CubeSat C-band transmitter for interplanetary missions

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Contents

- Requirements
- Technical solution
- Antennas
- Speeds
Requirements

- Get mission data down from 3U sat on Moon orbit
- 5,8 GHz HAM frequency band
- PSK
Why C band

- Legislative push away from lower frequencies
- Chipsets available
- Better gain with smaller antennas
System architecture

MSP430FR MCU

TCTXO → PLL → VCO → Power amplifier → Antenna
Power amplifier

- Analog Devices GaAs power amplifier
- 2W / 33 dBm output power
- 34 % efficient / 6 W power consumption
Transmitter

- ADF4158 PLL with built in PSK modulator
- Phase noise / bitrate tradeoff
- $<0.5$ W
Antennas

- Quad patch antenna with 12 dBi gain
- 16 m parabolic antenna for ground station
Link budget

- EIRP: 12 dBi + 33 dBm = 45 dBm
- Receiver gain 57 dBi
- Path loss for Moon: 220 dB
  - Bitrate ~10kb/s
- For GEO: 200 dB / 500kb/s (hardware limit)
- For Mars close encounter: 260 dB / 0.5b/s
Questions