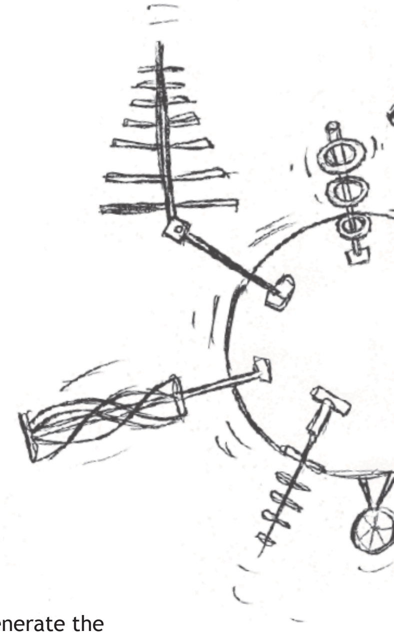


Newsletter 1.5

December 2009

Introduction

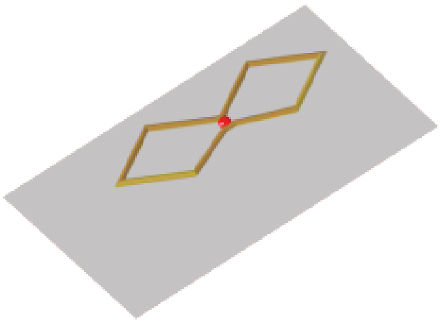
Version 1.5 is a landmark release – there are now over 100 Antennas in the database! 100 is a very large number, and with each antenna added, Antenna Magus comes closer to being the only resource needed for antenna design.

In other development news: We received some reports of users struggling with the installation process. It seems that there were issues on some systems with the permissions used to generate the Antenna Magus log file and license file (these used to be located in "Program files"). The installer has been overhauled in Version 1.5. and most of the problems were isolated and resolved. If you still experience any difficulties, please let technical support know as soon as possible so that we can continue improving Antenna Magus.

Six new antennas in version 1.5

An exciting selection of six new antennas has been added in version 1.5. Each of these antennas are very useful and worth taking time to explore.

Bi-Quad



If you want to improve your Wi-Fi reception at home or need an antenna with 10 dBi gain and 20% (typical) bandwidth that is cheap and easy to build the *Bi-Quad* may be the antenna for you. This antenna consists of two equilateral quadrilateral (i.e. rhombic) loops fed in parallel, above a flat reflector. Its relatively simple geometry provides design flexibility to achieve good performance. The *Bi-Quad* is popular for wireless communication applications in the ISM (~2.4GHz) band, where it is used both as a sector antenna for access-points and as a feed for reflector antennas. Although the *Bi-Quad* is not inherently balanced, the ground plane means that it works quite well without a balun.

One of the challenges in adding the Bi-Quad to Antenna Magus was that we weren't able to find measured data in any references. The image below shows the antenna that was fabricated by Antenna Magus engineers, measured and used to verify that the models were built correctly.

For a step by step explanation how to build your own Bi-Quad for a Wi-Fi booster, please have a look at the blog entry, www.antennamagus.com/blog/?p=216

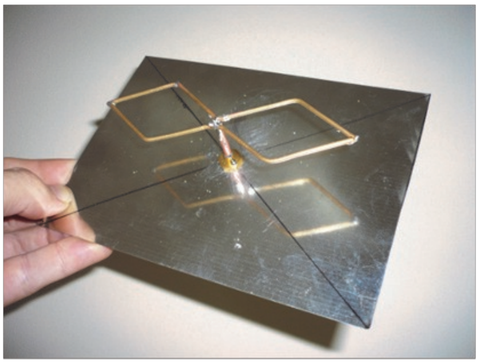


Photo of the Bi-Quad fabricated by the Antenna Magus engineers.

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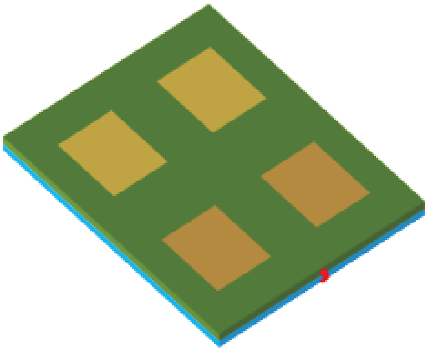
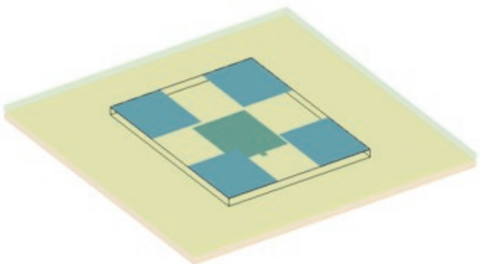
Stacked Microstrip patch array



This patch array does not use a traditional feed network, but provides a nice practical way to achieve the higher gain and bandwidth that is possible with patch arrays without the need for an often sensitive and hard-to-design feed.

The *2x2 stacked patch* is suitable for numerous microwave and millimeter wave applications such as tracking and search radars, altimeters, remote sensing, terrestrial and aerospace communication systems.

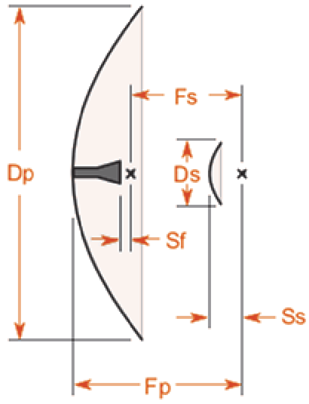
A general problem with patch arrays is spurious radiation caused by feed networks. There are different ways to reduce spurious radiation but generally these require feed mechanisms that are difficult to manufacture. An advantage of the *2x2 stacked patch* is that it uses a simple feed - a single feed line from below the ground plane excites the feed patch which in turn couples to the upper patch array. This results in minimal spurious radiation while maintaining a good bandwidth and gain.



Transparent view of the 2x2 stacked patch array model.

Horn-fed Cassegrain reflector antenna

The Horn-fed Cassegrain reflector antenna needs no introduction. Based on the dual-mirror construction used in optical telescopes, it has been around for a while (the idea was first published on April 25, 1672!). Cassegrain designs are utilized in many applications including satellite telecommunications, earth station antennas and radio telescopes. These antennas can be designed for very high gains (up to 50 dBi). One of the



Side view of the Horn-fed Cassegrain reflector antenna.

main advantages of the Cassegrain design is that the horn can be fed from behind the main reflector, removing the need for the (often bulky and heavy) feed structure and front-end electronics to be suspended or supported in front of the primary reflector.

Probe-fed Cheese Antenna

The *Probe-fed cheese antenna* is part of a family of antennas often called pillbox antennas. Pillboxes are sectoral reflector antennas that are often used in search-radar applications as they can produce narrow fan-beams and handle high power.

The *Probe-fed cheese* can be considered to be a sectoral part of a line-fed cylindrical reflector. These types of antennas were popular in WW2 radar systems (like the royal navy type 271 radar system and the stacked transmit/receive antenna from a 1941 radar shown below).

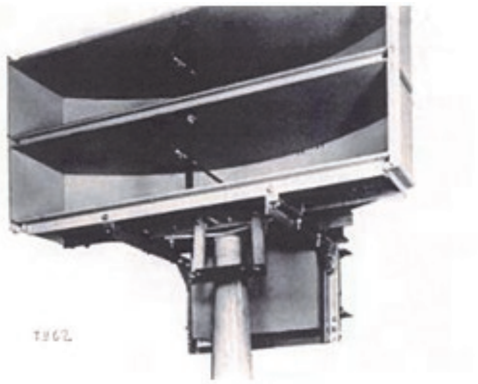


Photo of the Cheese antenna in a military application.

The *Cheese antenna* designed by Antenna Magus consists of a parabolic-cylinder reflector between two parallel plates. The reflector is excited by a probe with a single director element located in the middle of the radiating aperture. This realisation of the *Cheese antenna* is a robust structure that has moderate impedance bandwidth and can be designed for use in medium to high gain applications. The director element is attached to both the top and bottom of the aperture mouth providing additional mechanical support.

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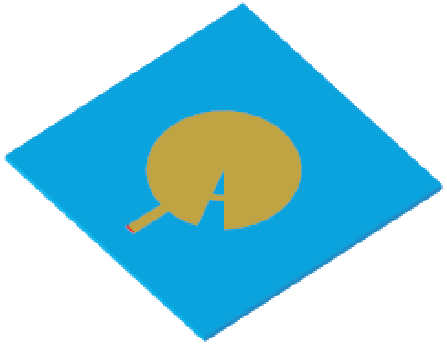
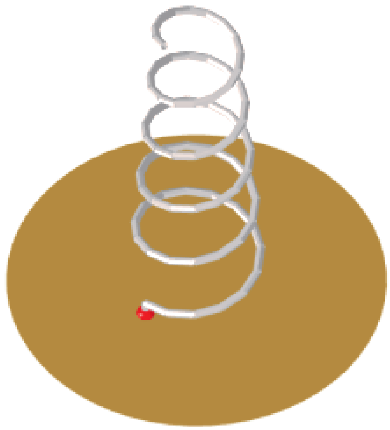
Circular edge-fed patch with sectoral slot





One very useful feature of the *Circular edge-fed patch with sectoral slot* (which has affectionately become known as the 'Pacman' antenna here at Antenna Magus) is that although it is fed with a microstrip line it requires no matching section. By adjusting the sector angle and size (shown in the image below) the real input impedance can be adjusted from 50 Ω to 200 Ω. This characteristic can be very useful in achieving the required input impedance on a given substrate (which may be impossible with an inset feed), specifically in array applications where the space saved by removing the matching sections from the feed network can be critical, though the effect on the polarisation purity of the radiation pattern must also be carefully considered.

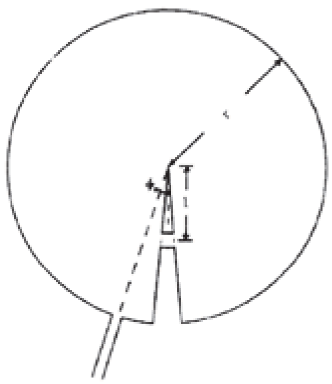
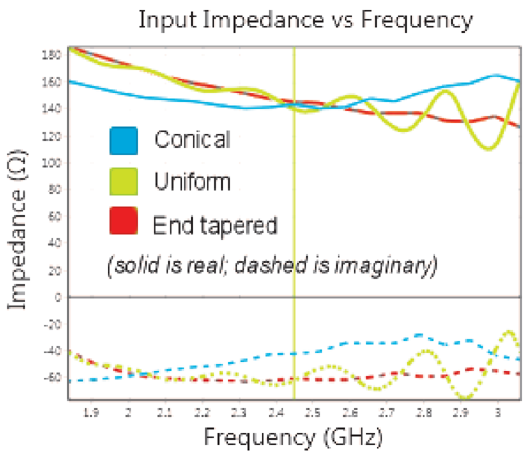


Diagram of the *Circular edge-fed patch with sectoral slot*.

Conical wire helix

The *Conical wire helix* can be compared with the *Uniform* and *End tapered helix* antennas that are already in Antenna Magus 1.4.0. The graph below compares the impedance calculations for all three of these antennas. It is clear that the conical helix is more constant over the whole frequency band. The linear variation of its diameter along the entire length of the helix results in an improved axial ratio especially when compared with the *Uniform end fire helix* at higher frequencies. The *Conical* provides a wider gain bandwidth and although it



Comparison of the input impedances of three different types of helix antennas.

is a bit harder to fabricate than a typical *Uniform helix*, it is definitely an option worth considering – especially now that Antenna Magus will do the design for you!

Closing remark.

One of the major features we have been working on for Version 2.0 is the addition of algorithms to speed up performance estimation. The addition of some of these algorithms makes such a big difference to using Antenna Magus, we decided to sneak the completed ones into Version 1.5. Nineteen of the antennas (predominantly planar and printed antennas) have already been reworked and sneaked into the current release. For some antennas the estimated performance is more than hundred times faster! We will continue releasing faster algorithms as they are implemented.

We are very proud of Antenna Magus 1.5 and hope that you enjoy it!

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