



# RF Measurement Capabilities at Michigan Tech Research Institute (MTRI)

## RF MEASUREMENT CAPABILITIES

MTRI is a recognized leader in the research, development and practical application of sensor and information technology to solve critical problems in national security, bio informatics, earth sciences and environmental processes.

The Institute maintains a reconfigurable measurement facility, 8 x 14 m, and RF equipment to make fully polarimetric scattering measurements over wide frequency bands. The facility allows MTRI to replicate a variety of real-world clutter scenarios, and MTRI's portable collection hardware allows for off-site collections with the same equipment used in the laboratory.

MTRI provides the expertise necessary to plan, collect, and analyze measurements from designing and executing experiments in our own laboratory to extended measurement campaigns at remote sites.



Collections are complemented by the Institute's expertise in signal processing, analysis and information technology. Collected data for a variety of collections can be processed as imagery, with detailed analysis of phenomena and results integrated into web-based decision support applications.

## COLLECTION MODES

- SAR, ISAR, HRR, MTI
  - Rotation platform
  - Horizontal and Vertical antenna translation
- Systems Spanning 300 MHz to 98 GHz
  - HF, VHF, UHF, L, S, C, X, Ku, Ka, W bands
- Up to 16 GHz of Bandwidth
  - 1 cm resolution
- Bistatic Imaging
- Passive Interferometric Imaging

## APPLICATIONS

- Ground penetrating imaging
- In-building imaging
- Target Signature Collection
- Material Characterization
- RF Source imaging

## ANTENNA COMPLIMENT

- Horn Antennas, 0.7 to 18 GHz
- Log Periodic antennas, 0.3 to 4 GHz
- Lens Antennas, 26.5-40 and 90-98 GHz



## MTRI COLLECTION EXPERIENCE

MTRI has demonstrated success in laboratory and field collections.

### CUSTOMERS

- DARPA
- US ARMY – TARDEC
- US AFRL
- Michigan Department of Transportation

### EXAMPLE COLLECTION CAMPAIGNS

- Supporting the development of through-wall imaging algorithms, MTRI designed experiments and collected data in its measurement facility to measure attenuation, delay, and dispersive effects of building materials
- Supporting algorithm development to detect urban weapons, MTRI planned experiments for laboratory and realistic field collections. Laboratory measurements, with static clutter, were used to mitigate risk and provide initial datasets. MTRI then deployed equipment and staff to a remote MOUT training facility, and successfully collected more than 26,000 range profiles, satisfying all principal objectives of the program



- Supporting algorithm development for locating assets, MTRI has planned, collected, and analyzed passive interferometric RF signals to image cooperative sources.

### RESEARCH AND DEVELOPMENT

- Tests of different GPR designs for ice penetration and sub-surface imaging
- Determining the electrical characteristics of concrete cores for studying weathering effects and moisture retention
- Measuring custom GPR antenna characteristics

Measurement Configuration	Implementation / Capabilities	Radar	Frequency Coverage	Polarization
Portable Multiband Radar	Wideband data collections over multiple frequency bands provide a versatile measurement capability. RCS measurements, outdoor collections	SPC Cheetah	2-18 GHz 26.5-40 GHz 90-98 GHz	Dual polarization (HH, HV together) (VV, VH together)
Bistatic Radar	Two sets of wideband antennas provide a versatile bistatic measurement capability	Network Analyzer	0.3 - 4 GHz 0.7 -18 GHz	Single polarization HH,HV,VV,VH
Compact Range Monostatic Radar	Dual offset reflector system produces a high-quality, plane-wave illumination for far field RCS and radar imaging measurements	SPC Cheetah	5.7 - 12 GHz	Fully Polarimetric
Dual-Channel Receiver	High-speed, dual-channel, synchronous digitization of received signals provides interferometric capability	PXI-based RF digitizers	0.33 - 3 GHz	Single polarization HH,HV,VV,VH
Ground Penetrating Radar	State-of-the-art capabilities in subsurface (ice/soil) RADAR measurements in man-portable, multi-static system	FM-CW Wideband RADAR	20 MHz-2000 MHz	Single polarization HH,HV,VV,VH

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