Microwave Radiometer (MWR)

A Ground-Based Instrument for Atmospheric Temperature and Humidity Profiling

INTRODUCTION:

The Microwave Radiometer (MWR) is a passive remote sensing instrument designed to measure the natural microwave radiation emitted by atmospheric gases, primarily water vapor and oxygen. It provides continuous vertical profiles of atmospheric temperature and humidity, supporting applications in weather forecasting, climate monitoring, and atmospheric research. MWR operates effectively in all weather conditions and is well-suited for unattended, long-term field deployment.

OBJECTIVES:

- Retrieval of atmospheric temperature and humidity profiles
- Support for weather forecasting and numerical model validation
- Climate monitoring and atmospheric process studies
- Continuous boundary layer profiling

KEY SPECIFICATIONS:

- Operating Frequency: 22–30 GHz and 50–60 GHz
- Measurement Range: Surface to ~10 km (model dependent)
- Temporal Resolution: ~1 second
- Output Format: NetCDF, CSV
- Power Supply: 110–240 V AC, solar-compatible

Principal Investigator:
Dr. Kaustav Chakravarty
kaustav@tropmet.res.in

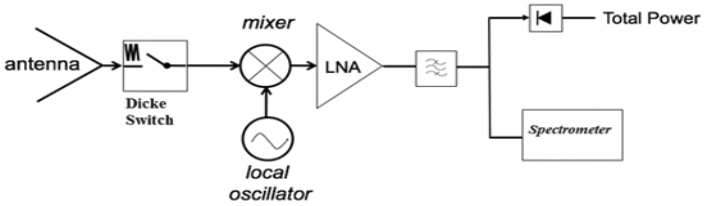
DATA OUTPUT:

- Brightness Temperature (TB)
- Atmospheric Temperature Profile
- Humidity Profile
- Liquid Water Path (LWP)
- Integrated Water Vapor (IWV)

MEASUREMENT & WORKING PRINCIPLE:

MWR detects atmospheric microwave emissions at specific frequency bands sensitive to water vapor and oxygen. By measuring brightness temperatures at these frequencies, the instrument retrieves vertical profiles of temperature and humidity through radiative transfer modeling and inversion techniques. This non-invasive method enables continuous atmospheric observations under all sky conditions.

Block Diagram



KEY FEATURES:

- Continuous, real-time atmospheric profiling
- All-weather, passive remote sensing capability
- High temporal resolution and unattended operation
- Compact and portable design
- Minimal maintenance requirements