National Radio Astronomy Observatory
Tech Transfer

Multiband Sinuous Antenna Covering 10x Frequency Range

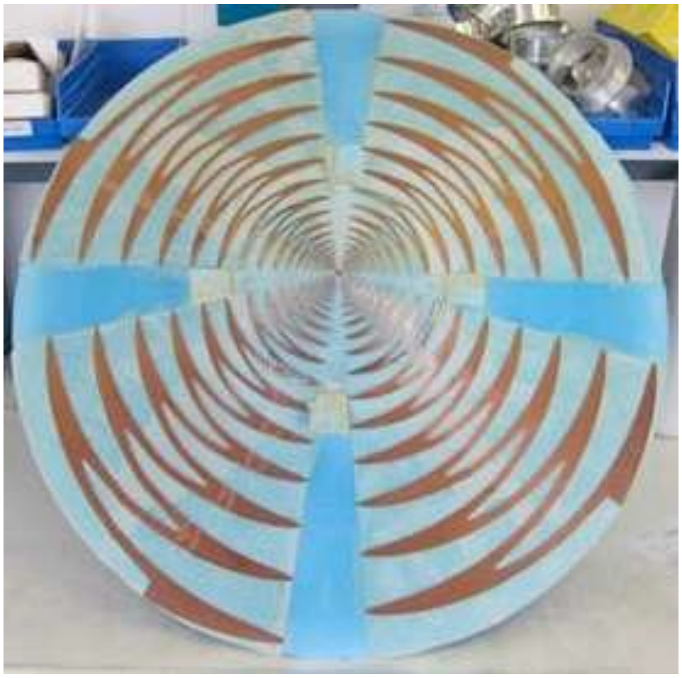
An engineering team at the National Radio Astronomy Observatory's (NRAO) Central Development Laboratory (CDL) received a patent for a new wide-band radio antenna. This breakthrough technology combines both traditional and highly innovative fabrication techniques to create an antenna with exceptional simultaneous frequency coverage. The prototype antenna covers the 300 MHz to 3 GHz range, but the invention can be implemented in any similar range of radio frequencies, such as 2 GHz to 20 GHz, which would have a significant impact on commercial satellite communications and space situational awareness operations.

The patent describes the design and placement of sinuous resonators – the part of the antenna that actually receives the radio waves – onto the surface of an inverted cone. The resonators form expanding wave-like bands snaking outward from the central focal point of the antenna. The entire apparatus sits atop a traditional ground plane: the base portion of an antenna. The steadily increasing width of the resonators allows the antenna to simultaneously receive a wide array of frequencies. Earlier wide-band antennas use a traditional planar design, which requires absorbers to make it unidirectional. These absorbers, however, add extra noise to the system and decrease effectiveness.

The new design elegantly solves this problem, making it suitable for systems in which low-noise and wide bandwidth requirements are a priority, such as spread spectrum radio communications. This allows one antenna to replace many in practical use, thereby reducing costs. The wide-bandwidth applications of this technology also include radio astronomy, biomedical imaging, spectrum surveillance, and satellite communications, among others. U.S. Patent #9,054,516 was issued on June 9, 2015, to NRAO researchers Richard Bradley and Rohit Gawande. The CDL supports the evolution of NRAO's existing facilities and provides the technology and expertise needed to build the next generation of radio astronomy instruments.

Shows sinusoidal resonators embedded onto an inverted cone.

This antenna feed operates between 300 MHz and 3 GHz.



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Why it Matters

Construction Cost reduction

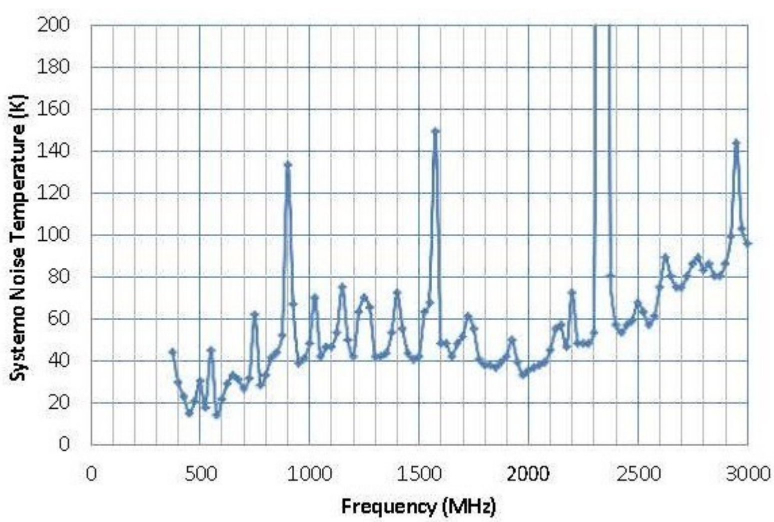
- Reduced number of ground terminals needed
  - Lower capital investment for fewer units
  - Lower systems integration costs (only need to integrate one system instead of several)

Operational Cost reduction

- Fewer ground terminals means less power consumption (think green)
- Fewer receivers/transmitters to repair and/or replace

Multiple Uses of Data output

- Can be used simultaneously on multiple bands with appropriate hardware
- Can be used for satcom links, telemetry and positional data for space situational awareness, etc.



Graph showing the multiband capabilities receiving RF signals from four different sources.

Results shown are for cryogenic temperatures.

Measured receiver noise from 0.4 to 3 GHz for the cryogenic system cooled to physical temperature 100 K. The four peaks are inputs from RFI sources.

NRAO Technology Transfer Office

https://info.nrao.edu/tto 434-296-0236 tto@nrao.edu