

**ANTENNA**

# ELLIPTICAL MULTIMODE FEEDS and DUAL-CHANNEL MICROWAVE ROTARY JOINT

## Elliptical Multimode Feeds

Indigenously developed multimode dual feeds for feed the prime focal reflector antenna of Pencil beam scanning Scatterometer of Oceansat-II.

### Heritage

The indigenously developed elliptical multimode feeds integrated with 1m reflector are already flown in Pencil beam Scatterometer payload for Oceansat-2 mission.

### Specifications

- Frequency: 13.5 GHz
- Bandwidth:  $\pm 50$  MHz
- Return Loss: 17 dB
- Amplitude taper of co-polar pattern in el and az:  $15.0 \pm 1.0$  dB in el  
 $10.0 \pm 1.0$  dB in az
- Polarization: Linear H-polarisation  
Linear V-polarisation

### Features

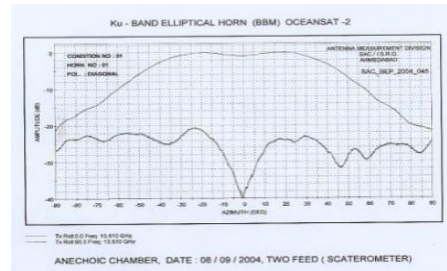
- Indigenous design and development
- Multi-mode, shaped radiation pattern
- Yields higher secondary gain than conventional feeds
- V and H-polarized feeds



Multimode Elliptical Feed



Dual channel Waveguide Rotary Joint



Shaped pattern of Multimode Elliptical Feed

## Dual-channel Microwave Rotary Joint

### Heritage

The indigenously developed Dual-channel microwave rotary joint with scanning antenna is already flown in Pencil beam Scatterometer payload for Oceansat-II mission.

### Specifications

- Frequency: 13.5 GHz
- Bandwidth:  $\pm 25$  MHz
- Return Loss(dB): 19 dB
- Insertion Loss(dB): 0.35 dB
- Isolation(dB): 40 dB
- Peak Power: Peak 140W, 34% DC
- EMI/ EMC (Test- RE102 Mil STD 461E): 67dB  $\mu$ Volt/ m
- Insertion loss variation within a single scan: 0.05dB

### Features

- Indigenous design and development
- Higher-order waveguide modes
- Dual Channel high power application
- Rotation independent RF performance
- Low insertion loss and high isolation

# HIGH POWER SHAPED BEAM ANTENNA

## High Power Beam Forming Network

Indigenously designed & developed high power multilevel beam forming network feeding multilayer printed antenna for shaped pattern to increase SNR for SAR Applications. The pattern shape will help in reducing the requirement of sensitivity time control correction at receiving end.

Null perturbation pattern synthesis technique has been applied to get the minimum ripple of 0.5 dB within 40 35 degrees.

### Heritage

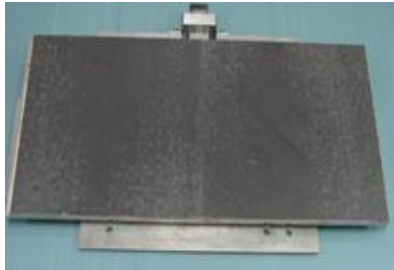
The high power beam forming network has employing square coaxial line has been integrated with C-Band SAR system on Beach aircraft and being used extensively for disaster management.



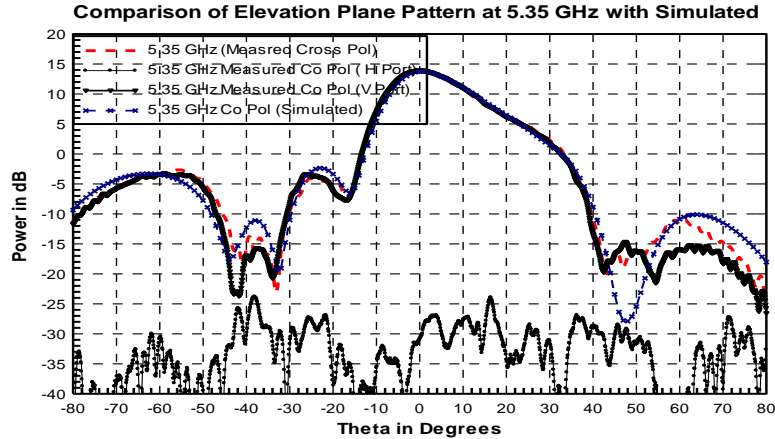
Inner Conductor of Power Combiner



8 Way Power Combiner Square Coaxial



SQL Power Combiner Feeding Multilayer Printed Antenna



### Specifications

- Operating Frequency: 5.35 GHz (C-band)
- Bandwidth: 225 MHz
- Return Loss : <-15 dB
- Shaping Angular Extent: > 35 deg
- Power : 8 kW (P-P)
- Duty Cycle : upto 5 %
- Polarization : Dual Linear
- Ripple Level in Shaped Region : < 0.5 dB

### Features

- Low loss transition from Square Coaxial to Square Coaxial, Square Coaxial to Microstrip and waveguide to Square Coaxial
- Pattern synthesis with minimum ripple

# PLANAR MICROSTRIP ANTENNA

## Wide Band Dual Polarized Microstrip Antenna Array

Indigenously developed Wide Band Dual Polarized Microstrip Antenna Array having 24% bandwidth with scanning of  $\pm 15$  degree can be used for communication, remote sensing, and ground segment payloads.

### Heritage

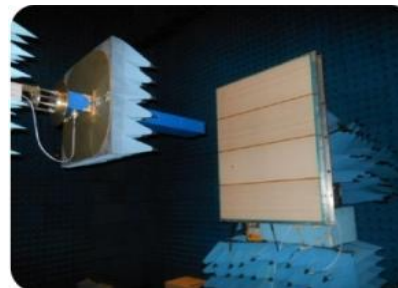
This antenna has been used in tile antenna for ISRO radar program.

### Specifications

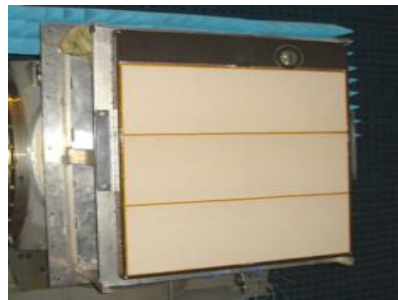
- Operating frequency: 1.1 – 1.4 GHz
- Return Loss: < -10 dB
- Gain of 8x6 Element Tile: 22 dB
- Gain Flatness:  $\pm 1$  dB
- Polarization Isolation: < -35 dB
- Scanning:  $\pm 150$

### Features

- Broadband performance (RL performance is 30%)
- High Gain and High Efficient Antenna System
- High Cross polarization Level
- Scanning upto  $\pm 15$  degree
- Compatible for mounting T/ R modules on the antenna.



Tile Antenna at L-band



Tile Antenna at C-band

## C- Band Dual Polarized Microstrip Antenna

Indigenously developed Wide Band Dual Polarized Microstrip Antenna Array operating at C-band having 5% bandwidth with scanning of  $\pm 15$  degree can be used for communication, remote sensing, and ground segment payloads

### Heritage

This antenna was used in Radar Imaging Satellite RISAT-1.

### Specifications

- Operating frequency: 5.2-5.5 GHz
- Return Loss: < -15 dB
- Gain of 24x20 Elements Tile: 32.5 dB
- Gain Flatness:  $\pm 0.5$  dB
- Polarization isolation: < -35 dB
- Scanning:  $\pm 15^0$

### Features

- Broadband performance
- High Cross polarization Level
- Scanning upto  $\pm 15$  degree
- Compatible for Mounting T/ R modules on the antenna.

# ORTHO MODE TRANSDUCER (OMT)

## Broadband Ortho-mode Transducer

Indigenously developed OMT having broadband (20% BW) performance, high return loss, high polarization isolation, and low insertion loss. The OMT can be used for communication, remote sensing, and ground segment payloads

### Heritage

Bread-board model have been developed successfully. The OMT have been integrated with antenna feed system for final payload system integration.

### Specifications

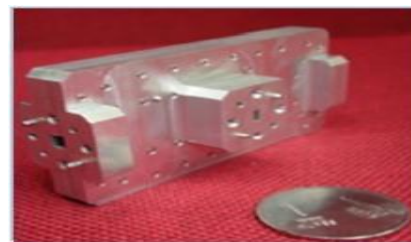
Operating frequency: 50 – 60 GHz  
Return Loss: < -18 dB  
Insertion Loss: > -0.6 dB  
Polarization isolation: < -38 dB

### Features

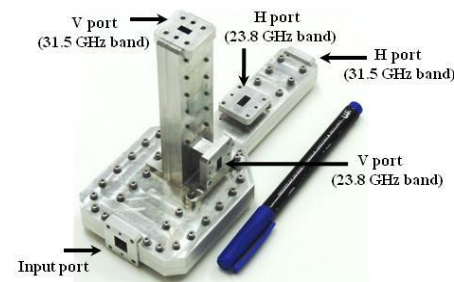
- Broadband performance
- Low insertion loss
- High polarization isolation
- RF design suited for fabrication at MMW freq. band
- Less volume



Turnstile junction broadband OMT



Backward coupler broadband OMT



Backward Coupler Dual band OMT

## Dual band Ortho-mode Transducer

Indigenously developed dual band OMT at 23.8 GHz & 31.5 GHz for dual polarized antenna system for communication, remote sensing, and ground segment payloads

### Heritage

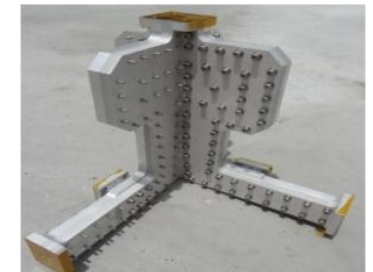
Bread-board model have been developed successfully. The OMT have been integrated with antenna feed system for final payload system integration.

### Specifications

- Operating frequency: 23.8 GHz± 150 MHz  
31.5 GHz ± 150 MHz
- Return Loss: < -19 dB
- Insertion Loss: > -0.5 dB
- Polarization isolation: < -35 dB
- Frequency isolation: < -22 dB

### Features

- Dual band performance
- Low insertion loss
- High polarization isolation
- RF design suited for fabrication



Turnstile Junction Dual band OMT

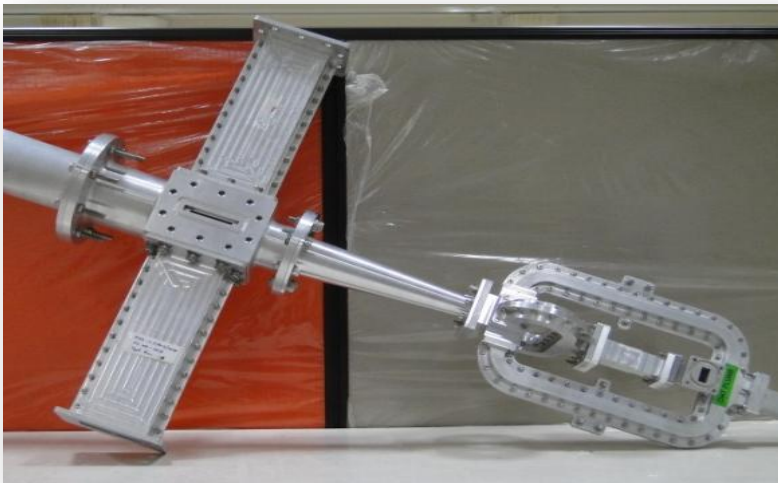
## ORTHO MODE TRANSDUCER (OMT)

### C /Ku Ortho Mode Transducer

The C/ Ku Ortho Mode Transducer (OMT) finds use in combined C/ Ku Earth Stations . It effects both polarization and frequency diplexing across C and Ku bands

#### Heritage

The OMT is part of the Bopal Earth Station [C band] and 11m MCF Earth station [Ku band].



#### Features

- Combined C/ Ku operation
- Low Insertion Loss
- High Isolation
- Compact size
- Simple fabrication

#### Specifications

- Operating Frequency : C Band 3.7 – 4.2 GHz  
Ku Band 10.95 – 12.75 GHz
- Polarization : Dual - Linear [ Lin- V/ Lin- H ]
- VSWR : 1.65 max
- Insertion Loss : 0.7 dB max
- Polarization Isolation : 35 dB min
- Ku- to C-Band Isolation : 70 dB min

## DUAL OFFSET GREGORIAN ANTENNA

### 23-31 GHz Offset Gregorian Antenna

#### Heritage

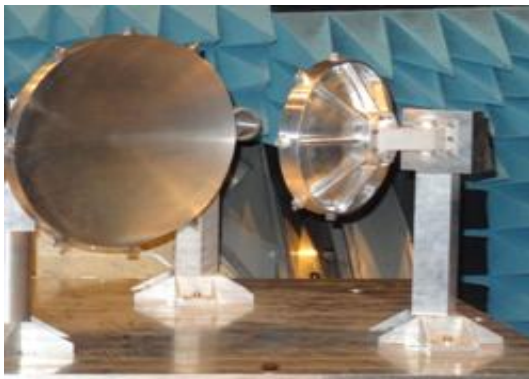
DVM successfully developed and integrated with mm wave payload system

#### Specifications

- Operating Frequency: 23-31 GHz
- Beam Efficiency: > 95%
- Side-lobe Level: < -29 dB
- X-Pol : < -24 dB

#### Features

- 360 deg. Vertical Scanning capability
- High Beam Efficiency
- Compact in volume



23-31 GHz Offset Gregorian Antenna

### 50-60 GHz Offset Gregorian Antenna

#### Heritage

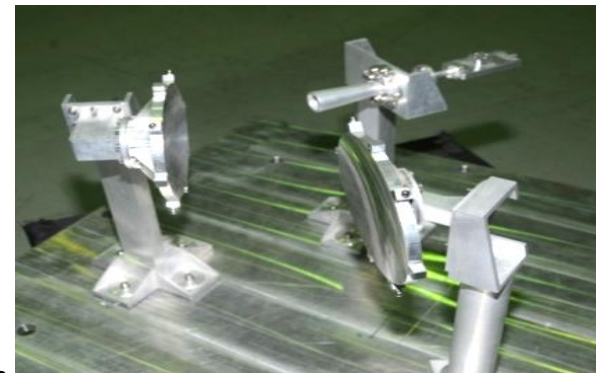
DVM successfully developed and integrated with mm wave payload system

#### Specifications

- Operating Frequency: 50-60 GHz
- Beam Efficiency: > 95%
- Side-lobe Level: < -29 dB
- X-Pol: < -24 dB

#### Features

- 360 deg. Vertical Scanning capability
- High Beam Efficiency
- Compact in volume



50-60 GHz Offset Gregorian Antenna

# MULTIMODE FEED HORNS

## Profile Corrugated Feed horn

### Specifications

- Frequency : 23-31 GHz
- Return loss : > 17dB
- Insertion loss: < 0.1
- Cross-pol.: < -35dB

### Features

Achieved 40% reduction in length compared to conventional corrugated horns



Profile corrugated horn at Ka band



Profile corrugated horn at V band



Spline Profile horn at W band

## Spline-Profile Multimode Feed horn

### Specifications

- Frequency :  $89 \pm 1.5$  GHz  
167-195 GHz
- Return loss : > 17dB
- Insertion loss : < 0.1
- Cross-pol. : < -30dB

### Features

It is alternative to corrugated horn, Less fabrication complexity



Spline Profile horn at mm-band

## Spline-Profile Feed horn and Septum Polariser at X-band

### Specifications

- Frequency : 7.145 - 7.19 GHz  
8.40 - 8.45 GHz
- Polarisation : RHCP
- Return loss : > 17dB
- Cross-pol. : < -20dB

### Features

Very compact in volume and light in weight





# UWB ANTENNA for GROUND PENETRATING RADAR

## UWB VIVALDI ANTENNA for GPR

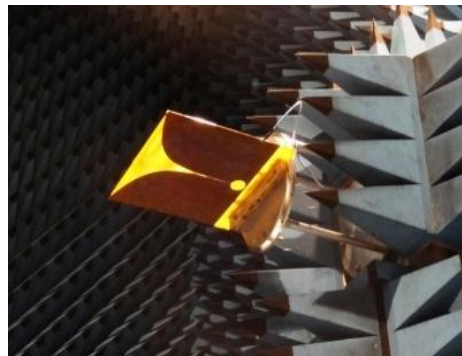
The indigenously developed UWB Vivaldi antenna can be used for portable, low cost, mass produced commercial GPR systems for the study of snow cover and sea ice thickness, landmine detection and archaeological and geo-physical investigations.

### Heritage

This antenna integrated with system hardware was successfully used for glacier studies at Manali. This GPR system will be used at Antarctica for glacier studies.

### Specifications

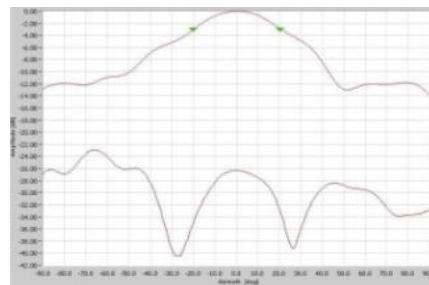
- Operating Frequency : 250 – 750 MHz
- Return loss : Better than 10 dB
- Polarization : Linear
- Radiation Pattern : Unidirectional
- Gain variation over band: Smooth
- Beam width :  $\sim 60^\circ \times \sim 60^\circ$
- Mass : < 600 gm
- Dimensions : 460mm x 460mm x 3mm
- Isolation between Tx and Rx : > 30 dB



Vivaldi Antenna

### Features

- Ultra wideband bandwidth performance (Measured return loss bandwidth of 204%)
- Antenna performance relatively independent of target ground properties
- Small size, and planar form with provision for mounting on three sides
- Integrated with radome and field tests carried out successfully
- Rugged yet light weight
- Uses printed circuit board technology and commercial grade FR-4 material, hence suitable for low cost mass production



Measured Radiation Pattern at 750 MHz



Integrated GPR System



Measured Return Loss