

Development of the new 20kW CW Transmitter for 34-meter antennas of NASA Deep Space Network

A next generation of 20kW dual-band (S/X) transmitters was developed for NASA's Deep Space Network (DSN) 34m Beam Waveguide Antennas. The transmitter consists of two separate high power amplifiers with water distribution manifolds and uses common High Voltage Power Supply with embedded controller, Heat Exchanger, and motor-generator. A wideband klystron is used in the X-band portion of the transmitter permitting communication with both Deep Space and Near Earth Orbit missions.

The embedded controller communicates over an Ethernet LAN both with the DSN Uplink controller (eliminating a cumbersome analog to digital interface assembly) and with instruments in each power amplifier. The implementation significantly reduces the amount of cabling between the power supply and power amplifiers from earlier designs.

The embedded controller provides all functions needed to calibrate transmitter and support its stable and reliable performance. New functions include:

- Fast automated zeroing and calibration of power meters, which reduces downtime needed for maintaining the required accuracy and repeatability of power measurements.
- Automated RF power setting. A new power-setting and saturation algorithm significantly reduces the time for transmitter pre-track calibration and completely eliminates need for lengthy calibration at installation.
- A newly developed interface allows multiple computers to access the transmitter data. An IP sockets interface is used to communicate with the DSN uplink controller and with up to 9 other computers permitting

monitoring of the transmitter from a centralized maintenance terminal, maintenance terminals located at each power amplifier as well as from remote sites such as JPL. The new interface allows calibration and performance parameters to be stored in a special DSN server, thus reducing the volume of memory needed for transmitter controller and maintaining the secure backup of data.

- Expanded logging functions including plotting of different operational parameters with 1 sec resolution, which reduces time for troubleshooting.

Safe operation of transmitter and protection of equipment and personnel is provided with an improved set of interlocks, which includes both hardware and software controlled interlocks. In future designs all interlock trip point setting may be controlled by software, and the time needed for interlock trip point setting or adjustment would be significantly reduced.

For better maintainability power amplifier instrumentation is designed as a set of functional assemblies placed in separate drawers. This allows field replacement of assembly as a whole, which significantly reduces antenna downtime for repairs.

The testing of the new generation of 20 kW transmitters continues at JPL and demonstrates ease of operating and more reliable performance than any of the previous DSN transmitters. Six transmitters are planned for delivery to the DSN in the next two years to support NASA Mars missions. The installation of the first new transmitter at the Goldstone 34-meter BWG antenna DSS24 is scheduled for the last quarter of 2002.