

MEOS™ Capture HRTG



KONGSBERG

High-Rate Test Data Generator & Transmitter V12

MEOS™ Capture HRTG V12 is a multi-purpose transmitter and 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.

MEOS™ Capture HRTG is a data transmitter providing capabilities for data formatting, encoding and modulation, as well as built-in test capabilities.

The generated output 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.

RELIABILITY

- 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

PERFORMANCE

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

FLEXIBILITY & MODULARITY

- 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

- 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 200 kbps to 5 Gbps per channel
- DSP implemented in Xilinx FPGA
- Extensive monitoring and control capabilities, local and remote
- Optional Test Data Generator Module
- SUSE Linux Enterprise Linux SLES 15
- Redundant power and SAS RAID disks
- Automatic operation and scheduling
- Online (real-time) and offline (buffered) data transmission modes
- HTML GUI (web browser)

* ETSI EN 302 307-1

** CCSDS 131.2-B-2

MODULATOR – PER CHANNEL:

- Fully programmable wideband digital modulator for:
 - BPSK, xQPSK, 8PSK, 16QAM
 - SCCC per CCSDS 131.2-B-2
 - DVB-S2 per ETSI EN 302 307-1
- Outputs: 1 SMA connector per channel
- Tunable carrier frequencies: 720/1200/2400 MHz
- 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, 64APSK
- SRRC Signal Shaping Filter with tunable rolloff factor
- Implementation loss: 0.1 – 0.3 dB
- Reference oscillator input: 10 MHz, 100 MHz
- System time: NTP time reference
- Doppler compensation

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
- SCCC Turbo codes

PROGRAMMABLE CHANNEL EMULATOR – PER CHANNEL:

- Additive White Gaussian Noise (AWGN) generator:
 - Noise power density: 0 to –93 dBm/Hz
 - Bandwidth: 2400 MHz
 - Programmable SNR (E_s/N_0): 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



MEOS
MULTI-MISSION EARTH OBSERVATION SYSTEM

PROCESSING

Data Framing:

- CCSDS CADU formatting of data on disk files and fill data
 - Data PN randomization
 - CRC checksum calculation:
 - CCSDS polynomial: $G(X) = X^{16} + X^{12} + X^5 + 1$
 - 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 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

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
- Rate buffering via local disk

10 Gbps Ethernet

Data Transfer & Buffering:

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

External Interface:

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

GRAPHICAL USER INTERFACE

- HTML based GUI application (web GUI)
- Stand alone or through remote web browser
- Real time status visualization



Channel 1 Satellite Orbit Start Stop

DATA FLOW

Fill Type: Pseudo Random Noi... Preamble: Off Postamble: Off Input: fill_data

Output: modulator

APPLY

OUTPUT MODULATION CARRIER SNR: ∞ dB Output Level: -25.09 dBm

SOURCE USER DATA FILL DATA INNER ENCODER MODULATOR IP IMPAIRMENTS

Carrier: ☒ Frequency: 1200 MHz Matched Filter: SRRC

Modulation: ☒ Symbol Rate: 1200 Msym/s Roll-off Factor: 0.25

Invert Spectrum: ☐ Sweep Rate: 0 kHz/s UQPSK Power Ratio: 3dB

AWGN: ☐ Noise Power Density: -110 dB Signal Power Level: -25 dBm

Mute Noise: ☐ Mute Signal: ☐ Target SNR: 25 dB

Omux Filter: ☐ Order: 4 Bandwidth: 0.6

Group delay peak value: 0 Symbols at offset ± 0 MHz

Amplitude Imbalance: 0 dB Phase Imbalance: 0 degrees

APPLY

APPLICATIONS

MEOS™ Capture HRTG V12 is a multi-purpose, multiformat and multi-function data transmitter and test 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.

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 ModCodes, per user command, for testing VCM and ACM scenarios.

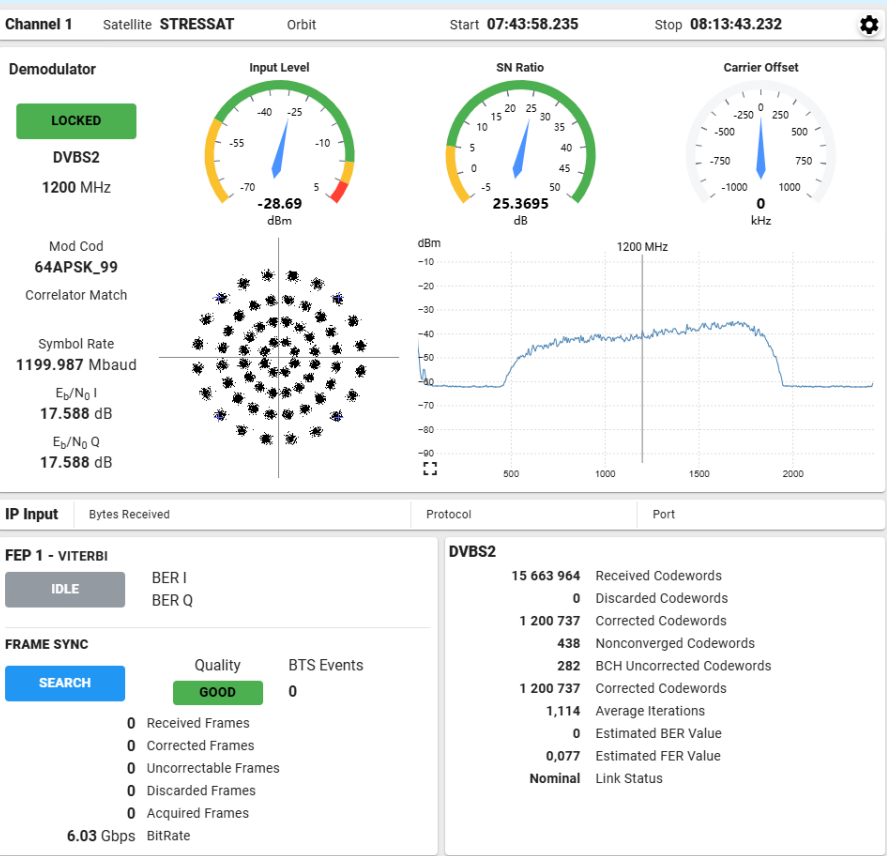
With the optional Test Data Generator toolkit, any set of test data can be converted into a format suitable for transmission (e.g. CADU, or SP/CADU, or CFDP/SP/CADU).

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.

Chassis Specifications	
Rack Mountable chassis	Standard
Height x Width 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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Specifications subject to change without any further notice.