Development of 30-MHz radar system with wide scanning capability for dedicated probing of ionosphere

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A 30-MHz radar has been developed at NARL, Gadanki, India (13.45°N, 79.18°E) for dedicated probing of ionosphere and to study the low latitude ionospheric plasma irregularities. The radar has the beam steering capability to scan a larger part of the sky up to $\pm 50^{o}$ in East-West direction, which will overcome the limitation of slit camera picture obtained by the fixed beam of the Indian MST radar in probing the ionospheric plasma irregularity/structures. The system is also configured for the aperiodic pulsing scheme to address the overspread of the targets, pulse-to-pulse beam steering, interferometry mode to find the zonal drift of the irregularities.

The radar system consists of 20x8 phased antenna array spread over an area of 6300 m^2 with the antenna beam tilted permanently to 14^{o} north from the zenith direction so that the antenna beam satisfies the perpendicularity condition for the detection of irregularities from the ionospheric E and F regions. The exciter system employs Direct Digital Synthesizers (DDS) to generate 30-MHz pulse coded signal, distributed to the Transmit-Receive modules (TRM) with equal amplitude and phase by using RF distribution system. High power solid-state Transmit-Receive modules (20 Nos) with forced air cooling are employed to generate a total peak power of 160 kW. Low loss RF feed and passive coaxial beam forming network are incorporated to distribute the output from each TRM (8-kW) to a row of eight antennae. Multi-channel direct digital receiver is being used for interferometry and wide scanning applications to generate the online Range-Doppler information. Uninterrupted observations are being made by the radar system and high quality E-and F-Region Range-Time-Intensity (RTI) and conical maps are obtained.

In this paper we present, the system design philosophy, realization, initial observations and also the capability of the system to augment for Meteor observations.