

Dual polarized broadband dipole antenna feed with conical reflector for uGMRT

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Hanumanth Rao B, Suresh Kumar S

GMRT Observatory, NCRA-TIFR, Post Bag 3, Ganeshkhind, Pune 411007, Maharashtra, India

(hanuman, skumar@gmrt.ncra.tifr.res.in)

The Giant Metrewave Radio Telescope (GMRT) is an international facility for Radio Astronomy, operational since 2002. It consists of 30 fully steerable prime focus feed parabolic antennas, each of 45 m. diameter, spread over an area with an effective radius of nearly 15 km, and covering frequencies in the range of 150 MHz to 1420 MHz. Though meant primarily as an aperture synthesis instrument, antenna arrays can be formed out of the 30 dishes, where separate sub-arrays can work on different frequency bands concurrently.

To meet the requirement of seamless frequency coverage from about 50 MHz to 1500 MHz, we have designed and developed wide-band feeds of an octave or more bandwidth, to efficiently cover the following bands: 120-240 MHz (Band-2), 250-500 MHz (Band-3), 550-850 MHz (Band-4) and 1000-1500 MHz (Band-5).

This paper describes the broadband dipole antenna feed with conical reflector design for L-band (1000-1500 MHz). This feed has been designed and prototype model was implemented at GMRT observatory. This future cone-dipole design for 900-1500 MHz, provides very good return loss performance (< -10 dB) and with uniform edgetaper ~ 12 dB throughout the band.

Dipole Design Concept: Any $\lambda/2$ dipole is resonant to particular frequency and narrow band in nature. When the dipole is loaded with plates/sleeves either on the top or bottom of the dipole, it will nullify the effect of Inductive reactance and improves the electrical bandwidth. $\lambda/2$ Dipoles for Band-2, -3, -4 & -5 have been designed and optimized the sleeve configuration to achieve required band width.

Cone Design Concept: Dipole and dipole with flat reflector will have asymmetric radiation pattern. If dipole arms are bent to achieve symmetry in radiation pattern, it will affect antenna impedance and power handling capabilities. To solve the above mentioned, dipole has to keep in the standard form and the flat reflector has to be bent to improve the radiation pattern symmetry. For Band-3, -4 & -5, cone-angle has been adjusted to 70 deg to optimize spill over and illumination losses for 45 meter dia. GMRT parabolic dish.

Successful completion and deployment of this wideband feed on all 30 antennas will make the GMRT a very sensitive and versatile instrument for a variety of new science in astronomy.

References

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