CELESTIA | Antwerp

Virtual integrated baseband V-IBB for Satellite Tracking, Telemetry & Telecommand (TT&C)

FAST, FLEXIBLE & RELIABLE COMMUNICATION BETWEEN THE SATELLITE CONTROL CENTRE & SATELLITE

Applications

Baseband equipment for reception of housekeeping and payload telemetry from GEO and LEO satellites, and transmission of telecommands to GEO and LEO satellites

Ranging of GEO and LEO satellites

Automated satellite test, like TT&C SCOE, ATE, EGSE

Main functionality

Carrier acquisition, tracking and demodulation

- » FM/PSK/PCM
- » PM/PCM
- » BPSK
- » QPSK
- » OQPSK
- » GMSK
- » 8PSK
- » 4D-8PSK-TCM
- » Spread spectrum (contact us for more details)

Telemetry (TM) subcarrier demodulation and bit synchronization

Processing of Telecommand (TC) data , TC subcarrier generation and modulation

Uplink carrier generation and modulation

- » PCM/PSK/PM
- » PCM/PSK/FM
- » PCM/PM
- » PCM/FM
- » BPSK
- » QPSK
- » OQPSK
- » GMSK
- » 8PSK
- » 4D-8PSK-TCM
- » Spread spectrum (contact us for more details)

Generation and reception of ranging tones and ranging code with associated delay measurement

Processing of ranging data

Doppler and Doppler rate measurements

Data logging

Local and remote monitoring and control

Spectrum analyser for real-time analysis of the received input spectrum

Key benefits

Easy and flexible to use resulting in reduced CAPEX and OPEX

- » No up/down converter
- » Easy (re)configuration due to the modular software architecture and the intuitive graphical user interface
- » Real-time built-in spectrum analyser
- » Direct interface at 70 MHz, L-band and/or S-band
- » Optional SLE interface
- » Optional EDEN interface
- » Optional MCS2BBE interface

Operational reliability resulting in improved total cost of ownership (TCO)

- » Limited number of hardware elements
- » Most functions are software based including modulation and demodulation
- » Linux based PC platform

Extremely short acquisition time, even in challenging receiving conditions like low signal/noise, Doppler, …

Field proven heritage (Globalstar, O3b, Proba, NAOS, MTSat,…)

- » Proven interoperability with the most common protocols for satellite control centres, which allows for smooth integration in ground stations
- » RF over IP concept allowing RF sampling very close to the antenna and TT&C processing at a remote centralised location.

Reception of telemetry data

CARRIER ACQUISITION & DEMODULATION

Number of receivers: standard 1 or 2 TM/TC chains (more chains available on request)

Receiver input frequency: standard frequency range: 55 MHz – 2300 MHz

Received carrier modulation: PM

PM RECEIVER CHARACTERISTICS

Receiver acquisition range: ± 1500 kHz

Acquisition and tracking threshold (C/N0): down to 10 dBHz

Carrier acquisition time: <0.5 s

FM TEST RECEIVER CHARACTERISTICS

Maximum deviation frequency in FM mode: ±400 kHz

Maximum AFC tracking range: ±300 kHz

FM threshold: C/N minimum 10 dB in IF bandwidth

TM sub-carrier frequency (fsc): integer multiple of symbol rate within the band

TM sub-carrier waveform: sine or square

PSK-symbol rate (Sr): 100 sym/s to 2 Msym/s (optional 7.8125 sym/s up to 10 Msym/s), maximum depending on the number of Rx chains and the coding used

SUPPRESSED CARRIER DEMODULATION

Modulation types: BPSK, QPSK, GMSK, 8PSK, 4D-8PSK-TCM

Symbol rate: up to 2 Msym/s (optionally up to 10 Msym/s)

Threshold for TM reception (E_s/N_0): 1 dB

TELEMETRY PROCESSING & DECODING

Convolutional decoding (K = 7, R = ½)

Reed Solomon (255, 223, ASM 32 bits) decoding
» Interleaving factor: 1 up to 5

Turbo decoding according to CCSDS 131.0-B-4
» Code rates 1/2, 1/3, 1/4, 1/6
» Block length (k) 1784, 3568, 7136, 8920 bits
» ASM 64, 96, 128, 192 bits

Optional LDPC decoding according to CCSDS 131.0-B-4
» Code rates 1/2, 2/3, 4/5 (AR4JA codes) and 7/8 (C2 code)
» Block length (k) 1024, 4096, 16384 (AR4JA codes) and 7136 (C2 code)
» ASM 32, 64 bits

Number of processing chains per carrier: standard 1 (2 processing chains on request)
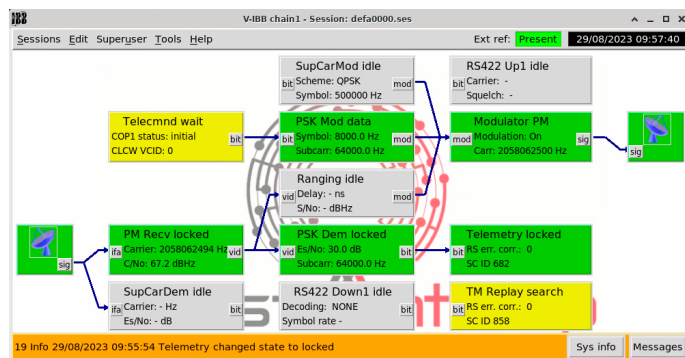
◩ Tone ranging

Ranging tone waveform: sine wave

Tone frequencies: fully programmable respecting the required mathematical relation between major and minor tones for ambiguity resolution

◩ PN / code ranging

PN ranging according to CCSDS 414.1-B-4

Code ranging compliant with PSS-04-104 and ECSS-E-50-02C

PN ranging in combination with GMSK (optional) as defined in CCSDS 401.0-B-32

◩ Transmission of satellite telecommand data

UPLINK CARRIER GENERATION

Number of uplink chains: 1 or 2 (more chains available on request)

Modulation format: FM/PM

Output frequency: 55 - 2125 MHz

Number of outputs: 2 (nominal + auxiliary)

Output level range: -30 dBm to 0 dBm, in 0.5 dB steps (optionally -60 dBm to 0 dBm)

◩ Environmental / power

Operating temperature: +10 °C to +40 °C

Storage temperature: -20 °C to +60 °C

Relative humidity: 40 % to 90 % non condensing

The equipment is CE compliant

Power supply: 90 - 265 V, 47 - 63 Hz

◩ Interfaces

Exchange of TM data, TC data, RNG data and Doppler data with the SCC via an ethernet interface using the TCP /IP protocol

Optional SLE interface (RAF, RCF, ROCF, forward CLTU)

Timing reference: Built-in IRIG-B decoder

Frequency reference: 10 MHz, automatic switchover to external reference when present

Optional RS422 interfaces for TM and TC (up to 10 Mbps)

Optional EDEN interface for easy integration in satellite ground testing (SCOE/EGSE)

Optional adaptation to proprietary interface

Optional input for GPS antenna

◩ Physical dimensions

The IBB equipment consists of two components

SERVER
» 19" rack mountable, height 2U
» Dimensions (W x H x D): 44.54 x 8.8 x 68 cm

FRONT END (SAMPLER)
» 19" rack mountable, height 1U
» Dimensions (W x H x D): 43.7 x 4.4 x 47 cm (without handles)

◩ Related product

i2b2 is an inverse IBB, which tests the ground segment by simulating the satellite

Note: contact us for more information

◩ Featured products

LSATx: digitizer X band

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