Newsletter 5.1

September 2014

Antenna Magus version 5.1 released!

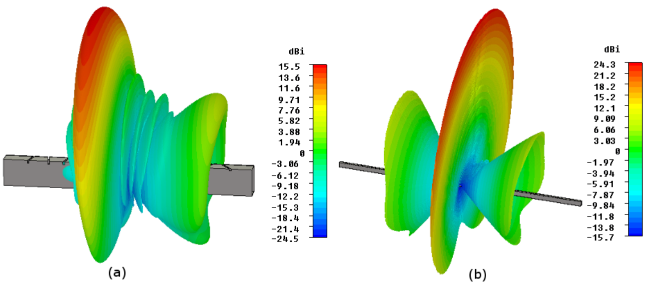
We are pleased to announce the release of Antenna Magus Version 5.1. This release sees the addition of 5 new antennas - increasing the total number of antenna templates shipped with Antenna Magus to 255. The new antennas are:

- Linear traveling-wave narrow wall slotted guide array
- Cycloid dipole antenna
- Low-profile rectangular corrugated feeder antenna
- Inductively-loaded wire monopole antenna
- Grid reflector with four bow-tie phase array feed

New antennas in Version 5.1

Linear traveling-wave narrow wall slotted guide array

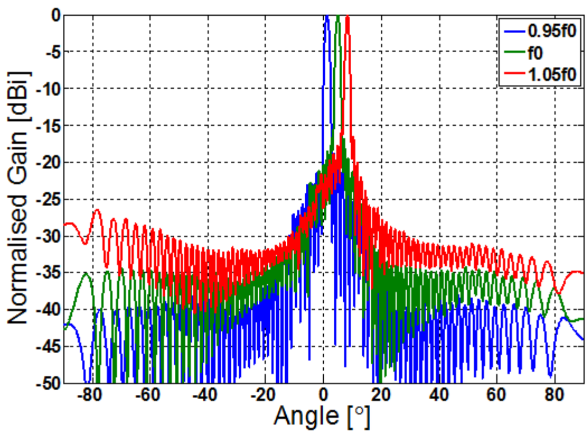
The narrow-wall slot array is a popular microwave frequency antenna, which is especially useful for Radar applications where mechanical robustness, low-loss and the ability to withstand high transmit power are advantageous. A single instance of the linear array produces a fan beam, while a pencil beam may be created by stacking a number of arrays to realise a planar configuration.



Fan-beam radiation patterns of linear traveling-wave narrow wall slotted guide arrays at the centre frequency of the operating band for (a) 12-element (with negative squint) and (b) 54-element (with positive squint) arrays.

The magnitude of the wave launched from the feed of the traveling-wave slotted waveguide array decays towards the load as the energy is coupled out and radiated by the slots. At the termination side of the waveguide, the remaining un-radiated power is absorbed by a matched load. For a correctly designed array the absorbed power should only be a small percentage of the input power.

The antenna is well matched over a reasonably wide bandwidth and the bandwidth does not degrade with increasing array length, as is the case for a resonant array. The antenna is designed such that coupling between the travelling wave and the radiating slots increases towards the load, such that the radiation intensity from the second half of the array is comparable to that from the first half. The slots are spaced such that there is a progressive phase shift between slots, resulting in a fan beam which squints off broadside at an angle that increases with excitation frequency – a property that is leveraged in many applications.

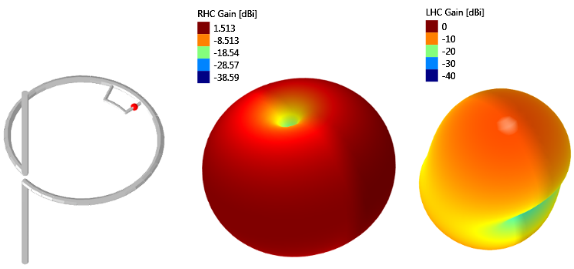


Typical main beam scan versus frequency for a 54-element array.

Cycloid dipole antenna

The Cycloid dipole, also known as the 'Ring and Stub', is an omnidirectional, circularly polarised antenna used primarily in FM broadcasting applications. As the physical structure of the Cycloid dipole is not symmetrical, it is typically side-mounted on masts or towers and multiple elements may be stacked to realize vertical arrays and increase gain.

The near-horizontal loop section provides a horizontal component for the radiation, while the vertical sections provide a vertical component. If the dimensions of the loop and vertical elements are chosen correctly, the amount of vertical and horizontal radiation, together with the correct delay between these components, will result in circular polarisation. Typically the Cycloid dipole is matched to 50 Ω and has a narrow impedance bandwidth.



Polarisation-specific radiation patterns for a right hand circular (RHC) design.

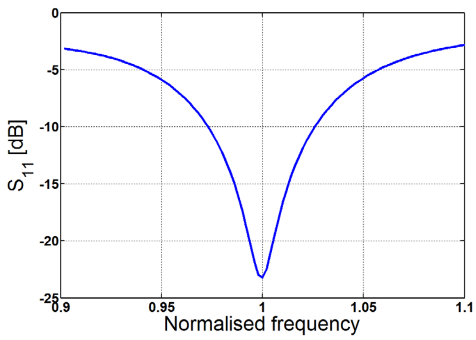
AntennaMagus
Explore.Design.Deliver.

Low-profile rectangular corrugated feeder antenna

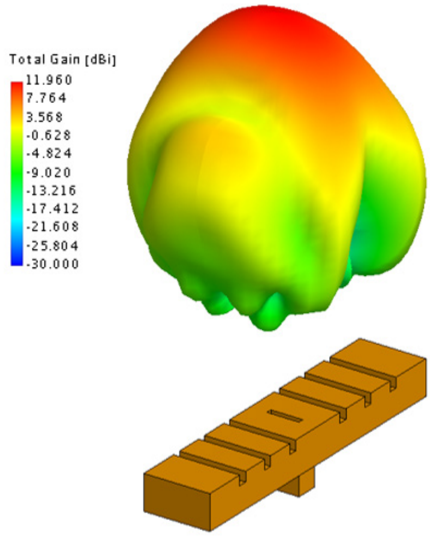
The low-profile corrugated feeder antenna is a linearly polarised, medium gain antenna which has been used in reflector feeds, as well as in integrated wireless networking applications. The antenna radiates through a sub-wavelength aperture in a conducting metallic plate while corrugations in the plate allow further shaping of the beam.

The thickness of the plate determines the resonant frequency while the width of (and distance between) the corrugations determines the angle of constructive interference.

Increasing the number of corrugations increases the gain and flattens the beam in the E-plane, resulting in a sharp pattern roll-off. This effect is only achievable for a limited number of corrugations, where after additional corrugations have no effect.



The low-profile corrugated feeder antenna has a narrow impedance bandwidth

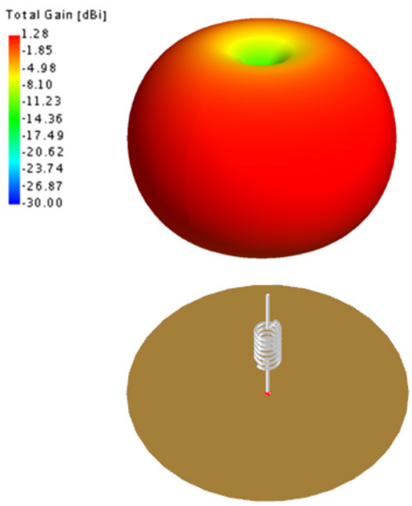


Radiation pattern of the low-profile corrugated feeder showing medium broadside gain

---

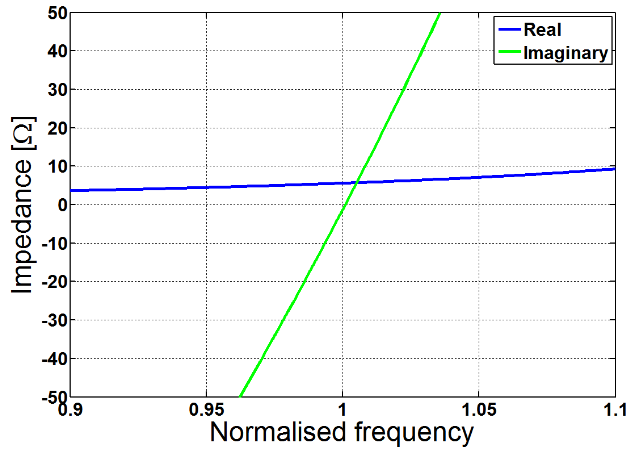
Inductively-loaded wire monopole antenna

The inductively-loaded monopole antenna is a linearly polarised low gain antenna with an omnidirectional radiation pattern. The antenna uses a series inductor to tune out the large capacitive reactance introduced by shortening the traditional quarter-wavelength long wire.



Radiation pattern of the inductively loaded monopole illustrating the familiar omnidirectional pattern of a conventional monopole.

The benefit of the shorter structure comes at a price - a very low input impedance and a narrow bandwidth. A conventional monopole may provide 10% usable bandwidth in a 50 Ohm impedance system, while the inductively loaded monopole may require matching to a real impedance below 10 Ohm and achieve a bandwidth as low as 0.5%!



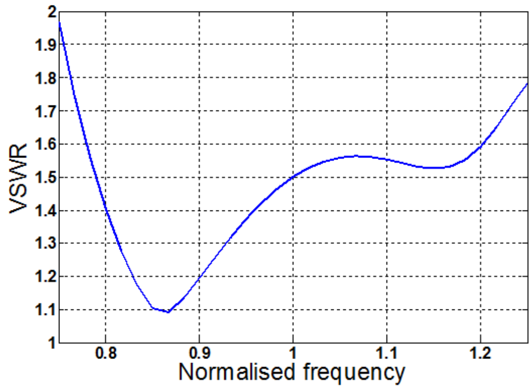
The inductively loaded monopole antenna has a very low input impedance.

Grid reflector with four bow-tie phase array feed

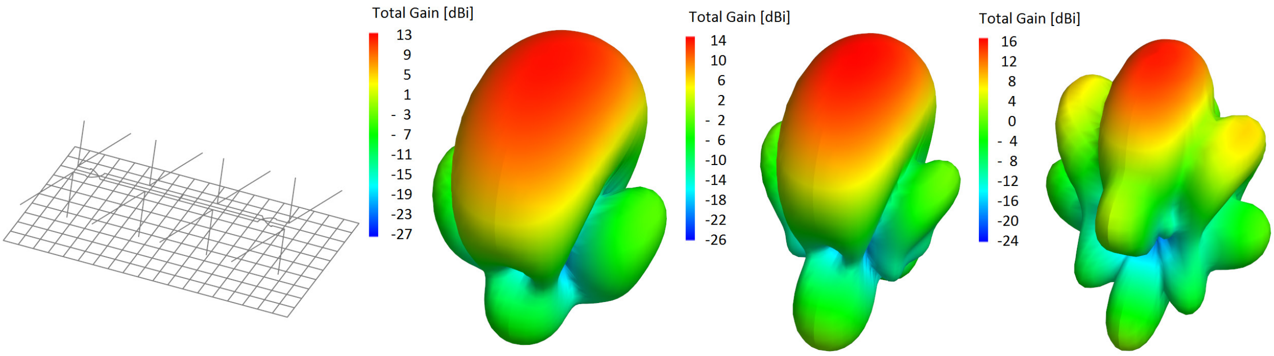
This grid reflector is a popular, low cost reception antenna for terrestrial television signals in the UHF band. The antenna may be easier to mount and is less obtrusive than the other low cost reception antennas such as Yagi-Uda and LPDA-type antennas.

The array of wire bow-tie antennas provides a fairly simple, yet wideband array with an integrated feed structure. This antenna requires a balun when feeding the structure with a coaxial cable or other unbalanced transmission line type. The balun is often designed to also provide impedance matching. For example, in TV applications, the balun provides an impedance transformation from 300 Ω to 75 Ω.

By placing a planar reflector behind the bowtie array, a directional radiation pattern is achieved. The wire construction of the grid reflector makes the antenna light-weight and practical at lower frequencies. While the bowtie array feed provides acceptable input reflection performance over a 2:1 band, the usable bandwidth is dictated by the pattern stability - which is limited to approximately 1.55:1.



VSWR performance of the antenna in a 300 Ω system



Typical 3D gain patterns at 80% of the centre frequency, at the centre frequency and at 120% of the centre frequency.

AntennaMagus
Explore.Design.Deliver.