Connect Global Positioning System RF Module

This is a GPS software-defined radio down-converter for the ISS.

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The CoNNeCT Global Positioning System RF Module (GPSM) slice is part of the JPL CoNNeCT Software Defined Radio (SDR). CoNNeCT is the Communications, Navigation, and Networking reconfigurable Testbed project that is part of NASA's Space Communication and Navigation (SCaN) Program. The CoNNeCT project is an experimental demonstration that will lead to the advancement of SDRs and provide a path for new space communication and navigation systems for future NASA exploration missions. The JPL CoNNeCT SDR will be flying on the International Space Station (ISS) in 2012 in support of the SCaN CoNNeCT program.

The GPSM is a radio-frequency sampler module (see Figure 1) that directly sub-harmonically samples the filtered GPS L-band signals at L1 (1575.42 MHz), L2 (1227.6 MHz), and L5 (1176.45 MHz). The JPL SDR receives GPS signals through a Dorne & Margolin antenna mounted onto a choke ring. The GPS signal is filtered against interference, amplified, split, and fed into three channels: L1, L2, and L5. In each of the L-band channels, there is a chain of bandpass filters and amplifiers, and the signal is fed through each of these channels to where the GPSM performs a one-bit analog-to-digital conversion (see Figure 2). The GPSM uses a sub-harmonic, single-bit L1, L2, and L5 sampler that samples at a clock rate of 38.656 MHz.

The new capability is the down-conversion and sampling of the L5 signal when previous hardware did not provide this capability. The first GPS IIF Satellite was launched in 2010, providing the new L5 signal. With the JPL SDR flying on the ISS, it will be possible to demonstrate navigation solutions with 10-meter 3-D accuracy at 10-second intervals using a field-programmable gate array (FPGA)-based feedback loop running at 50 Hz. The GPS data bits will be decoded and used in the SDR. The GPSM will also allow other "waveforms" that are installed in the SDR to demonstrate various GNSS tracking techniques.
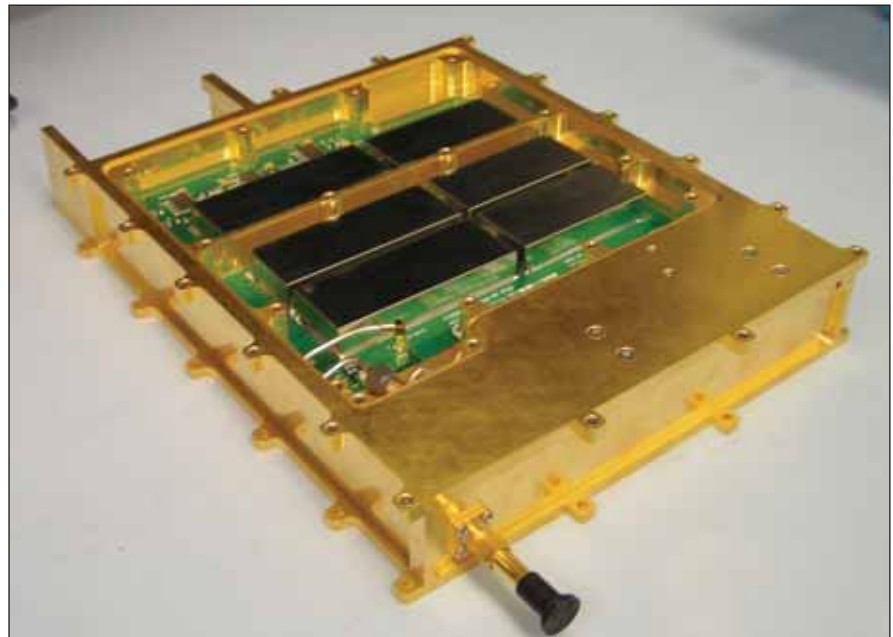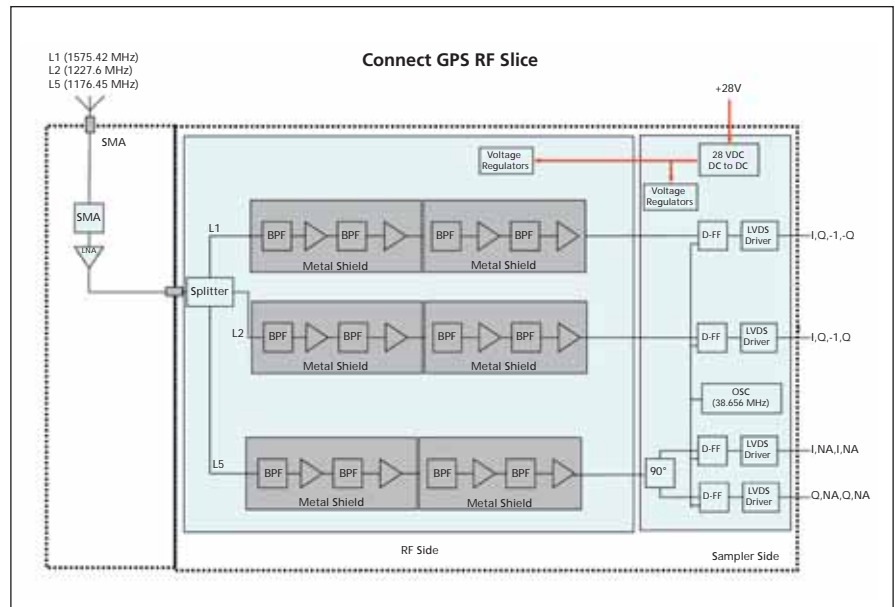
Figure 1. **JPL CoNNeCT GPSM**

Figure 2. **JPL CoNNeCT SDR Block Diagram**