Tracking the ISS

Tyneside, UK
2020 Oct 1
Thursday, Day 275

Maintained by:
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Satellite Tracking Home

ISS Frequencies

Shuttle/Soyuz Day 1

Transmissions near 600 MHz

Doppler at 922 MHz

Progress M-06M

Visit by Mark Shuttleworth

ISS Now
(new Window/Tab, Flash... "sorry iPad")

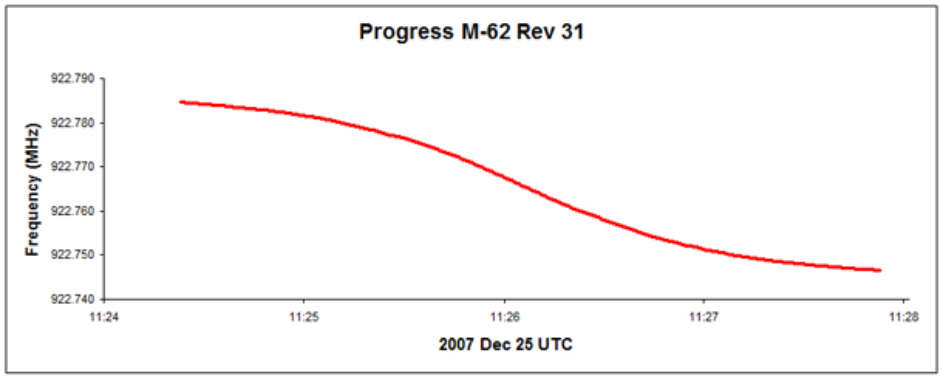
Visual Flare

STS-127 & Tank

ISS Operations - 922 MHz

While en-route to the ISS, the Soyuz piloted spacecraft and the Progress cargo transports transmit routinely at 922 MHz. Transmissions can occasionally be detected from the ISS itself when the health of a docked spacecraft is checked-out.

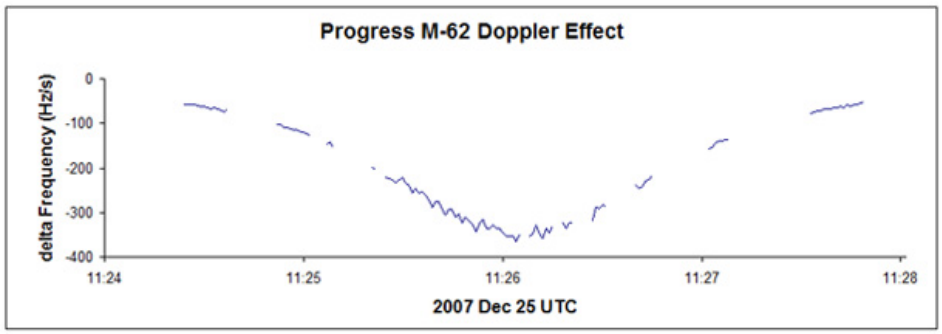
The signal manifests itself as a tone that can be heard through a receiver set to the "CW" reception mode. The Doppler effect is very noticeable at this frequency and the signal drops by something like 40 kHz in the space of five minutes or so. With a conventional receiver, rapid re-tuning is needed to keep it in earshot.



Here is the Doppler curve for Progress M-62 on rev 31, 2007 December 25 as viewed from Lincoln in the UK. It exhibits a classic low-orbit "S" shape and the time of closest approach to the receiving station comes in the middle of the near-straight section, just after 11:26 UTC. Data was collected as an output stream from an SDR-14 Software Derived Receiver.

Measurements from the Doppler Curve

Using the data that produced the curve it is possible to determine the precise time of closest approach, the true transmission frequency, and the range at closest approach.



This plot shows the rate of change in frequency as time passed. The missing segments are the result of variations in signal strength.

The time when the curve changes from a negative to a positive slope is Closest Approach, which occurs at 11:26:05 UTC. At that point, the rate of change in frequency due to Doppler is -350 +/-3 Hz/s.

Distance

Another parameter that can be calculated is the range at the time of Closest Approach. The orbit announced by Russia that equates to the time of the observation is 243 x 266 km. The average along-track orbital velocity is 7.75 km/s but it varies between 7.76 and 7.74 km/s - at perigee and apogee respectively.

The range at Closest Approach computes as 528 km +/-6 km. The error margin allows for not knowing exactly where Progress M-62 was situated in repect to perigee, and the uncertainty in the rate of change in the frequency.

Frequency

Relating the closest Approach time to the original Doppler curve gives the precise transmission frequency for Progress M-62 as 922.765 MHz. In the past, Soviet authorities gave the slightly-different frequency of 922.763 MHz. It would seem that it may vary slightly from craft to craft.

The plot below, of Progress M-63, the next in the series, was gathered real-time. The mid-point is at 922.763 MHz. In this case, the Doppler Curve is displayed as an image using the output from the SDR-14 and the Spectrum Laboratory software package.

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