RF Suitcase reference units.

The MEOS™ Capture HRTG supports conventional satellite downlink standards as well as DVB-S2* and CCSDS SCCC**.

Two transmitter channels each support symbol rates up to 1200 Msps to make full use of a 1.5 GHz bandwidth as in e.g. Ka-band.

PERFORMANCE

Outputs

- 1200 Msps per channel: 10+ Gbps total
- Conventional modulations and coding, DVB-S2*, CCSDS SCCC**

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

RELIABILITY

Reduce your operations cost by automated operations.

- Automatic recovery in case of network problems
- Automated storage management using RAID
- Hot swap disks
- Dual power supplies, hot swappable
- Monitoring of HW resources
- SUSE Linux Enterprise 15 system (SLES 15) without operator intervention
- Robust server computer and data processing boards

FLEXIBILITY & MODULARITY

Keep your system continuously updated simply by downloading new software.

Re-programmable / in-field upgradable FPGA technology. New versions and updates are provided as files.

TECHNICAL SPECIFICATIONS

MEOS™ CAPTURE HRTG V12

Modulator (HRM) – Per Channel:

- Fully programmable wideband digital modulator for:
  - BPSK, xQPSK, 8PSK, 16QAM
  - SCCC per CCSDS 131.2-B-1
  - DVB-S2 per ETSI EN 302 307-1
- Outputs: 1 SMA connector per channel
- Carrier frequencies: 720/1200/2400* MHz (with tuneable offsets)
- Max symbol rate per channel: 1200 Msps
- Output impedance: 50 ohms
- VSWR: < 1.5
- Output power range: 3 dBm to –50 dBm
- Spurious signal attenuation > 60 dBc
- Modulation type:
- BPSK, CBPSK, QPSK, OQPSK, 1/2 UQPSK, 1/4 UQPSK, 1/8 UQPSK, AQPSK, 8PSK, 16QAM
- SCCC: QPSK, 8PSK, 16APSK, 32APSK, 64APSK
- DVB-S2: QPSK, 8PSK, 16APSK, 32APSK
- Signal shaping filters: RC, SRRC
  - Rolloff factor: 0.2 to 1
- Implementation loss: 0.1 – 0.3 dB
- Reference oscillator input: 10 MHz, 100 MHz
- System time: NTP time reference

Programmable Channel Emulator – Per Channel:

- Additive White Gaussian Noise (AWGN) generator:
  - Noise density: 0 to -93 dBm
  - Bandwidth: 2400 MHz
  - Programmable SNR (Es/NO): 0 - 40 dB
  - Individual On/Mute of signal and noise
- Spectrum tilt (frequency response): ±10 dB max (across 1620 MHz bandwidth)
- Power level variation: > 15 dB/sec max
- I/Q phase imbalance: ± 10 deg. Max
  - Resolution: 0.1 deg.
- I/Q amplitude imbalance: ± 9 dB max
  - Resolution: 0.1 dB
- Frequency and symbol rate continuous variations (Doppler)
  - Max range: 8 MHz (±4 MHz)
  - Max rate: 100 kHz/s
- OMUX filter / group delay:
  - Programmable filter order/group delay
- Phase noise: Programmable phase noise mask
- Cross-Channel Interference
  - Programmable mutual power leakage
- Spectrum inversion

Data Encoders:

- Differential encoding
- PCM: NRZ-M, NRZ-S, NRZ-L
- Trellis encoding 4D-TCM according to CCSDS
- 401.0-B:
  - Rate: 8/12, 9/12, 10/12, 11/12
- Convolutional encoding: CCSDS compliant polynomial:
  - Rate 1/2, 3/4, 2/3, 5/6, 7/8
- Reed-Solomon:
  - 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
- BCH/LDPC for DVB-S2
- SCCC Turbo codes

Data Framing:

- CCSDS CADU formatting of data on disk files and fill data
  - Data PN randomization
- - CRC checksum calculation:
    - CCSDS polynomial:G(X) = X16 + X12 + X5 + 1
- ASM (sync marker) appending

Fill Data Generators:

- Standard PN sequences (PN9, PN15, PN20, PN23)
- Common sequence or separate I/Q sequences
- Programmable fill patterns
- Fill frames or PN sequence:
  - Preamble
  - Fill data
  - Postamble

Test Data Generator Tools (Optional)*:

- VCDUs/CADUs format:
  - Generation of user data VCDUs or CADUs
- Space Packets and VCDUs/CADUs format:
  - Generation of Space Packets containing the user data
  - Wrapping Space Packets in VCDU/CADU format
- CFDP, Space Packets and VCDUs/CADUs format:
  - Generation of CFDP PDUs containing the user data
  - CFDP PDUs encapsulated in Space Packets
  - Wrapping Space Packets in VCDU/CADU format

Baseband Data Inputs/Outputs*:
Input and playback data

Differential ECL or LVDS:

- Per channel: Two separate or merged (I+Q) synchronous clock/data differential signals
- Data rates: Up to 1 Gbps per channel
- Electrical standard: Differential ECL or LVDS
- Clock duty cycle: - 50% ±10%
- Configurable clock phase and data polarity
- External clock (output interface)
- User controlled locking of data
- Rate buffering via local disk

10 Gbps Ethernet

Test Data Transfer & Buffering:

- Data copied to local disk buffer via TCP/IP & FTP
- Data output to via TCP/IP or UDP/IP

** Optional*

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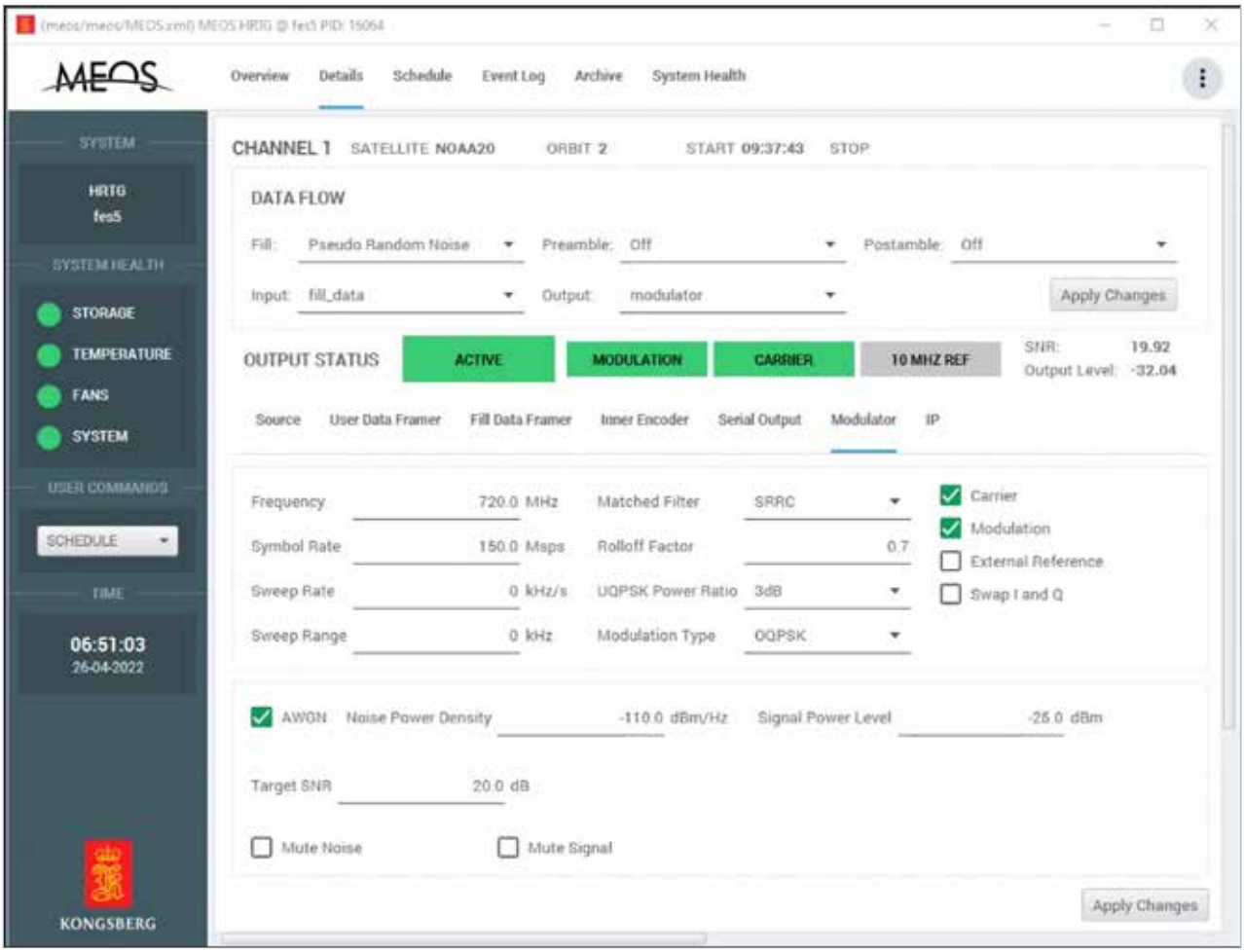


GUI window showing modulator configurations and settings, with signal tuning Individual menus per channel (Channel 1 shown)

MEOS™ CAPTURE HRTG V12:
2U unit, two channels, conventional modes, SCCC and DVB-S2

External Interface:

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

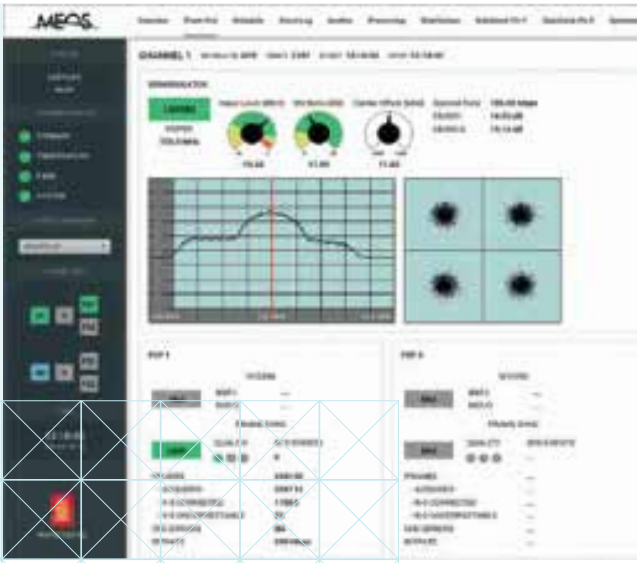
Graphical User Interface

- Java based GUI application
- Stand alone or through remote web browser
- Real time status visualization

	HRTG V12
Rack mountable chassis	Standard
Height x Width x Depth (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,	2
800 W	-30°C to 60°C
Number of power supplies	2
Temperature non-operating	-30°C to 60°C
Relative humidity operating	10-90%
Relative Humidity non-operating	5-95%

FEATURES

- Dual IF modulator channels
- Modulated IF signal with programmable signal characteristics & signal impairments
- Output of transfer frames or PRN patterns
- Data files or synthetically generated data
- Encoding of output data
- Data rates from 1 Mbps to 5 Gbps per channel
- DSP implemented in Xilinx FPGA
- Java based Graphical User Interface
- Extensive monitoring and control capabilities, local and remote
- Optional capabilities:
  - Test Data Generator Module
  - Baseband Clk/Data interfaces (input/output)
- SUSE Linux Enterprise Linux SLES 15
- Redundant power and SAS RAID disks
- Automatic operation and scheduling



MEOS™ HRDFEP Front-End view

APPLICATION NOTE

MEOS™ CAPTURE HRTG V12

APPLICATIONS

MEOS™ Capture HRTG V12 is a multi-purpose, multi-format and multi-function device for testing ground system RF chains and their individual components. It has been developed with a special focus on efficient testing of high-rate data receivers.

The internal Channel Emulator provides a list of advanced features that make the HRTG V12 well suited for complex and diverse test scenarios and use cases.

It is common in the established space business to rely on so-called “satellite RF suitcases” as a reference for dedicated test signal transmission. Even if a representative RF suitcase is needed as a reference at some point, the vast majority of the required system tests can normally be performed without such critical dependencies. Exploiting the HRTG V12’s easily accessible capabilities is a simple way of increasing testing efficiency and reducing schedule and technical risks in satellite programs.

Both CCSDS SCCC and DVB-S2 standards are supported, with seamless and lossless transitions between ModCods, per user command, for testing VCM and ACM scenarios.

With the optional Test Data Generator toolkit, any set of test data can be converted into a format suitable for transmission (e.g. CADU, or SP/CADU, or CFDP/SP/CADU).

Data can also be streamed from the IP (Ethernet) interface to any receiver unit, or transferred as a baseband, synchronous Clk/Data stream.

Manual operations are supported through the Graphical User Interface (GUI). External commanding and control is supported by commands from the external, XML based interface.

For single channel use cases: One HRTG channel is the user signal. The other channel can be used as an interference signal or noise source with a wide range of properties and capabilities. Then the signal and the generated interference can be physically combined to represent most signal conditions.

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