NASA SBIR/STTR Technologies

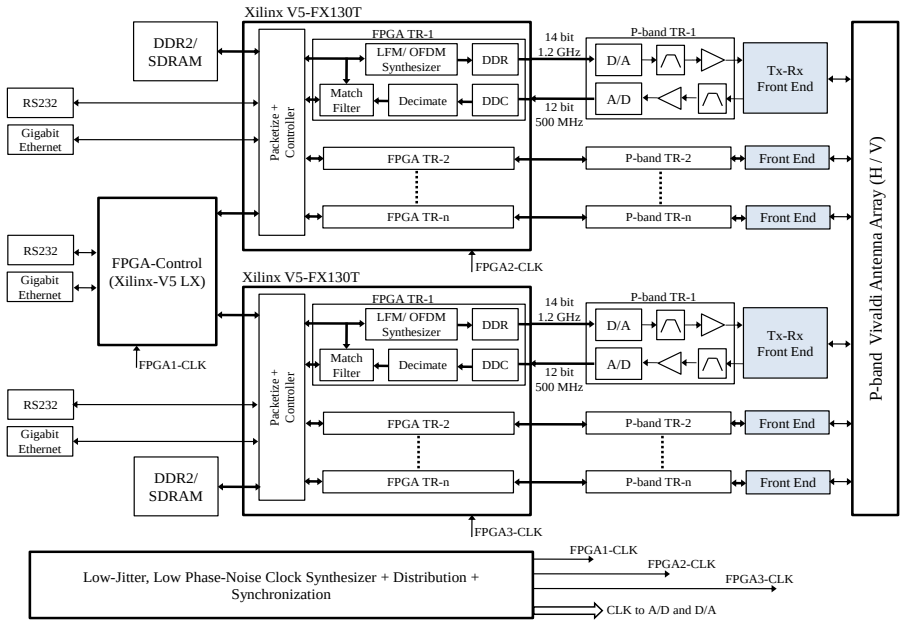
Reconfigurable, Wideband Radar Transceiver and Antenna for P-band Stretch Processing

PI: Arvind Bhat
Intelligent Automation- Rockville, MD

Identification and Significance of Innovation

There is considerable interest among the earth-science community to pursue P-Band radar development, due to its ability to penetrate deeper into vegetated areas. Measuring biomass is very important for studying the impact of global warming. P-band radar applied for ecological applications can provide the capability of monitoring variations in biomass of forested ecosystems. The proposed P-band radar system design uses the state-of-of-art digital and signal processing technology to reduce the cost, size, and weight of hardware and facilitates reconfigurable operation.

This Phase-I effort highlights some major milestones that have been achieved to develop a reconfigurable P-band radar design. IAI has demonstrated through prototype development and simulations, that highly reconfigurable P-band radar system can be developed using direct digital transceivers. The radar can be configured to operate in nominal mode with a few MHz of bandwidth in the allotted radar bands in UHF spectrum, or in experimental mode with up to 200 MHz of bandwidth. To support such low frequency waveforms at high bandwidth, a novel antenna concept has been developed in Phase-I. The antenna performance for return loss, gain, dual-polarization operation and cross-polarization isolation has been evaluated via simulations. Using the P-band radar waveform parameters, antenna performance specifications and the knowledge of target airborne integration platforms, we have developed SAR simulation results and evaluated the radar link-budget. A complete Size, Weight and Power budget is also generated.



The proposed P-band radar system

Expected TRL Range at the end of Contract (1-9): 4

Technical Objectives and Work Performed

Phase-I technical objectives and work accomplished are:

•We completed the prototype design of a fully digital P-band transceiver, and demonstrated the capability to synthesize and process wideband/ narrowband P-band waveforms.

•We designed a Vivaldi antenna also referred to as tapered slot antenna, which is among a few designs that exhibit broadband pattern, broadband impedance and broadband cross polarization isolation. Wide-band dual-polarization pattern can be achieved with two orthogonal Vivaldi antenna elements arranged in array configuration.

• In this Phase-I, we have investigated potential RFI sources in P-band, FCC rules for emitters operating in this band were researched and signal processing approaches for RFI sensing/mitigation we simulated.

•A complete system design for the P-band radar is proposed. We have performed the link budget (SNR and Sigma Naught Analysis) and generated estimates for Size, Weight and Power for such a system.

NASA and Non-NASA Applications

NASA applications

•**Biomass mapping : M**apping forests and perform ecological monitoring tasks
•**Forest tomography/interferometry and carbon sequestration :** SAR tomography retrieval of vertical structure of forests.
•**Planetary subsurface sensing and imaging :** Mars exploration, Ice detection on Moon and Mars.

Non- NASA commercial applications

•**Forest management:** Biomass mapping and forest height estimation.
• **Earth subsurface sensing and imaging: S**oil moisture measurement, mineral detection and underground archeological exploration.
• **FOPEN SAR :** FOPEN surveillance SAR for military applications

Firm Contacts

Arvind Bhat
abhat@i-a-i.com, 301-294-5254