# Antenna Characterization for the Wideband Instrument for Snow Measurements

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## I. Introduction

This poster describes experiments implemented to baseline the performance of the antenna used for the Wideband Instrument for Snow Measurements (WISM). WISM is under development for the NASA Earth Science Technology Office (ESTO) Instrument Incubator Program (IIP). A current sheet antenna, consisting of a small, 6x6 element, dual-linear polarized array with integrated beamformer, feeds an offset parabolic reflector, enabling WISM operation over an 8 to 40 GHz frequency band.

## II. WISM

The WISM featured the application of an innovative feed antenna design for use in a reflector system (see companion poster in this session titled “Design of an 8-40 GHz Antenna for the Wideband Instrument for Snow Measurements (WISM),” by Durham, et al.). NASA Glenn Research Center supported development of the feed design by providing characterization measurements of two prototypes and two final design versions in a far-field range. The reflector system was tested in a planar near-field range.

## III. Summary of Far-Field Tests Performed on the Final Design Versions

- **Feed Ka-band gain.**
- **Feed return loss.**
- **Feed principal plane patterns at 36.5 GHz.**
- **Far-field pattern cut at 36.5 GHz.**
- **Ka-band directivity and gain.**
- **Cross-polarized far-field pattern at 36.5 GHz.**

## IV. Characterization Results of Final Design WISM Antenna Feed Versions

### Radiation Patterns
- Four frequency bands:
  - X-band (9.5 to 10.0 GHz)
  - Ku-band (18.95 to 17.45 GHz)
  - K-band (18.6 to 18.8 GHz)
  - Ka-Band (36 to 37 GHz)
- Principal and intercardinal planes
- Four ports
- Dual linear antenna
- Two ports per orthogonal polarization
- Co-polarized and Cross-polarized, each port
- Magnitude and phase
- Co-polarized far-field pattern at 36.5 GHz
- Cross-polarized far-field pattern at 36.5 GHz

## V. Reflector System Integration and Alignment

- Leica Geosystems LR200 Laser Radar
- Surface mapping and data analysis
- Provides best-fit paraboloid
- Focal point location
- Feed integration
- Feed phase center known from design and RF measurement
- Feed position mapped relative to reflector surface
- "Best Fit" Paraboloid
- Analysis and discussion produces recommended adjustment
- Final position: phase center 0.013 in. from focal point (0.044 λ) at 40 GHz

## VII. Summary of Near-Field Tests Performed

- 40 by 40 by 60 ft test volume
- Vertical Scanner with 22 by 22 ft scan plane
- 15 ton capacity azimuth over elevation pedestal
- Removable sidewall, bridge cranes, and drive-in dock
- Nearfield Systems, Inc., transceivers, motion control, and experiment and data processing software
- Transceiver frequency range 2 to 50 GHz
- Probe rotational stage for automated polarization control

## VIII. Characterization Results of Integrated Reflector System

- Far-field pattern cut at 36.5 GHz
- Ka-band directivity and gain
- Co-polarized far-field pattern at 36.5 GHz

## IX. Concluding Remarks

Testing of the feed and reflector antenna for the WISM demonstration has provided necessary system information and shown their suitability for the proposed purpose.

## X. Acknowledgments

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