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Title:
A TORIC OFFSET THREE-REFLECTOR ANTENNA FOR THE ADVANCED MICROWAVE LIMB SOUNDER

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Abstract:
The Advanced Microwave Limb Sounder is a space-borne heterodyne radiometer which
will measure pressure, temperature, geopotential height and atmospheric constituents from thermal emission at frequencies from 120 to 640 GHz. Its predecessors, one launched in 1991 on the Upper Atmosphere Research Satellite and another scheduled for 2003 launch, used pencil-beam antennas sized to resolve at about one vertical scale height. However, for current atmospheric models one should trade horizontal resolution for better coverage
than typical orbit spacing provides. A new antenna concept combines the wide scan range of the parabolic torus with unblocked offset Cassegrain optics. The resulting system is diffraction-limited in the vertical plane but highly astigmatic in the horizontal, giving beamwidths of 0.13x2.5 degrees. Symmetry about the nadir axis ensures that this Beam Aspect Ratio (BAR) is invariant over +/-33 degrees of azimuth scan. The antenna may feed either an array of MMIC receivers or a single low noise receiver whose FOV is swept over the reflector system by a small scanning mirror. This paper describes 3 stages of antenna design and analysis: A paraxial-optics design chooses conic profiles given orbit geometry and vertical resolution requirements, then develops the surfaces by rotation about an axis parallel to nadir, matching axisymmetric feeds to the desired BAR. We verify the design and generate alignment and thermal deformation tolerances using spot diagrams and scalar diffraction fields from a commercial ray-trace program. Finally, a physical optics analysis permits fine tuning of reflector outlines and contours based on surface current distributions.

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