The TriG Radio-Occultation System on COSMIC-2. Early Performance Assessment

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Topics

• Recent Events
• TGRS C2 Configuration
• Space Weather
• Neutral Atmosphere
• Post-launch Assessment
Topics

- Oscillator
- POD
- On-board Nav
- SEU Effects
TGRS / C-2
TGRS Antenna Orientation
TGRS / C-2
Rumble in the Jungle
TGRS / C-2
Launched and Deployed
TGRS / C-2
Launched and Deployed
TGRS / C-2 Key Reqs

• 1015 Ionospheric Occultations / Day
  Settable Azim, Altitude Range

• 550 Ionospheric Arcs / Day

• High-rate (>=50 Hz) S4, L1, L2 Phase
  & Power over Ionospheric Occ Region

• POD (~10cm, 0.1mm/sec)

• 1100 Atmospheric Occultations / Day
  Settable Azimuth, Altitude Range, BF
TGRS / C-2
Space Weather Instrument

• Fore/aft Navigation Antennas Used for Space Weather

• ~1000 GPS / GLONASS Ionosphere Occultations (550 km - 60 km) per Day

• Phase/Range at 1-sec. S4 every 10-sec based on 50 Hz (GPS) or 100 Hz (GLO)

• All GLONASS processed open-loop

• High-rate scintillation data can be produced either by schedule or by triggering above settable S4 levels
TGRS / C-2
GPS Ionosphere Coverage

AFT Coverage

FWD Coverage

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TGRS / C-2
POD/Iono Antenna Performance

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Data Fit Residuals for C2F6

RMS PC (cm)

RMS LC (cm)

Day of Year 2019

Da Kuang, JPL
TGRS Oscillator Drift

FM2 thru FM6 TGRS clock drift (ns/s) *

* FM1 in orbit maneuver

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TGRS / C-2
RO Antenna with Beam Forming

- Fore/Aft Orientation Phased Towards Earth Limb
- Wide-band to accept all GNSS
- Expect >2x Better Precision ( COSMIC-1 )
FM6 GPS L1CA Aft RO Beam-formed D245 vs Antenna Range
TGRS / C-2
RO Beam forming performance

FM6 GPS L1CA Aft RO Beam-formed D245 vs Antenna Range

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TGRS / C-2
RO Beam Forming Performance

C2_D203_FM4_G09 L1CA SNRv, L2C SNRv

SNRv

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TGRS / C-2
All TGRS, Beam forming is ON
Consistent SNRs
TGRS / C-2
GLONASS RO L1 Gain Similar to GPS

GLO RO SNR with Azimuth LEO ID: 005
TGRS / C-2
RO Frequency Model Check

SNR & Residual Doppler

FM2_G12_1248728437_Setting

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Thus far, all 6 TGRS show:

- Stable Oscillator Performance
- Excellent SEU Tolerance
- Expected SNRs for Nav/POD
- Expected POD Accuracy
- Expected OL Model Accuracy
- High RO SNR Over Required Azimuth Range
Thank You
TGRS Refresher

RO Antenna Fore

POD Antenna Fore

POD Antenna Aft

Filter/LNA Assemblies (8)

RO Antenna Aft

TriG C2 Early Performance

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