

Make the right choice early in the design cycle.

Welcome to Brainstorm!

The antenna is a key component in an RF system and can have a major impact on performance.

What are the most desirable antenna characteristics when used in a MIMO technology-based wireless device?



By Monty Rohde, Product Management Director, Laird Technologies, Inc.

Antenna design for any wireless device is critical to the overall range and data throughput of that device, yet is often times under-emphasized or done at the very end of a project as opposed to being treated as an integral part of the design. That said, in order to leverage the latest wireless standards and improvements in radio technology, such as MIMO (Multiple Input-Multiple Output), it becomes even more necessary to put forth an excellent antenna product that will improve the QoS of any OEM's wireless device.

MIMO technology is often misunderstood as a "smart" antenna technology. No doubt, a MIMO radio system could certainly use smart antennas, i.e. beamforming adaptive arrays, etc., but the real intelligence in a MIMO device is the fact that the system uses multiple RADIOS and multiple antennas to create separate and independent signal paths into the wireless device. Once inside the device, the data streams are combined to significantly improve the data throughput. In effect, these are independent radio/antenna combinations that are all operating in parallel. Many of the antenna elements used in MIMO applications are the same as on a non-MIMO device — there are just more of them.

In order to ensure that the most desirable antenna characteristics are leveraged into a MIMO application, the design must have the best isolation between antennas as possible (lowest correlation coefficient). By designing the antenna system to have good decorrelation, the chances of picking up a signal that has been altered via multipath, scattering or fading issues, are greatly increased. There are several ways to decorrelate antennas: place them a certain wavelength multiple away from each other (spatial), place them orthogonal to each other (polarization), or place them orientated differently in order to ensure the radiation patterns overlap. Additionally, the radiation patterns should be as omnidirectional as possible in order

Make the right choice early in the design cycle.

Published on Wireless Design & Development (<http://www.wirelessdesignmag.com>)

for best coverage.

It is important that designers understand these key antenna embodiments because designing them incorrectly can actually degrade the system worse than single-antenna, non-MIMO devices!



By Joe Gifford, Vice President, SkyCross, Inc.

Next generation protocols such as 802.11n, WiMAX, and LTE require multiple antennas at both the receiver and transmitter locations to support MIMO. Desirable MIMO antenna systems exhibit the following characteristics:

Low correlation coefficient: The correlation coefficient is a measure of the independence of the signals being broadcast and depends in part on differences in the radiation patterns for different antennas. Antennas with very different radiation patterns cover new spatial regions to achieve pattern diversity and signal independence. If the radiation patterns are exactly the same, the correlation is assumed to be 1. If they are completely different, the correlation is 0. Correlation coefficients closest to 0 are preferred in obtaining the greatest effectiveness of the MIMO system over the entire cell area.

High isolation/low coupling: Coupling is a term describing how one antenna affects another antenna in close proximity. Closely coupled antennas exhibit low isolation from one another and begin to exhibit unwanted power transfer to each other and to the circuitry connected to each. High isolation and low coupling are therefore desirable characteristics from the standpoint of radiated power efficiency.

High efficiency: Radiation efficiency is a measure of how much of the electrical power supplied to an antenna element is converted to electromagnetic power. A 100% efficient antenna would theoretically convert all input power into radiated power, with no loss to resistive or dielectric elements. Highly efficient antennas exhibit low power consumption for longer battery life, greater signal strength in fringe areas, fewer dropped calls, and fast data transfer.

Small size: Available space is at the root of antenna design challenges for MIMO systems. Designers must not only find room in crowded devices to place extra antennas, but also find the right space that will enable optimal performance.

SkyCross addresses MIMO antenna challenges using its patented iMAT® design techniques. iMAT enables a single antenna element to behave like multiple optimized antennas. This solution offers high performance, low cost, small size, and simple integration.

Make the right choice early in the design cycle.

Published on Wireless Design & Development (<http://www.wirelessdesignmag.com>)

What tools and techniques are available today that help designers to find the optimal power solution very early in the design process?

By Vandana Lokeshwar, Technical Marketing Manager, Newark

Environmentally driven design guidelines covering aspects such as power efficiency and standby consumption are coming into force in US, European and Asian markets, and have a major impact on power design in new products. Whether for a mains-powered or battery-operated device, the design of the power conversion architecture holds the key to satisfying these requirements, as well as rules on aspects such as EMC and harmonic distortion.

Determining the optimal power solution early in the design process is vital if the product is to meet all applicable standards and deliver the required performance and functionality, within tight constraints on cost and time to market.

To aid power supply design many vendors of power supply components (e.g. voltage regulators), and complete power supplies provide interactive tools such as online device-selector guides. Such tools allow the engineers to enter key design criteria, such as power rating, input and output voltages, based on which a recommended list of suitable components is generated. Other requirements such as efficiency or transient performance can then be evaluated, to make a final decision. Mechanical aspects such as maximum dimensions must also be considered, to ensure the chosen components or modules will not exceed the form factor of the end product.

More powerful web-based simulation tools provide a virtual workbench allowing designers to configure and evaluate various components and circuit topologies quickly, without committing to hardware. Working from the required design specification and data, a tool such as National Semiconductor's WEBENCH is able to select a suitable power topology and regulator components, help with circuit design, and simulate the behavior of the system. Thermal analysis capabilities also help predict reliability and guide heatsink selection. Manufacturers also regularly update such tools to include their latest products.

Make the right choice early in the design cycle.

To meet the challenge of increased power consumption in today's complex and integrated designs, a variety of techniques are available to be used in combination.

By Doug Bailey, VP Marketing, Power Integrations, Inc.

The common theme running through all wireless applications is power efficiency. Government regulations on the no-load power and operating efficiency of portable battery-operated equipment chargers are increasingly tough to meet. At the other end of the scale, base stations must be efficient to minimize running costs and avoid unnecessary heat dissipation which can result in larger equipment with unreliable electromechanical elements (e.g., fans).

Make the right choice early in the design cycle.

Published on Wireless Design & Development (<http://www.wirelessdesignmag.com>)

High-efficiency power supply design is a subtle art with a high premium on practical design experience and requiring time-consuming experimentation. The obvious option is to choose a standard, easily-available power supply from an external vendor, and this approach is favored in many instances. However, an off-the-shelf unit will usually involve some kind of compromise; available power, configuration of outputs, size, and shape; as well as costing considerably more than a simple power circuit BOM and assembly.

The solution is an easy-to-use tool, PI Expert? from Power Integrations. More than a simple calculation engine, the software incorporates real-world, practical, electrical design, device selection, and magnetic component optimization experience. It enables engineers skilled in analog and digital design; but perhaps less experienced with power supply development; to create a custom power supply design with a high probability of success.

The software consists of three components:

PI Expert: An interactive program that takes a user's power supply specifications and automatically determines the critical components (including transformer specifications) needed to generate a working switch-mode power supply. Optimization choices for cost or efficiency are included to deliver designs that meet specific needs. The program reduces design time from days to minutes.

PI Xls Designer: A simplified spreadsheet approach to power supply design for advanced users and those who prefer a spreadsheet interface.

PI Viewer: A method for viewing design files created with older versions of PI Expert.

PI Expert Suite is available now for free download at www.powerint.com/pi-expert, with fully supported English and Simplified Chinese versions, as well as a video tutorial to help simplify the process.

More powerful web-based simulation tools provide a virtual workbench allowing designers to configure and evaluate various components and circuit topologies quickly, without committing to hardware. Working from the required design specification and data, a tool such as National Semiconductor's WEBENCH is able to select a suitable power topology and regulator components, help with circuit design, and simulate the behavior of the system. Thermal analysis capabilities also help predict reliability and guide heatsink selection. Manufacturers also regularly update such tools to include their latest products. Environmentally driven design guidelines covering aspects such as power efficiency and standby consumption are coming into force in US, European and Asian markets, and have a major impact on power design in new products. Whether for a mains-powered or battery-operated device, the design of the power conversion architecture holds the key to satisfying these requirements, as well as rules on aspects such as EMC and harmonic distortion. Determining the optimal power solution early in the design process is vital if the product is to meet all applicable standards and deliver the required performance and functionality, within tight constraints on cost and time to

Make the right choice early in the design cycle.

Published on Wireless Design & Development (<http://www.wirelessdesignmag.com>)

market. To aid power supply design many vendors of power supply components (e.g. voltage regulators), and complete power supplies provide interactive tools such as online device-selector guides. Such tools allow the engineers to enter key design criteria, such as power rating, input and output voltages, based on which a recommended list of suitable components is generated. Other requirements such as efficiency or transient performance can then be evaluated, to make a final decision. Mechanical aspects such as maximum dimensions must also be considered, to ensure the chosen components or modules will not exceed the form factor of the end product. More powerful web-based simulation tools provide a virtual workbench allowing designers to configure and evaluate various components and circuit topologies quickly, without committing to hardware. Working from the required design specification and data, a tool such as National Semiconductor's WEBENCH is able to select a suitable power topology and regulator components, help with circuit design, and simulate the behavior of the system. Thermal analysis capabilities also help predict reliability and guide heatsink selection. Manufacturers also regularly update such tools to include their latest products. By Eberhard Waffenschmidt, Senior Scientist, Philips Research

Power efficiency is a crucial aspect of wireless power transmission. With diminishing resources and the threatening climate change in mind we cannot longer afford to waste energy, especially for general purpose applications.

Comparing efficiency to a simple cable connection, wireless power will always lose. But compared to a power supply, the result may look different. An additional aspect of saving resources and standby power arises, if one wireless power system replaces several individual supplies. Concluding, comparing a wire with wireless power would be comparing apples with pears.

In an inductive system the magnetic field itself is not lossy. The only losses appear due to the current in the transmitter (Tx) coil, which generates the magnetic field, and in the receiver (Rx) coil, in which a voltage is induced. These losses must be compared to the losses of a transformer in a conventional power supply. Further losses appear in generator and receiver electronics, which are very similar to a switched mode power supply and can be optimized accordingly. Optimizing the losses in Rx and Tx coils however is something specific for an inductive power system.

The coil arrangement is characterized by the coupling factor k between Tx coil and Rx coil and the quality factor Q of the two coils. The losses are proportional to the product $Q.k$. This means, a bad coupling can be compensated by a better quality factor of the coils or bad coils require a good coupling to get low losses. Assuming a pretty good quality factor of $Q=1000$, the efficiency can be calculated for different arrangements by first calculating k . As a rule of thumb, a distance of more than the diameter of the coils leads to an unacceptable low efficiency of a few percent. Consider a small coil to charge a mobile phone and you'll realize that wireless charging in a space like W-LAN is utopistic. However, if the distance is less than about 1/10th of the coil diameter, efficiencies of more than 90% can be achieved. Thus, wireless proximity power at a surface can be an option, which may compete with conventional power supplies.

Make the right choice early in the design cycle.

Published on Wireless Design & Development (<http://www.wirelessdesignmag.com>)

Assuming a pretty good quality factor of $Q=1000$, the efficiency can be calculated for different arrangements by first calculating k . As a rule of thumb, a distance of more than the diameter of the coils leads to an unacceptable low efficiency of a few percent. Consider a small coil to charge a mobile phone and you'll realize that wireless charging in a space like W-LAN is utopistic. However, if the distance is less than about 1/10th of the coil diameter, efficiencies of more than 90% can be achieved. Thus, wireless promimity power at a surface can be an option, which may compete with conventional power supplies.

Source URL (retrieved on 01/28/2015 - 5:27pm):

http://www.wirelessdesignmag.com/articles/2009/10/make-right-choice-early-design-cycle?qt-most_popular=0