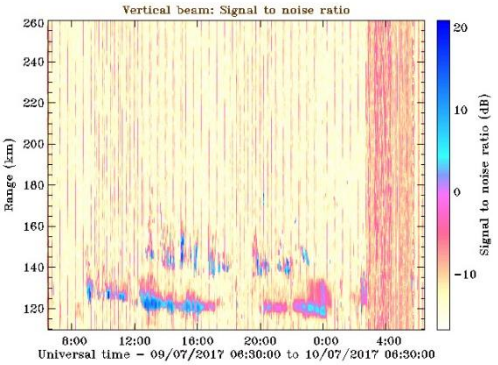
SIA VHF IONOSPHERIC RADAR
25 to 65 MHz

The ATRAD SIA radar is designed to observe ionospheric irregularities and their drift in the E and F regions. The radar operates as a coherent Doppler backscatter radar, with the radar beam directed perpendicularly to the geomagnetic field at E or F region heights. The radar beam can be steered within ±45° in azimuth around the radar boresight. A typical 3 dB beam polar width is 10° in azimuth and 24° in zenith angle.

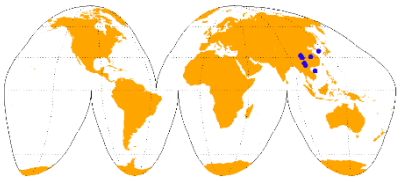
(Above) 24 kW VHF SIA radar with six-channel digital transceiver



(Above) Typical real-time quick-look E-region SNR results from one day of operation of a low latitude 24 kW, six channel SIA radar.

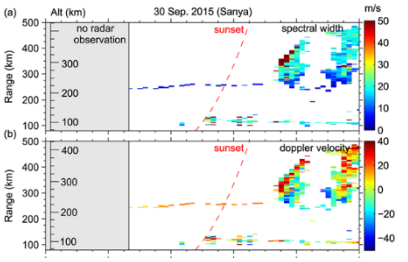
KEY FEATURES

The SIA is based on highly reliable ATRAD VHF radar technology. This features the use of efficient and reliable solid-state power amplifiers, and sophisticated monitoring and control for enhanced reliability.



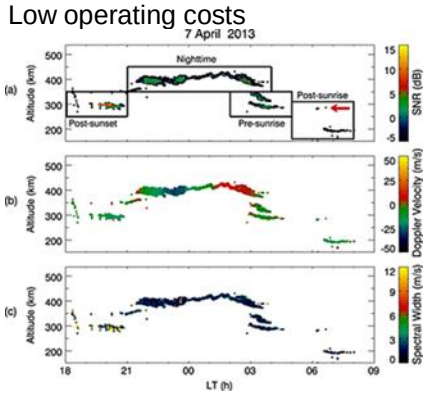
(Above) ATRAD has considerable experience with VHF Ionospheric radars. Most recently, 6 have been installed in the Asian sector.

- Ionospheric Doppler radar operation with:
  - Conventional beam steering
  - Hybrid Doppler Interferometry (HDI)
- Frequency Domain interferometry (FDI)
- Pulse coding
- Spaced Antenna operation
- **5-year warranty on power amplifiers**

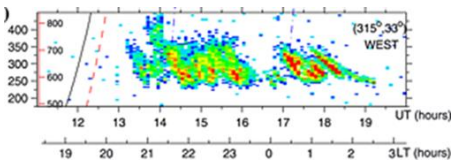


(Above) Range-time (a) Doppler spectral width and (b) Doppler velocity plots of irregularity echoes observed in one beam of the Sanya (China) radar (J. Geophys. Res. Space Physics, 122, 3788–3797, doi:10.1002/2016JA023647)

- Real-time Wind Profiles
- Superior performance
- Remote monitoring and control
- Fully automated
- Unattended operation
- Low operating costs



(Above) Occurrence climatology of F region field-aligned irregularities in middle latitudes as observed by the 40.8 MHz coherent scatter radar in Daejeon, South Korea (J. Geophys Res.: Space Physics, 120, 10107-10115, 2015 DOI: 10.1002/2015JA021885)



(Above) Height-time-intensity (HTI) plots of backscatter plume echo observed with the Sanya radar

APPLICATIONS

- Basic research in the E and F-regions
- Space situational awareness
- Space weather analysis and forecasting

(Left) Three views of a 40.8 MHz SIA antenna array. The required beam elevation angle dictates the tilt of the five-element Yagi antennas. In this case, the antennas are horizontal, resulting in a polar diagram which is perpendicular to the magnetic field at this location.

ATRAD Pty Ltd
20 Phillips Street, Thebarton SA 5031
AUSTRALIA
Tel: +61 8 7324 0818
Email: enquiries@atrad.com.au

ABN 72 112 121 801

Transceiver
(Digital receiver)

- Fully synchronous transmit exciter, six-channel receiver and digital IF acquisition
- Six-channel I and Q output data sent to the Linux analysis PC
- Programmable receiver gain and bandwidth
- Interfacing to the beam-steering system and antenna selectors
- **Expandable to 12-channels**

Transmitter
(24 kW transmitter)

Antenna Array
(24 element antenna arrays)

General Description

16-bit Digital Transceiver incorporating receiver and exciter

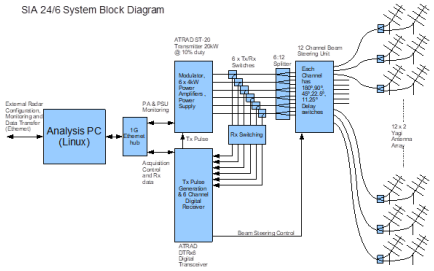
Solid-state, scalable modular transmitter (in 24 kW blocks). 10% duty cycle Gaussian pulse, 15% square

Doppler Beam Steering Interferometric Array

Specifications

Receiver: 6-Channel, 16-bit
Exciter: Single Channel, 16-bit
Typical Sounding Range:90-850 km
Range Resolution: 100 – 4,000 m (software selectable)
Range Gates: Up to 6,000
Operating Modes: Doppler Beam Steering, Spaced Antenna Interferometric and Mixed-Mode operation
Data output: Wind field, spectral width, signal-to-noise ratio (SNR)
Data Output Formats: ADF, User defined
Remote access: Remote monitoring and control via satellite, 3G/4G, ethernet or dialup.

Transmitter Power: 24 kW
Operating Modes: mono-pulse / pulse coded
Frequencies: 25 to 65 MHz fixed at factory.
AC Mains Power: 220-240V or 110-120V AC, Three Phase
System Block Diagram:



Array Configuration: 2 x 12 five-element Yagi antenna with $\lambda/\sqrt{2}$ spacing. The required beam elevation angle varies with latitude with typical values between 45 and 90 degrees.
Antenna Array Footprint: Frequency-dependent (~ 6 m x 40 m at 55 MHz)
Azimuthal Steering Range: Up to ±45°
3 dB Antenna Beamwidth:10° in azimuth and 24° in zenith
Steering Resolution: Typically, 20-50 steps across the steering range

Options

GPS Reference

GPS disciplined oscillator (GPSDO) / GPS locked time and frequency (module shown left). Used for bi-static, multi-static, and / or remote receiver operation

Meteor Mode

The radar can also be fitted with additional switched antenna sets to allow alternative operating modes such as meteor detection

Antenna Arrays

Alternate phased arrays for other beamwidths

Remote Receiver System

(Left) Remote six-channel receiving system. This is a complete receive system for remote ionospheric or meteor operation (with an appropriate antenna system)

ATRAD Pty Ltd
20 Phillips Street, Thebarton SA 5031
AUSTRALIA
Tel: +61 8 7324 0818
Email: enquiries@atrad.com.au

ABN 72 112 121 801