NASA SBIR 2015 Phase I Solicitation

S1.02 Microwave Technologies for Remote Sensing

Lead Center: JPL

Participating Center(s): GSFC

NASA employs active (radar) and passive (radiometer) microwave sensors for a wide range of remote sensing applications (for example, see http://www.nap.edu/catalog/11820.html). These sensors include low frequency (less than 10 MHz) sounders to G-band (160 GHz) radars for measuring precipitation and clouds, for planetary landing, upper atmospheric monitoring, and global snow coverage, topography measurement and other Earth and planetary science applications. We are seeking proposals for the development of innovative technologies to support these future radar and radiometer missions and applications. The areas of interest for this call are listed below.

Ka-band Power Amplifier for CubeSats:Â

- F = 35.7 GHz +/- 200MHz.
- Volume: <1U (10mmx10mmx10mm).
- Psat>32W.
- Gain > 35 dB.
- PAE > 20%.Â

Deployable Ka-band Antennas for CubeSats:Â

- F = 35.7 GHz +/- 200MHz.
- Aperture size = 0.75m.
- Gain > 45dB.
- Sidelobe ratio > 20dB.
- Stowed volume: <2.5U (25mmx10mmx10mm).
- Polarization: Linear.Â

Components for addressing gain instability in LNA based radiometers from 100 and 600 GHz.

NASA requires low insertion loss solutions to the challenges of developing stable radiometers and spectrometers operating above 100 GHz that employ LNA based receiver front ends. This includes noise diodes with ENR>10dBm with better than d 0.01 dB/Â°C thermal stability, Dicke switches with better than 30 dB isolation, phase modulators, and low loss isolators along with fully integrated state-of-art receiver systems operating at room and cryogenic temperatures.

Technology for low-power, rad-tolerant broad band spectrometer back ends for microwave radiometers.Â

Includes digitizers with 20 Gsps, 20 GHz bandwidth, 4 or more bit and simple interface to FPGA, ASIC implementations of polyphase spectrometer digital signal processing with ~1 watt/GHz.Â

Local Oscillator technologies for THz instruments.Â

This can include GaN based frequency multipliers that can work in the 200-400 with better than 30% efficiency GHz range (output frequency) with input powers up to 1 W.Â Graphene based devices that can work as frequency multipliers in the frequency range of 1-3 THz with efficiencies in the 10% range and higher.Â

Low power RFI mitigating receiver back ends for broad band microwave radiometers.Â

Low power, low mass, low volume, and low data rate RFI mitigating receiver back end that can be incorporated into existing and future radiometer designs. The system should be able to channelize up to 1 GHz with 16 sub bands and be able to identify RFI contamination using tools such as kurtosis.**Â**

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Fast tuning, low-phase-noise, widely tunable, low-power, microwave synthesizers.

Used as reference source for Earth/planetary applications. The frequency tunability should be >=15% within the frequency range of 23 to 29 GHz. Power level <= 5 W, with radiation tolerance at least 100 krad, 300 krad preferable. Tuning speed <= 10 ms.Â

Development of 4 channels VHF (240-270 MHz) passive receiver for 6U Cubesat platforms.

Enables Root Zone Soil Moisture Measurements from LEO using the Follow-on military SatComm satellites as signals of opportunity transmitters.Â

Development of innovative analogue/digital hardware designs for the implementation of distributed beam forming Synthetic Aperture Radar (SAR) architectures.Â

Enables beam steering over many array elements while reducing size, weight, and power compare to state-of-the-art.

Radars operating at 17.0 GHz +/- 150 MHz, >=6W transmit power meeting a detection capability with a range of 54km for a 20 square meter target.

The radar will be part of a Laser Hazard Reduction System(LHRS). The installed LHRS provides a means of detecting aircraft before they intersect a transmitted laser beam. Upon detecting an aircraft by the radar, the LHRS provides a signal so that laser beam be blocked to transmit.Â

Interconnection technologies to enable highly integrated, low loss distribution networks that integrate power splitters, couplers, filters, and/or isolators in a compact package. Technologies are sought that integrate X, Ku, and Ka-bands transmit/receive modules with antenna arrays and/or LO distribution networks for F- and/or G-band receiver arrays.

Dual-frequency (Ka/W-band), dual polarization compact quasi-optical front-end for cloud radars.

- Freq: 35.5 GHz Â± 100MHz.
- 94 GHz Â± 100MHz.
- Loss: < 0.5 dB.
- Polarization Isolation: > 30 dB.

- Polarization: V and H.

Development of structurally integrated/embedded airborne (P3, C130 aircrafts) antennas.Â

Enables mounting in non-traditional locations (e.g., doors, wing skins, fuselage panels and wing leading edges) covering 20 MHz-500 MHz bandwidth.

Analog to Digital (A/D) and Digital to Analog (D/A) Monolithic Integrated Circuit (MMIC) for P-band and L-band radar.Â

High efficiency, low power, high throughput.