

# BRITE-Austria/TUG Sat1: Ground Station Technology

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## Abstract

This proceeding paper was generated using a Power-Point presentation from the workshop.

## Presentation Slides

### COMMUNICATIONS SPECS (1)

- Downlink (S Band)
  - Science data
  - Housekeeping data
  
- Uplink (UHF Band)
  - Sending commands
  
- Beacon (VHF Band)
  - Essential housekeeping data
  - Locating satellite

## FREQUENCIES

- S-Band: 2234.4 MHz
  - Scientific band
- UHF-Band: 437.365 MHz
  - Amateur radio
- VHF Band: 145.89 MHz
  - Amateur radio

## POWER

- S-Band Uplink: 0.5 W
- UHF Uplink: 100 W
- Beacon: 100 mW

## DATA RATES

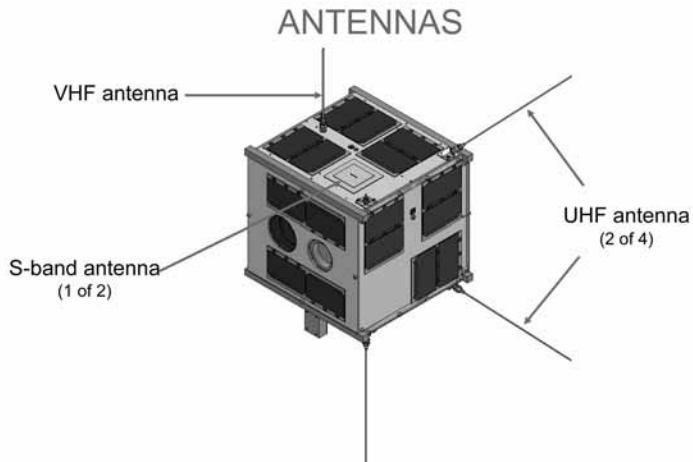
- S-Band: 32 kbit/s min. (link budget supports up to 512 kbit/s)
- Downlink protected by forward error-correction (convolutional encoding/Viterbi decoding)
- Modulation: BPSK (QPSK)
  
- UHF Uplink: 4 kbit/s
- Modulation GMSK (simple, robust)
- No coding
  
- Beacon: slow-speed Morse code

## LINK BUDGETS

- Orbit: 900 km (worst case)
  
- Free-space loss:
  - 145 dB (VHF)
  - 155 dB (UHF)
  - 169 dB (S-Band)
  
- Margins:
  - 9 dB (VHF)
  - 14.3 dB (UHF)
  - 8.7 dB (S-Band)

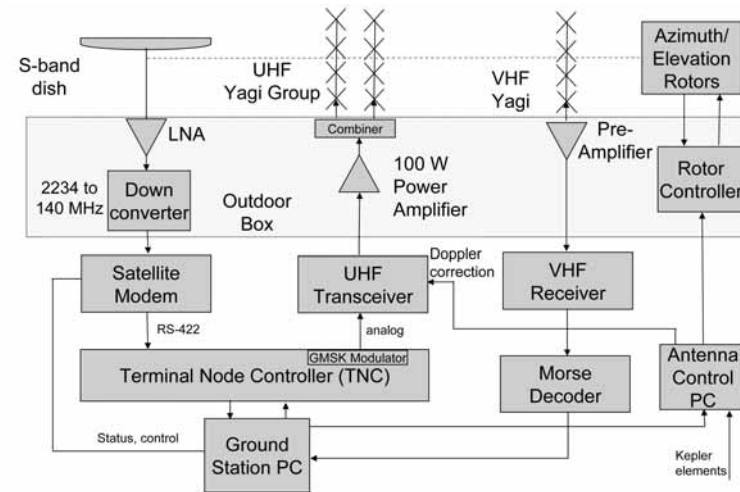
## ANTENNAS

- Satellite:
  - S-Band: 2 patch antennas on opposite sides
  - UHF: 4 canted  $\lambda/4$  monopoles, generating circular polarisation
  - VHF: monopole (shortened antenna)
  
- Ground stations:
  - 3 m parabolic dish for S-band
  - Cross-Yagi group for UHF
  - Cross-Yagi antenna for VHF



## TRACKING

- Satellite moves relative to ground station
- Antennas need to track spacecraft
- Program track
  - Computer calculates orbits
  - Based on Kepler elements provided by NORAD
  - Azimuth/elevation rotor driven by computer
  - Doppler correction calculated -> UHF uplink frequency modified
  - Downlink modem tracks automatically frequency



O. Koudelka, W. W. Weiss and C. Grant during the workshop dinner at the Institute of Astronomy.