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A NOVEL X BAND TRANSMITTER FOR SMALL DEEP SPACE EXPLORERS

**Abstract**

Design scheme of the X band transmitter that integrated data transmission and beaconing functions for YingHuo-1 Mars Probe based on the international collaboration project is specified. The transmitter does not only finish science data and telemetry data transmission from the Probe to the Earth stations, but also provide the beacon signals of different carrier frequency modes which are used to VLBI Very Long Baseline Interferometry tracking demonstrations between the Probe and the ground sites. RF carrier section based on DRO oscillator referenced to high stability OCXO at 10.878MHz is to generate beacon signals of high frequency stability. The beacon schemes of Single frequency point beacon at 8424MHz, double frequency point beacons at 8402MHz and 8446MHz and three frequency point beacons at 8424MHz, 8402MHz and 8446MHz are separately chosen by the external control commands according to the requirement from VLBI demonstrations programs. Based on the CCSDS (the Consultative Committee for Space Data Systems) B20.0-Y-2 in Recommendations on data rates and modulated formats for deep space applications, the X band transmitter can be operated in PCM/BPSK/PM (Modulation index is 1.05) modulation mode with subcarrier to support the ranging function in the downlink telemetry data rates of 8bit/s/16kbit/s. The X band transmitter with light weight, small volume and high efficiency is achieved, in which its mass is 1.45kg and RF output power with SSPA (Solid State Power Amplifier) based on four GaAs FET devices is more than 10W at 8424MHz on -35+65 temperature conditions. Every unmodulated signal output level is up to 10W in the single frequency point, 3W in the mode of two frequency points and 2W in the mode of three frequency points, respectively. The YingHuo-1 Radio Frequency Compatibility Test (RFCT) at European Space Operations Centre (ESOC) in July 2009 was finished. The suggest results is that the transmitter of YH-1 Mars Probe assumed to be transmitting through High Gain Antenna and maximum distance (3.6 E8km) can support TM data rates to 2kbps from TM link margin.