

Simplifying MIMO Antenna Installations With The FlexMIMO Antenna



Introduction

Before diving into the subject of simplifying MIMO antenna installations, let's first discuss what exactly a MIMO antenna is. A MIMO (multiple-input, multiple-output) antenna is basically two (or more) antennas located in a single physical structure. With the benefit of multiple antennas rather than just one, data throughput, range, and general performance are greatly enhanced. To put it simply, two antennas receive the same basic radio waves and then, from those, they help the attached radio system reconstruct the highest quality signal.

For most, if not all devices that require embedded MIMO antennas, both physical space and antenna placement are critical. Regarding space, there's only so much room within a device to fit multiple antennas. Also, antenna placement is challenging; if the antennas are not placed correctly, connectivity can be adversely affected.

Now, let's look specifically at Laird Connectivity's FlexMIMO antenna and the many ways it enables a much simpler installation process while also enhancing performance... basically, how it's different from other MIMO antennas.

With other MIMO antennas, you must install at least two separate antennas inside your device. The Laird Connectivity FlexMIMO is different in that it is a single unit with two integrated dual-band antennas specifically designed for 802.11 a/b/g/n as well as 802.11ac Wi-Fi modules that use MIMO or Wi-Fi diversity. Because the orientation and spacing between these two antennas is already optimized for ideal MIMO radio performance, the FlexMIMO drastically simplifies size, cost, and technical requirements.

As Jonathan Kaye, Senior Director of Product Management for Laird Connectivity, states it, "The FlexMIMO is designed with the ideal orientation and spacing between the two integrated antenna elements, so it's already optimized for 2x2 MIMO (two transmit/two receive antennas) radio performance, giving our customers the best possible range and throughput for their wireless applications, without having to worry about antenna isolation and orientation."



Installation of a MIMO Antenna

As stated earlier, antenna installation is a tricky thing. If the placement isn't exact, connectivity can be adversely affected. Antennas must be the correct distance apart (at least a 1/4 of a wavelength) which is especially complicated when you're trying to fit multiple antennas into a small space. Antennas also require the correct orientation for optimal performance. A 90-degree angle is typical for a 2x2 MIMO antenna array.

Correct placement and orientation allow each antenna to catch a different polarization and decrease spatial redundancy. If the antennas are too similar in location and position, there's no advantage because they'll both receive the same radio waves. Both will receive strong and/or weak signals at the same time. When each antenna is receiving differing radio waves (decreased redundancy), the chance of establishing a better resultant signal is increased.

If a 2x2 Antenna Array Isn't Enough - Use Case

To step this up one level, for more advanced or high bandwidth devices, some customers may

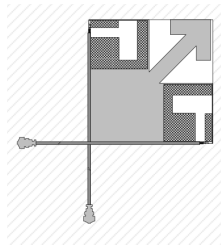


Figure 1: 2x2 antenna array

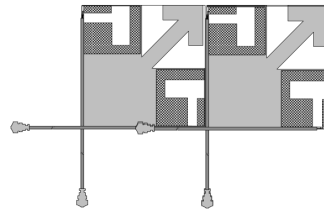


Figure 2: 4x4 antenna array at a 0-degree configuration

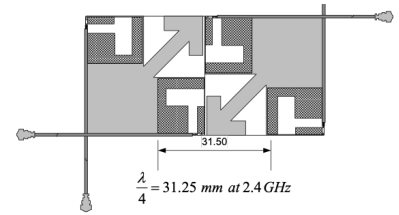


Figure 3: 4x4 antenna array at a 180-degree configuration

Note: Please refer to the Laird Connectivity 4x4 FlexMIMO Antenna Application Guide for a summary of our test results for both the 0-degree configuration and the 180-degree configuration. You can access this from the [FlexMIMO antenna product page](#) of the Laird Connectivity website.

need more than two antennas – a 4x4 MIMO (four transmit/four receive antennas), for example, rather than a 2x2 antenna array. Fitting four antennas into a single device is an even greater challenge than fitting the standard two. But, the alternative of placing them outside of the device leaves them vulnerable to installer damage and being knocked off while in use. This would obviously result in a costly disruption of service.

With the Laird Connectivity FlexMIMO antenna, not only does a customer not have to worry about external antennas, they only have to use two antenna arrays per device (resulting in four total antennas), which greatly reduces the overall footprint required to successfully implement MIMO. With two FlexMIMO antenna arrays strategically co-located in a single assembly, we've minimized the antenna pattern correlation in the

least amount of physical space, while still benefitting from the flexible form-factor and antenna efficiency.

Antenna pattern correlation, simply put, is the amount of similarities (or dissimilarities) between two antenna patterns. To gain the most advantage of a 2x2 or 4x4 antenna array, you must have a measure of dissimilar antenna patterns in antenna diversity systems to increase the probability that at least one of the antennas will have a solid signal strength at any given time. You can create these dissimilarities through separation and orientation of the antennas. The Laird Connectivity FlexMIMO antenna was developed to minimize the separation of the antenna elements and to provide antenna pattern dissimilarity in the smallest physical area possible through relative element orientation.



Success Story from a Major Grocery Store Chain

We recently worked with a major retailer who develops and designs much of their own technology for their stores. Their engineering team developed a unique combination Wi-Fi access point/security camera to mount on their store ceilings. The main goals for these cameras included identifying and automating out-of-stock items to decrease the amount of lost revenue and reducing store theft (the camera has a 360-degree view).

They had chosen a Wi-Fi module that listed Laird Connectivity as an approved antenna supplier. And this is how we entered the story with our FlexMIMO antenna's 4x4 array capabilities.

Their team was originally looking for a dual-band Wi-Fi external antenna (such as a rubber duck-type antenna). They had very aggressive gain specifications and we had a variety of multi-band antennas that could meet these requirements. After reviewing our samples, they expressed concern about the general durability of external antennas in environments such as theirs. Damage during installation was also a concern considering that each module would have four separate rubber duck antennas hanging down from the unit. Their powerful access point/security camera needed an antenna that would meet their rigorous requirements while also being extremely durable.

At this point, our team suggested an embedded antenna. If an embedded antenna could meet their requirements, it would be an ideal answer to their durability concerns. Our new Laird Connectivity FlexMIMO dual-band antenna piqued their interest and, after accommodating their request for a special cable length, we provided them with ten samples of the antenna.

Simply put... they were thrilled! This solution matched their aggressive requirements, answered their durability concerns, and performed well under their rigorous testing.

And, with this Laird Connectivity FlexMIMO antenna solution, they benefited from some unexpected perks:

- **High-level performance with a small footprint** – Rather than trying to fit and properly-position four antennas into a relatively small space, they only had to place two antennas.
- **Maintained product aesthetics** – Because of the small size and form factor, these antennas were easily concealable within the product's enclosure which maintained the sleek design and general aesthetics of their device.
- **Installation/mounting flexibility** – With the absence of external antennas, they had much more flexibility with and less worries about the installation of their devices.

With our FlexMIMO antenna, Laird Connectivity was able to provide this major retailer with the right MIMO embedded antenna solution for their unique situation.

Conclusion

MIMO antenna installation is a difficult and challenging undertaking. If antenna placement and orientation isn't exact, connectivity can be adversely affected. Laird Connectivity has simplified embedded MIMO antenna installations with the FlexMIMO, which is designed with the ideal orientation and spacing – providing the best possible range and throughput for wireless applications.



Learn more by visiting the [FlexMIMO antenna product page](#) in our website.

About Laird Connectivity:

As a long-established industry leader in wireless connectivity, Laird Connectivity offers a broad embedded antenna portfolio for Wi-Fi and Bluetooth applications. Available in various configurations designed to save space, increase performance, and offer mounting flexibility, Laird Connectivity's Wi-Fi and Bluetooth antennas are precisely designed to the unique requirements of embedded connectivity.

[Learn more at lairdconnect.com](http://lairdconnect.com)

