NASA SBIR 2007 Phase I Solicitation

S1.03 Passive Microwave Technologies

Lead Center: GSFC

Participating Center(s): JPL, MSFC

NASA employs passive microwave and millimeter-wave instruments for a wide range of remote sensing applications from measurements of the Earth’s surface and atmosphere to cosmic background emission. Proposals are sought for the development of innovative technology to support future science and exploration missions employing 450 MHz to 5 THz sensors. Technology innovations should either enhance measurement capabilities (e.g., improve spatial, temporal, or spectral resolution or improve calibration accuracy) or ease implementation in spaceborne missions (e.g., reduce size, weight, or power, improve reliability, or lower cost). While other concepts will be entertained, specific technology innovations of interest are listed below for missions to measure soil moisture, temperature sounding, cloud particles, and cosmic microwave background.

- Low power >200 Mb/s 1-bit A/D converters and cross-correlators for microwave interferometers;
- Automated assembly of 180 GHz direct conversion I-Q receiver modules;
- Low power, tunable, local oscillators from 400 to 600 GHz with 4-5 mW output power;
- Low noise (3), heterodyne mixers requiring low local oscillator drive power;
- Low DC power spectrometers covering 500 MHz with 125 kHz resolution;
- Highly stable variable correlated noise sources for calibrating correlation-type receivers;
- MMIC Low Noise Amplifiers (LNA). Room temperature LNAs for 165 to 193 GHz with low 1/f noise, and a noise figure of 6.0 dB or better; and cryogenic LNAs for 180 to 270 GHz with noise temperatures of less than 150K;
- High emissivity (near-black-body, >40 dB return loss) surfaces/structures for use as onboard calibration targets that will reduce the weight of aluminum core targets, while reliably improving the uniformity and knowledge of the calibration target temperature;
- New approaches, concepts, and techniques for microwave radiometer system calibration over or within the 1-700 GHz frequency band which provide end-to-end calibration to better than 0.1K, including corrections for temperature changes, standing waves, linearity, and other potential sources of instrumental measurement drift and error;
• RF (GHz to THz) MEMS switches with low insertion loss (18 dB), capable of switching with speeds of >100 Hz at cryogenic temperatures (below 10 K) for 108 or more cycles;

• Lightweight deployable L-band antenna structures and deployment mechanisms suitable for large aperture (reflectors or phased array of 50m² and larger) systems;

• Dual-polarization multi-frequency micropatch array antenna designs for combinations of frequencies in the C-, X-, or K-bands.