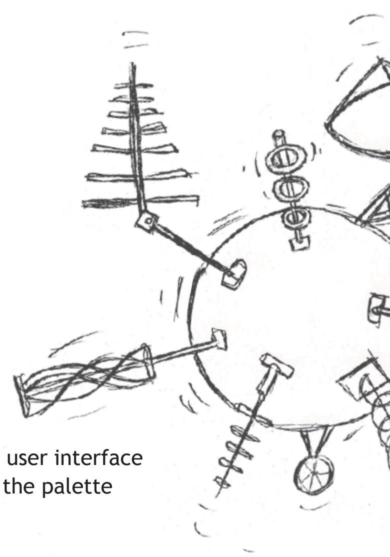


Newsletter 3.1

July 2011

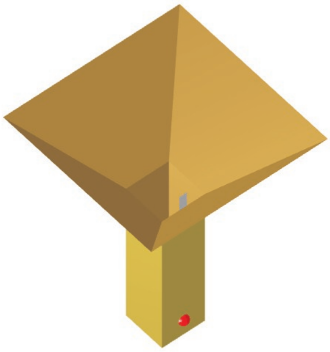
Antenna Magus version 3.1 released!

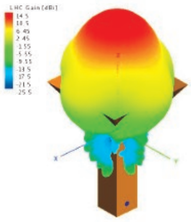
Antenna Magus 3.0 was such a feature laden release that not all of the new features could be mentioned in the newsletter, so we decided to rather announce them in this newsletter. Users who have upgraded to version 3.0 would have noticed these features in addition to the “add your own antenna” feature, chart tracing tool and additional libraries. The first of these features aids in the qualitative assessment of radiation patterns by showing 3D gain patterns as part of the performance estimation of most antennas. The second of these features is the addition of a collection of thumbnails at the top of each information document to provide an indication of the electrical size of the antenna, and its radiation pattern. Lastly, user interface improvements were made, primarily on the palette and in the array synthesis tool.

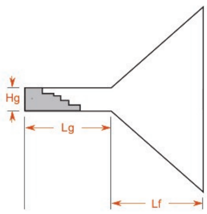
These feature additions increase the ease of using Antenna Magus, but the unwavering development focus is to supply reliable antenna designs and models. The huge database of antennas is still the most valuable contribution of Antenna Magus and with the release of version 3.1 the database now boasts 6 new antennas and 2 transitions, expanding the total to 154 antennas and 9 transitions.

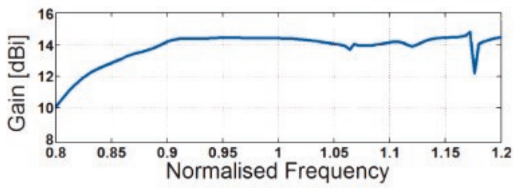
New antennas in the database

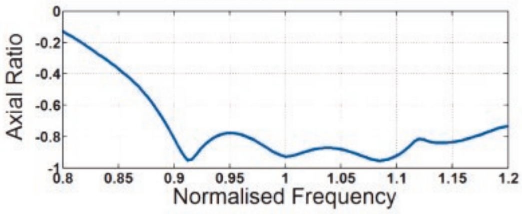
Square pin-fed septum horn









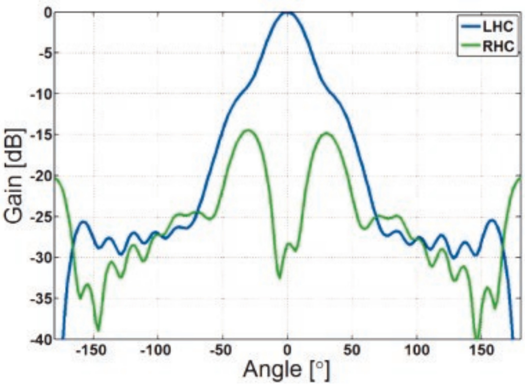


Typical gain and S11 vs normalised frequency with a reference impedance of 100 Ω.

The standard rectangular horn antenna is one of the simplest and probably the most widely used microwave antenna and its existence and early use dates back to the late 1800s. A simple and effective way of exciting high purity left- or right-hand circular polarisation using a single feed, is by the addition of a septum polariser into the square feed waveguide.

The *pin-fed square septum horn* may be designed for an input impedance range from 50 to 150 Ω, while the gain can vary between approximately 10 and 24 dBi.

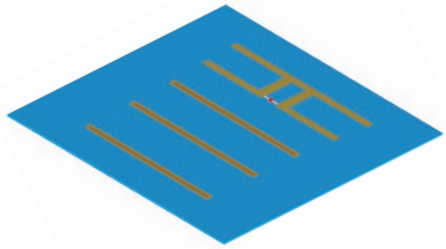
The following graphs show typical S11, gain and radiation performance for a left-hand circular 14 dBi design.



Total normalised left- and right- hand circular gain patterns.

AntennaMagus
Explore.Design.Deliver.

Printed Yagi-Uda Dipole Array with quarter-wave balun

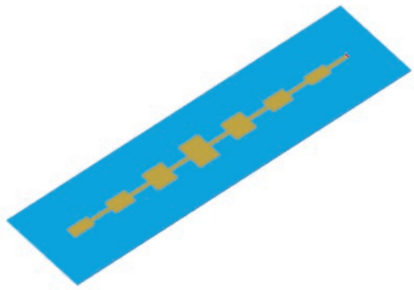


This antenna is a printed version of the *classical Yagi -Uda antenna*. Compared to the *Classical Yagi*, the *printed Yagi Uda* antenna has similar performance with the advantage that no supporting booms are required. This antenna is particularly useful in low power applications where the option of manufacturing on copper clad substrate is attractive.

A balun is needed to feed the driven element of a Yagi-Uda Antenna. This design already includes the design of an integrated quarter wave balun into the structure.

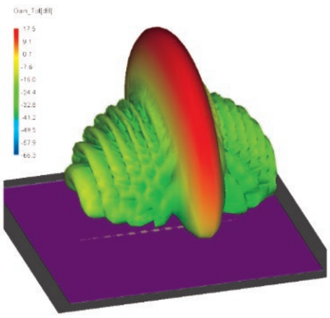
Although the antenna can be optimised for a variety of requirements such as gain, impedance or bandwidth there is a trade-off between the performance characteristics. Antenna Magus designs this antenna for optimal gain and the parametric simulation model can be exported and optimised for other objectives, using CST MICROWAVE STUDIO or FEKO.

Resonant Rectangular Series-Fed Patch



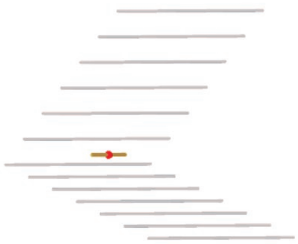
Series-fed microstrip patch arrays are typically used for communication and microwave sensing applications. This light weight, low profile antenna can achieve high gain of up to 20 dBi at a specified squint angle, but due to its resonant nature it typically has a narrow (~2%) bandwidth.

Series-fed patch arrays fall into one of two categories, namely resonant and travelling-wave arrays. *The resonant rectangular patch array* has better efficiency than the traveling-wave array.



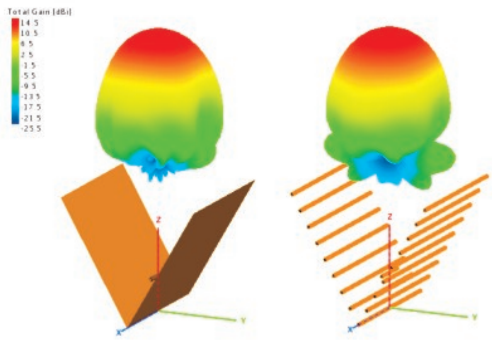
Typical fan beam gain pattern for a 12 element array with a Dolph-Chebychev distribution.

Grid corner reflector



This antenna is a variation on the popular *dipole-fed corner reflector antenna,* but the solid reflector is replaced by a grid of parallel wires spaced ~1/10 lambda apart. Both of these antennas have similar peak gain characteristics with the main difference in the side and back lobes as illustrated in the next image. As the spacing between the grid elements increases, the gain and front-to-back ratio decreases as the effectiveness of the gridded reflector decreases.

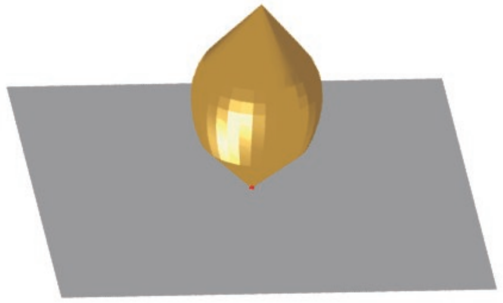
The grid corner reflector is mostly used for physically large antennas at lower frequencies, in order to reduce the weight and wind resistance of the structure.

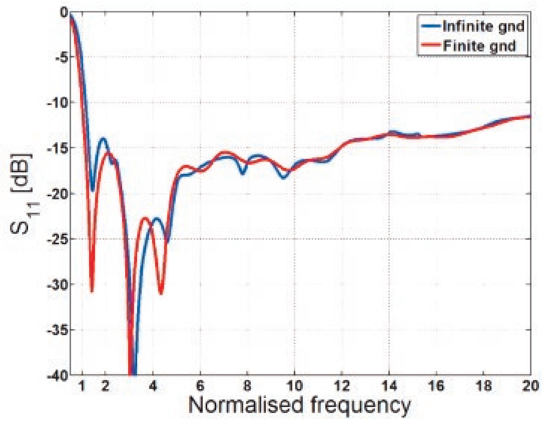


Comparative radiation patterns for grid and solid corner reflectors.

AntennaMagus
Explore.Design.Deliver.

Wideband Monocone Antenna with shaped cap





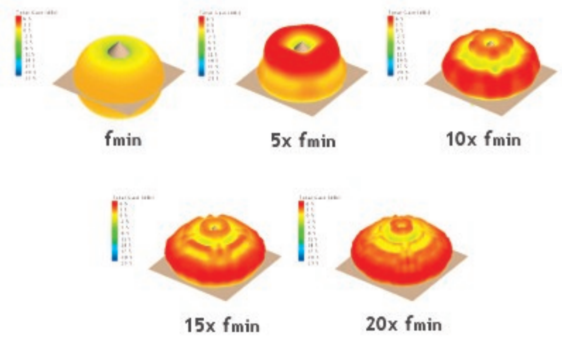
Typical S11 vs frequency for finite and infinite ground planes.

The *Wideband Capped Monocone Antenna* is a variation of the standard monocone where a cap-like structure has been placed on top of the conical base. This antenna provides ultra-wide impedance bandwidth and an omnidirectional radiation pattern.

The feed is positioned between the truncated bottom cone section and the ground plane. Precise construction of the area near the feed is very important since this region determines the high frequency performance.

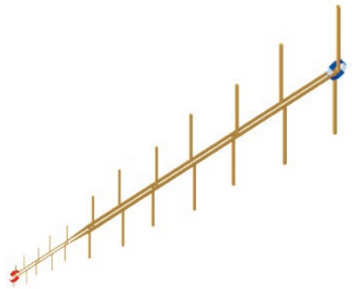
The plots shown compare the performance a 50 Ω design on a 1λ by 1λ rectangular ground plane (where λ is wavelength at fmin) with the same design on an infinite ground. Frequency is normalised to fmin - the low end performance cut-off frequency.

The addition of the cap results in a more stable radiation pattern across the band when compared with the standard *Monocone*. The last image illustrates this showing total gain patterns at various frequencies.



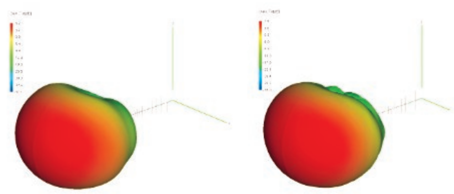
Typical 3D radiation patterns vs frequency.

Dualband LPDA antenna



The *single-band LPDA antenna* is one of the most popular broadband antennas due to its simple, lightweight, construction and low-cost. The *dual-band LPDA* consists of two single-band LPDA antennas in a cascade arrangement facilitating dual-wide-band operation with a single feed. This configuration is specifically useful where the desired upper and lower operating bands are far apart, and the dualband configuration results in a structure that it physically shorter than a single band LPDA that covers both required bands. Within the bands of operation, the *dual-band LPDA* has a single linearly polarized main lobe with gains ranging between 6 and 12 dBi. Out of band performance typically results in increased backlobe levels and sidelobe levels are generally more than 10 dB down from the main lobe for a well-designed structure.

The performance graphs shown below are for an LPDA designed to work in the normalised frequency range from 0.5 to 1.5 and then from 3.5 to 4.5. It is designed for a gain of 8 dBi and a resistance of 150 Ω.

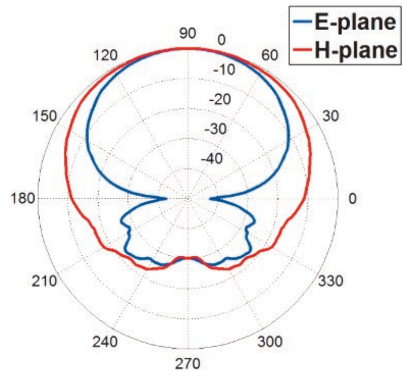


Typical radiation pattern at the two centre frequencies.

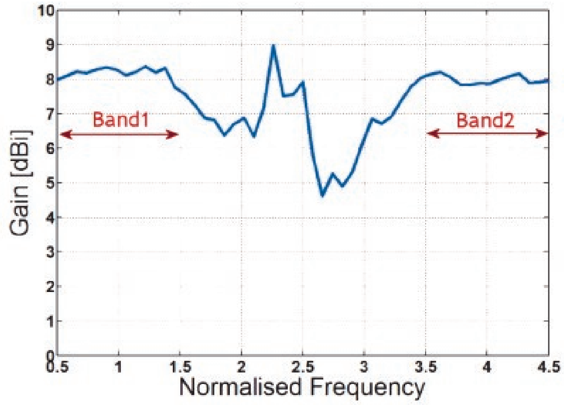
(Continue on the next page.)

AntennaMagus
Explore.Design.Deliver.

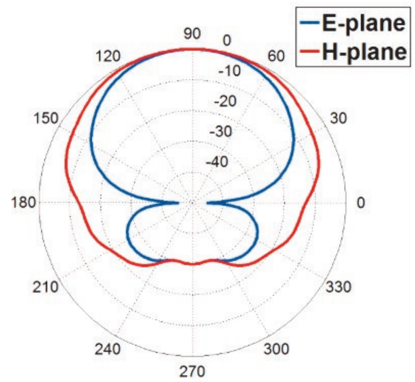
(Dualband LPDA continued)



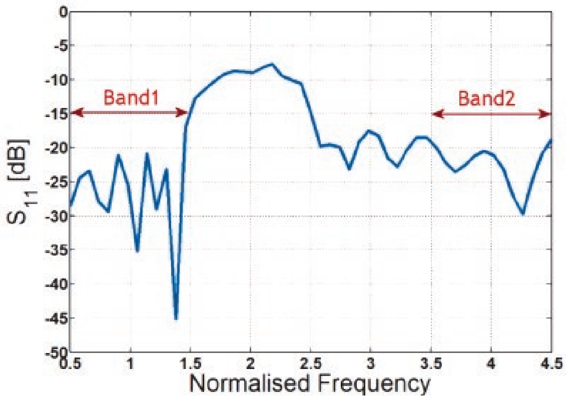
Typical gain pattern at lower centre frequency.



Typical gain vs frequency.



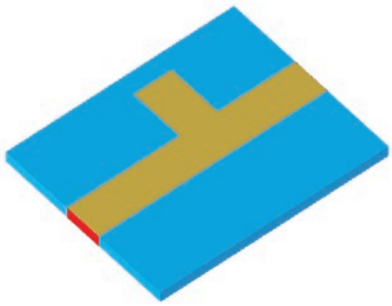
Typical gain pattern at upper centre frequency.



Typical S11 vs frequency

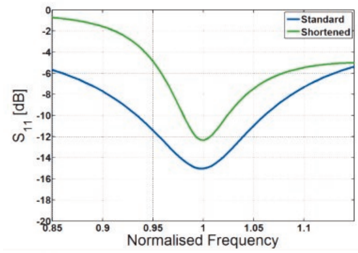
Transitions

Microstrip shorted and open stub matching transitions

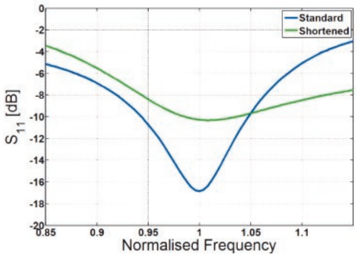


Open- and *shorted shunt-* stub matching transitions are very useful when matching antennas with complex input impedances. By improving the impedance match between the antenna and the system, power transfer can be improved resulting in more efficient system performance and higher effective antenna gain.

Antenna Magus offers two different design approaches for the transitions. The 'standard' approach provides a physically longer transition than that of the more compact 'shortened' design – but the 'standard' design has a wider operational bandwidth and better match. The results shown below are for open-circuit shunt stub (1) and shorted shunt stub (2) transitions designed at 10 GHz on a 1 mm thick substrate with a relative permittivity of 2, and transform a 100 + j100 Ω impedance for connection to a 50 Ω system.



1. Open shunt stub transition S11.

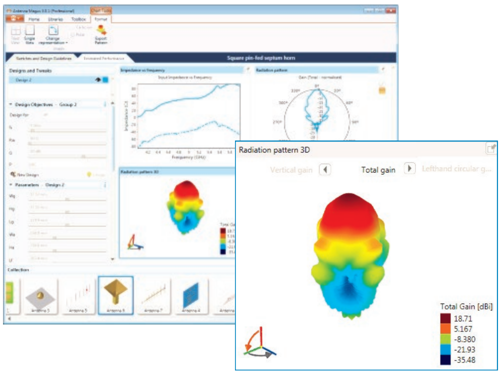


2.Shorted shunt stub transition S11.

AntennaMagus
Explore.Design.Deliver.

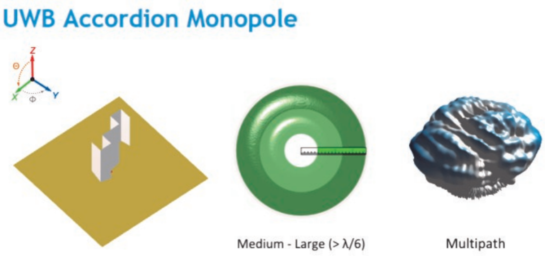
3D radiation pattern added to Estimated Performance

When running a performance estimation on any antenna, Antenna Magus 3 now also calculates and displays the full 3D radiation pattern of a design as shown in the screen capture of the estimated performance of the Septum horn. The pattern can be rotated interactively and exported as a *.ffe (FEKO far-field format), *.ffs (CST MICROWAVE STUDIO far-field format) or *.tsv (general tab-seperated values) files. These can then be imported and used outside of Antenna Magus, or applied as far field sources in FEKO and CST MICROWAVE STUDIO.

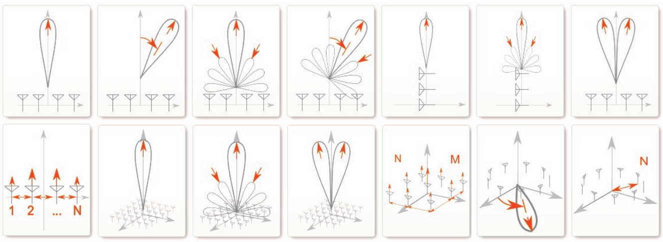


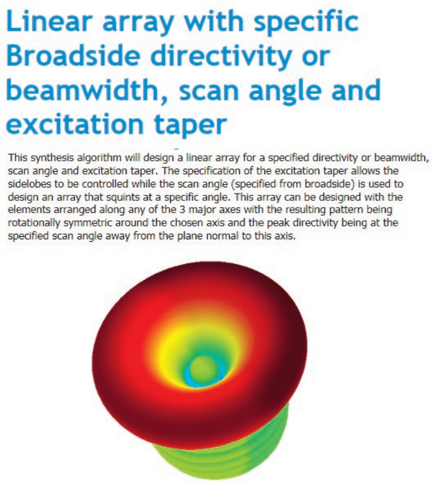
Changes to the info documents

With the increase in the number of antennas in the antenna magus database, it has become more important to be able to quickly find a selection of antennas which are feasible solutions for a design. To speed up this process, a row of three images has been placed at the top of each information document in the info browser (shown to the right). The first image is the thumbnail of the antenna, showing geometric complexity. The second is an indicator of electrical size. For many antennas, the electrical size depends on the design objectives, and a typical range is shown. This information can be used to very quickly determine whether or not an antenna will fit into the space requirements of the design. The last image is an indication of the expected radiation pattern. The indicator shows typical attributes, such as general shape of the pattern, planes of symmetry and changes in pattern over frequency.



User interface reworked





For the release of Antenna Magus 3.0, several smaller improvements were made to the user interface. Most notably, the array synthesis tool was modified by adding thumbnail-cards as shown in the above image. This helps the user to easily select the right array layout. Specific information as shown in the next image was added to aid the setup of an array layout. These improvements will help users to design and synthesise arrays more efficiently.

More exciting antennas planned for future releases!

AntennaMagus
Explore.Design.Deliver.