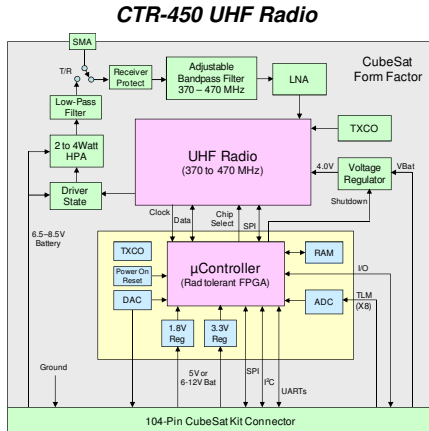


CCS-100 CubeSat Communications Suite

Innoflight CEU-100 Encryption Unit and SpaceQuest CTR-450 Radio



The CCS-100 (CubeSat Communications Suite) provides a turn-key communications system with integrated Type 1 encryption for CubeSat spacecraft. The CCS-100 provides simplex data transmission and reception at up to 150 kbps data throughput. The CCS-100 consists of two elements:

- 1) The Innoflight CEU-100 encryption unit provides link layer protocol services, optional forward error correction, and Type 1 encryption for spacecraft downlink telemetry data and uplink commands.
- 2) The SpaceQuest CTR-450 transceiver provides UHF transmit and receive functions with transmit power of up to 6W and receive sensitivity of -115 dBm at 9.6 kbps and 100 dBm at 150 kbps.
- 3) The two sub-components interface directly with each other in the CCS-100 configuration, but they can be used separately as well.

CCS-100 Comm Suite Specifications

Mechanical Interface

- Size: Two CubeSat form factor cards (96 x 90 x 32 mm)
- Mass: 350 grams
- Thermal strap (graphite) for transferring power amplifier heat to the spacecraft structure

Power Interface

- Input voltage: unregulated battery (6.5VDC - 14VDC)
- Input power (RX): ~0.5W steady-state
- Input power (TX): ~7.5W to 12.5W with 35% efficient wideband/linear class A/B Final amplifier (60% efficiency with class C amplifier if desired)
- Power saving mode: Receive encryption can be power cycled at a pre-set rate (10% to 80%), or controlled directly by the spacecraft C&DH platform

Environmental

- Operating temperature range of -20°C to +60°C
- Survive vibration of 15grms 20-2000 Hz (3 minutes/axis)
- Unlimited altitude

CEU-100 Encryption Unit Specifications

Data Interface

- 3.3V CMOS synchronous serial interface
 - Transmit data and clock
 - Receive data and clock
- Data rates: up to four pre-selected data rates from 1200 bps to 150 kbps
 - Separate transmit / receive data rates are supported
- Frequencies: up to 4 pre-selected frequencies based on radio selection matrix
 - Separate transmit / receive frequencies are supported

Link Layer Protocol Features

- HDLC transmit and receive framing
- Optional Forward Error Correction

Type 1 Encryption Features

- Storage of up to 128 uplink and 128 downlink keys
- Both symmetric and asymmetric keys modes supported
- Over-the-air key selection
- Command port authentication for UDP/IP communications protocols

CTR-450 Radio Specifications

Common RF Specifications

- Operating frequency band of 370-470MHz in 20MHz segments (other bands are possible)
- FM, FSK/GMSK/GFSK modulation
- 50 ohm input/output impedance
- 20:1 VSWR handling at all phase angle

Transmit

- Fixed or selectable transmit power of 1 to 6 Watts
- Carrier stability: 2ppm from -20°C to +60°C
- Transmitter spurious and harmonic emissions are better than 50dB

Receive

- Noise figure of less than 2dB with custom strip line filters
- Sensitivity of -115dBm for 9.6kbps and zero errors
- Sensitivity of -100dBm for 150kbps and zero errors
- 120dB of dynamic range (-120dBm to 0dBm)
- Maximum RF input without damage is +5dBm (+20dBm for short duration)
- Linear, digital Receive Signal Strength Indicator RSSI from -110dBm to -50dBm
- Built-in Automatic Frequency Control AFC (for automatic receive Doppler control)
- Built-in automatic gain control
- Carrier attack and delay time of less than 15ms
- 50 ohm input/output impedance
- 20:1 VSWR handling at all phase angle
- RF shielded 4-layer FR4 board