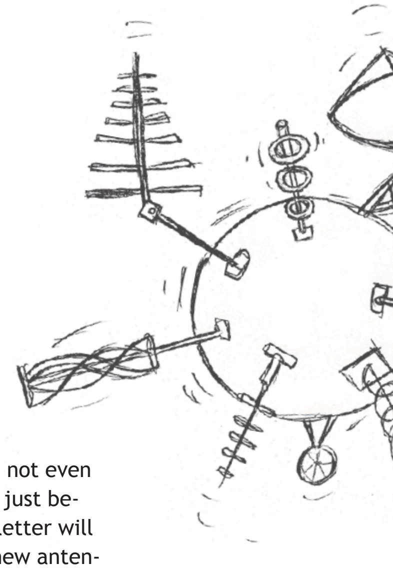
Newsletter 2.1

May 2010



Antenna Magus version 2.0 released!

One could easily wonder '…what is there left to write about in the first follow up newsletter after a major release like version 2.0?'. Well, the answer to that question is quite simple: LOTS OF OTHER FEATURES!

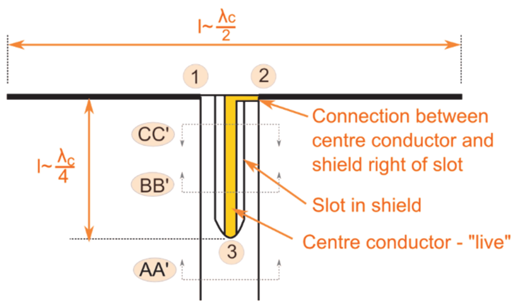
There are actually a whole lot of features that were released as part of version 2.0 that have not even been mentioned in previous newsletters, just because there wasn't space left. This newsletter will focus on these features as well as the 6 new antennas that are added in the version 2.1 release.

New article: Understanding antenna baluns

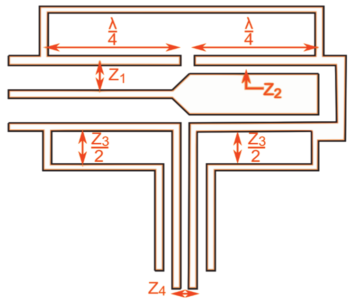
For those of you who haven't noticed, the Info Browser has a new article section where interesting antenna related articles as well as handy "how to use" Antenna Magus documents are posted. A very interesting article called, "Understanding antenna baluns" (added as part of the Antenna Magus 2.0 release) is definitely worth reading when considering an unbalanced antenna.

Not all unbalanced antennas require baluns (like the Bi-Quad) but lots of antennas do need baluns to achieve the required performance - and it's not always apparent which balun to use.

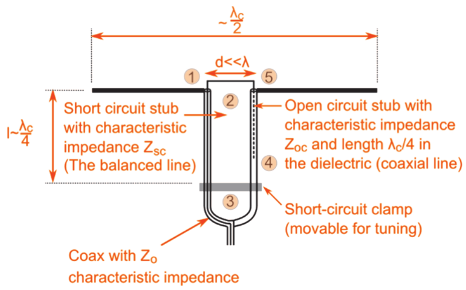
The article explains the operation and design of different types of baluns. Detailed sketches, equivalent circuits diagrams, typical antenna applications and quality references for eight different baluns are provided. Another useful feature addition since version 2.0 is an added field in the summary table of each antenna stipulating whether it needs a balun and what type of balun is typically used. Here are a few sketches of some of the baluns discussed in the article:



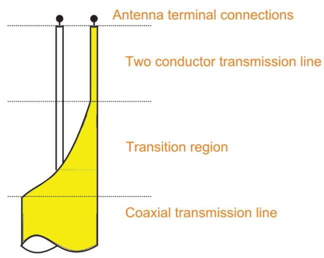
Physical structure of a split-coax balun.



Coaxial realisation of a Marchant Balun.



Physical structure of the Robert's balun.



Physical structure of the tapered coaxial balun.

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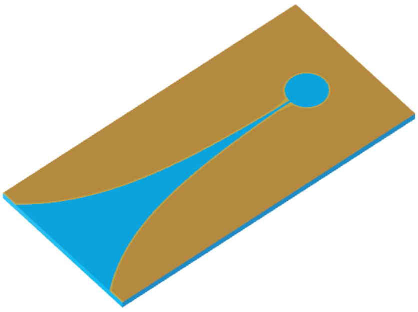
New antennas in Version 2.1

There are 6 new antenna additions to the database since the release of Antenna Magus version 2.0.

Microstrip-fed Vivaldi slot



When one compares the new *Microstrip-fed Vivaldi* with the staple feed *Vivaldi* which was included in Version 1.3, it has some notable practical advantages.

Tapered-slot antennas are often etched with other components onto the same dielectric substrate. *The Microstrip-fed Vivaldi* has the advantage that it can easily be integrated in the circuit.

The microstrip to slotline transition is realised by etching the slotline on one side of a substrate. On the opposite side of the substrate , a microstrip line crosses below and perpendicular to the slotline (as shown in the next image). After crossing below the slotline, the microstrip line is flared to form a radial stub which acts as a wideband, virtual short circuit. Antenna Magus has taken care of this non-trivial design process and includes the designed feed section detail in the antenna model as shown in the image below.

This endfire antenna can be designed for a 3:1 performance bandwidth and up to 17 dBi gain.

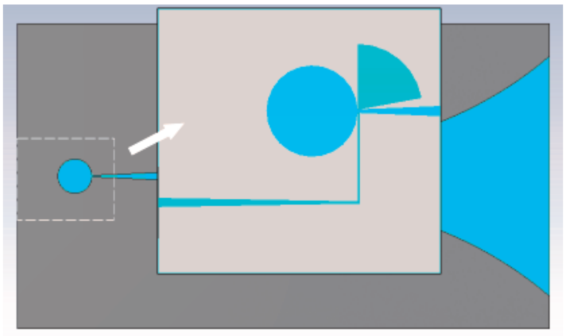
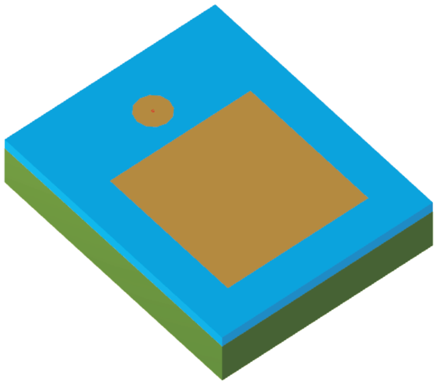


Figure: *The Microstrip-fed Vivaldi slot* with transparent enlarged view showing the feed section detail.

Rectangular Capacitive-disc-fed Patch



The *Rectangular Capacitive-disc-fed patch* is a variant of the standard R*ectangular pin-fed patch* with a unique feed structure (shown in the Antenna Magus design sketches below) allowing much thicker substrates to be used without introducing excessive inductance due to the feed-pin length. This makes much broader operational bandwidths achievable when compared to bandwidths that can be achieved with traditional microstrip patch structures.

The Antenna Magus design gives the user freedom to design for frequency only or to specify one or both substrates as well.

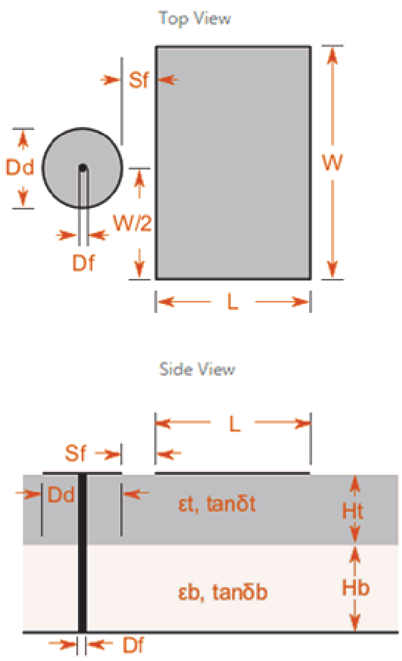
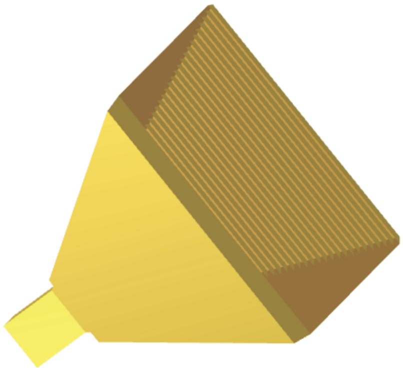


Figure: Top and side view sketches with design parameters of the *Rectangular Capacitive-disc-fed Patch*.

Waveguide-fed Pyramidal Corrugated Horn



The *Corrugated pyramidal horn* is a variation of the standard *Pyramidal horn*. The addition of corrugations to the standard pyramidal horn improves the back and sidelobe level performance. Higher back- and sidelobe levels result from energy diffracted by the edges perpendicular to the E-plane. Corrugations in the E-plane edges of the corrugated horn control the illumination of the diffracting edges, suppressing unwanted back- and sidelobes.

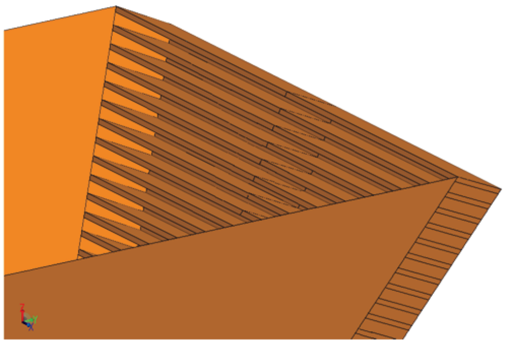
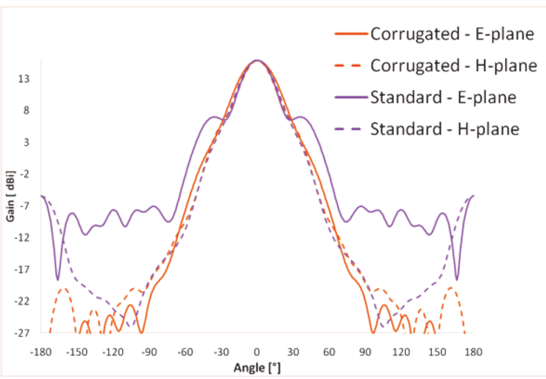
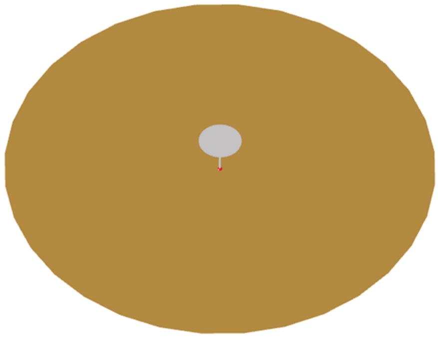


Figure: Close-up of the *Corrugated pyramidal horn* simulation model.



Comparison between the back and sidelobe levels of the *Standard pyramidal* vs the *Corrugated Pyramidal Waveguide-fed horn*. Designed at 10 GHz for 16 dBi Gain. Graph data was directly exported from Antenna Magus.

Top-loaded monopole antenna



The monopole is one of the most widely used antennas. In its simplest form, it consists of a quarter-wavelength wire driven with respect to a ground plane by a coaxial feed line. By adding a top loading, the height of the monopole can be reduced to less than an eighth of a wavelength at the operating frequency (about half the height of a standard monopole antenna).

Electrically short antennas have been in use since the 1920's for long range radio communication at > 1km wavelengths. For this reason electrically small antennas were used to reduce their height to practical dimensions. Efficient electrically small antennas have very high Q's and therefore narrow impedance bandwidths (bandwidth = 1/Q).

End or top-loading of an electrically short antenna lowers its Q and thus increases the bandwidth. This is illustrated in the next |S11| graph image comparing the *Top loaded monopole* with a *Normal mode helix*. Both designs are at 1GHz and 15 Ohms. Although both these antennas are electrically small (with similar in physical dimensions) the *Top loaded monopole* has a much wider bandwidth and 4.7 dBi gain compared to 1.8 dBi of the helix.

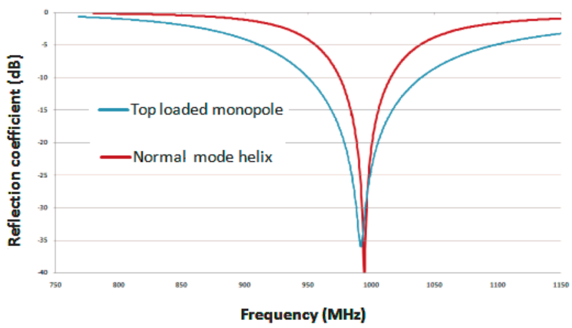


Figure: Comparison between the Q's of the *Top loaded monopole* and the *Normal mode helix*.

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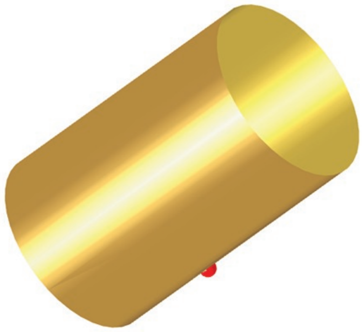
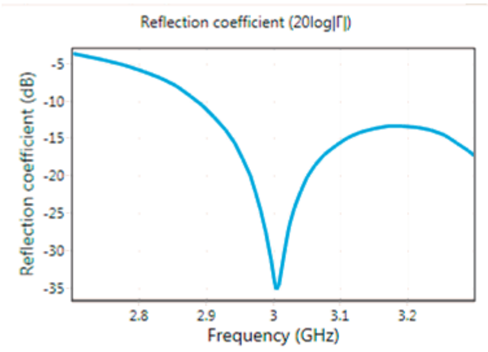
Pin-fed Circular Waveguide Antenna ("Cantenna")

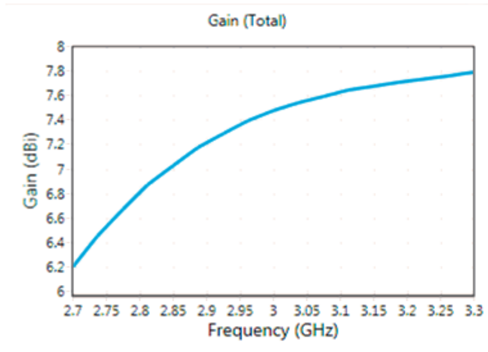


The *Circular waveguide antenna* (often called "*Cantenna*") is a simple microwave antenna. It is used in applications demanding a robust, low-cost uni-directional microwave antenna, such as wireless networking (both stand-alone and as a reflector feed) and consumer-grade RADAR applications. Although the axial symmetry makes it capable of handling any polarisation of the exciting fundamental (TE11) mode, the pin-feed design provided by Antenna Magus is for linear polarisation only.

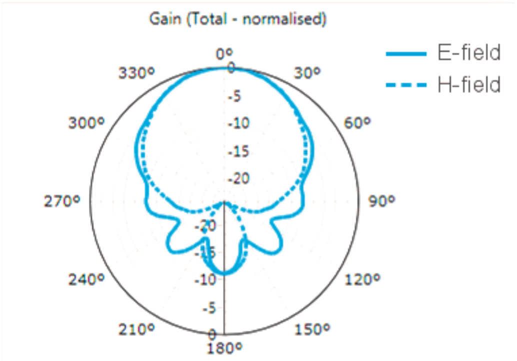
The *Circular waveguide antenna* can be seen as the simplest member of the conical horn antenna class, representing a conical horn with no flare. It has moderate performance capabilities: performance bandwidth of up to 20% and maximum gain of 8 dBi. The following graphs are taken from an Antenna Magus performance estimation for a 50 Ohm design at 3 GHz.



Typical |S11| of the *Cantenna*.



Gain vs frequency of the *Cantenna*.



Normalised 2D E- and H-field pattern cuts of the *Cantenna*.

Yagi-Uda Dipole Array with Folded Dipole

The conventional *Yagi-Uda array*, using a dipole as driven element typically has low input impedance and narrow bandwidth. By replacing the dipole feed with a folded dipole, the input impedance can be increased to match common cable impedances.

Antenna Magus allows the user to design the *Yagi-Uda Dipole Array with Folded Dipole* for different parameter objectives like gain, beamwidth and frequency and number of elements. There is a trade-off between the performance characteristics when optimising for increased bandwidth which reduces the obtainable gain. For optimum designs, the director spacing and lengths are not uniform. Optimum structures are generally achieved based on optimisation of a first-order design.

The following image shows a design comparison at 600 MHz. Antenna Magus provided an optimum gain design (blue trace) which was optimised by shortening some of the directors and the folded dipole length. This achieved a wider impedance match while trading off some gain performance.

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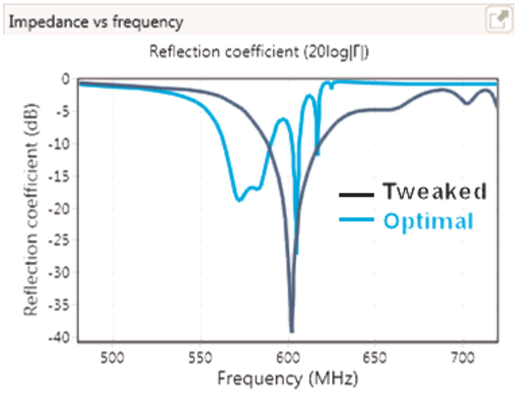
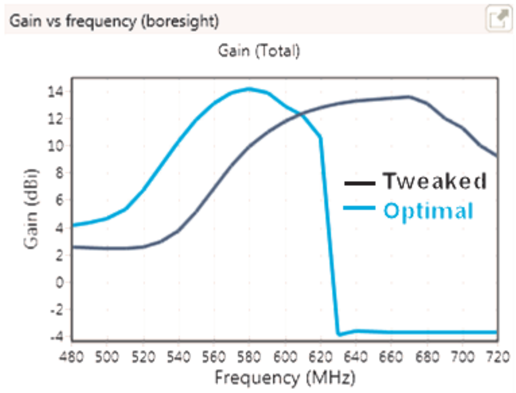


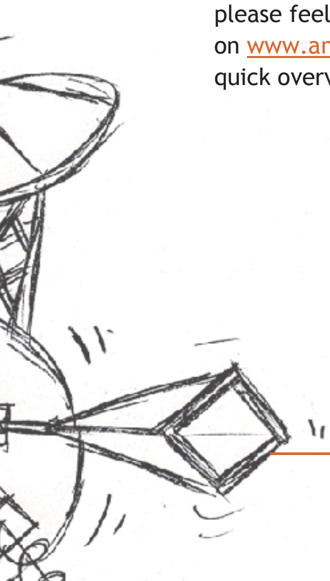


***Yagi Uda with folded dipole antenna*. Comparison of an optimal gain design vs a design that was tweaked in order to increase the bandwidth.**

Closing comment

We would like to encourage anyone in an academic environment to make use of the free Classroom option. New technology was implemented to support environments with strict IT policies where licenses cannot be node-locked.

In closing I would like to thank everyone for sending us feedback suggestions on version 2.0. The response so far has been overwhelmingly positive. I would like to encourage everyone to send any antenna or feature related requests to info@antennamagus.com or contact your reseller. Such feedback is very valuable and taken into account in future product development. Lastly, please feel free to check out the antennas page on www.antennamagus.com/antennas.php for a quick overview on each antenna in the database.



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