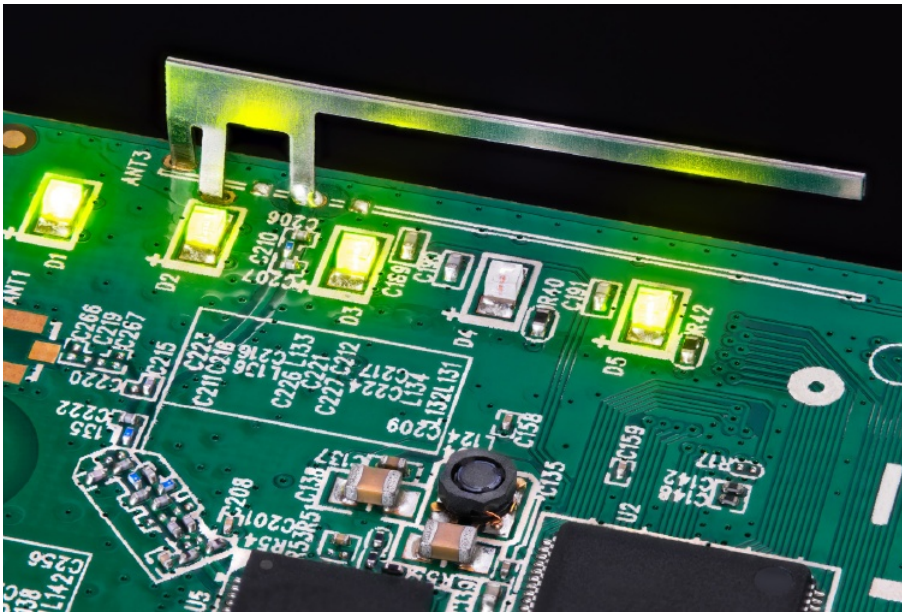
Working with a distributor helps cut through the noise

The antenna market has undergone major changes in recent years. With the proliferation of wireless devices and the IoT (internet of things), there is a growing need for antennas that can support these new technologies. Antenna efficiency, application and usage needs have become more complex as a result, posing considerable performance challenges to product designers and manufacturers. ***Technical Director & antenna expert at value added electronics distributor, Solid State Supplies, Richard Bethell*** *examines the challenges that have arisen from modern antenna applications – and how working with a knowledgeable distributor can help design engineers overcome them...*

The basic fundamentals of antennas themselves have not changed. Antennas, like all things electrical, are based around the laws of physics. What have shifted, however, are customer requirements. It used to be that 'gain' was the key word in the antenna market, as these antennas were mainly located on the outside of the product and they had to communicate over long distances. Now, gain is no longer the main focus; optimal efficiency is, as the wireless networks have become so highly populated that in many applications, long range communication isn't always required.



Aesthetics, in terms of product shape, size, and keeping design costs down, play a huge part too, especially in the consumer market — these days, no one wants an antenna sticking out from their mobile phone as we had years ago. There are applications where the required aesthetics can still be achieved, although this may result in having to compromise on certain other factors. That's why it's important to get the right expert advice from the start, so compromise can be kept to a minimum and expensive design changes can be avoided.

Where size and design are less of a problem, such as with 4G masts, large, external antennas can be used for maximum transmission and performance. In these kinds of applications, it's all about what works best, with greater emphasis on performance, rather than the look and feel of the product.

In some cases, having an antenna with performance in terms of range can be detrimental, such as home Wi-Fi, where you don't want to transmit radiated emissions to external parties. There are other applications where a limited range may be advantageous, such as Bluetooth Low Energy in earbuds and headsets, where lower transmit levels extend the operational battery life of the products, which is key in these applications. They also have the advantage of operating at 2.4GHz, where the antennas are physically much smaller.

Antenna efficiency, application and usage needs have all become more complex, posing considerable performance challenges to product designers and manufacturers.

The general trend in recent years is for antennas to be embedded inside a device, making it more pleasing to the eye, and mitigating risks such as damage of the antenna connector, or of someone replacing the antenna with an inferior one (or one that takes product performance outside of the product's certification). The downside is that the embedded designer needs to take many factors into account with regards to the positioning of the antenna, to ensure it isn't de-tuned by close metal objects, such as batteries, capacitors, relays, near field devices and the enclosure itself. Advice can be given, and tests can be done, to ensure it doesn't affect the antenna's performance.

The good news is that, while a compact, embedded antenna may never perform to its maximum potential, there are things which can be done to make sure an antenna is more suited to the application and gives better performance. It's also worth mentioning that in some cases, the PCB (printed circuit board) size will need to be increased to enable the antenna to meet its optimal efficiency in the design.

As someone who advises customers on antenna selection and application, my ideal scenario is to be involved in a project from the early stages, to get a clear understanding of what's required. What type of antenna you use for your product and where it will be located within the device should never be an afterthought — these need to be key and early considerations.

Although you can theoretically put an antenna anywhere within a product, and it will work to some limited degree, optimal performance needs careful consideration of design, positioning and choice of material. Fixing these problems after the design has been finalised can be a very costly business, which is easily avoided if the project is planned properly from the start.

Another way in which design engineers can benefit from working with a trusted distributor is gaining peace of mind that their finished product will pass the certification testing.

Where we've been able to have the most positive impact on a project, in terms of achieving optimum efficiency, is when we've been brought on board early. We've even been able to advise on housing options in some projects, which can make all the difference to antenna performance, as the antenna is critical within any RF (radio frequency) design. As a value added distributor, we have extensive knowledge of, and access to, all types of antennas from a wide range of suppliers. Knowing which one would be best for which application is invaluable to the success of a project.

Another way in which design engineers can benefit from working with a trusted distributor is gaining peace of mind that their finished product will pass the certification testing. Some manufacturers self-test, which is perfectly legal in Europe, and is fine when the manufacturer has the necessary equipment in-house, or uses an external test house. Those that don't, however, run the risk of their product failing at certification stage – which can be time-consuming and costly when it comes to fixing issues and re-testing.

We work with suppliers who will run pre-compliance approval tests on behalf of customers, so the customer knows their product is certification-ready. It's also important to remember that just because an RF module is CE certified, this doesn't mean that the end product it goes into will make the grade. This can be quite challenging when products need to meet the certification for various regions around the globe. In addition to this, for cellular designs, there are some critical areas that need attention to meet the test criteria. These include checking the 50 Ohm microstrip match of the antenna to the module, making sure the power supply has enough capacity and decoupling to reduce noise and support the transmitter, and checking the protection to the SIM card to ensure it can't be disrupted.

Another trend which has taken place over recent years is the reduced use of expensive RF cabling to connect from the antenna to a 4G router. In these applications, thick low loss cables are required; these can be both difficult to route and expensive, and can introduce a great deal of attenuation. For these reasons, we offer a different approach – pole mounted 4G & 5G routers and gateways with integrated directional or

omni-directional antennas, making for a more efficient solution that's easy to install.

For example, people who live in remote areas and struggle with poor broadband coverage, would historically connect to the internet via a cellular router. In most cases, the router would be located in the building, and a long run of expensive low loss coax would be taken from the router around the building and onto a pole located on a wall bracket on the roof. This was quite unsightly, presented a high loss to the signal and would be difficult to install. But now, a roof-located 4G or 5G router can be used – a router that's POE (power over Ethernet) powered and connected by an Ethernet cable. Another advantage of Ethernet is that it's easy to install and can be run over a long distance with little signal degradation. This solution offers great RF and end-to-end system performance.

The emergence of 5G has thrown up a major new challenge for antennas. As these antennas have to work over such a wide frequency range, it's quite a challenge to keep the VSWR (voltage standing wave ratio) as low as you'd like to. In many cases, the RF modules are presented with quite a large mismatch from the antenna, but very little can be done.

Due to the demand for aesthetically-pleasing, compact devices with embedded antennas, far from seeing improvements in antenna technology, if anything, recent years have resulted in a backward step. Although these demands won't go away, it's important to remember that the better the antenna performs, the longer the battery will last. Battery power and longevity are also key factors in contemporary designs, with companies citing battery power as a main selling point. As a well-matched antenna which is the best choice for purpose won't have to transmit so hard, this results in saving power consumption within the device.

On the other hand, the detuning of the antenna due to poor enclosure material choice will result in the transmitter operating at a higher power level, and the battery losing capacity quicker.

There's an ecological impact from a poor-performing antenna. A resultant higher battery drainage will mean more frequent charging or cell replacement. With an optimised antenna design, there are implied maintenance savings due to enhanced battery performance which will result in less time recharging or replacing batteries in the field, where a battery needs to last greater than 5 years. Premature battery changes mean additional cost, impacting both profits and the environment.

When choosing which antenna to use for your project, the need for communication range, performance, size and cost all need to be taken into consideration. In some applications, performance cannot be compromised, such as in vehicles, robots and drones. In others, aesthetics may take priority. Whatever the project, there's such a diverse range of possibilities when it comes to antennas that it's important to know which one will provide you with your desired outcome. Guidance here is imperative. Get your antenna choices right first time and you will save yourself time, money and pain in the long run.

Partnering with a knowledgeable distributor will give you the best possible chance of getting your design optimised.