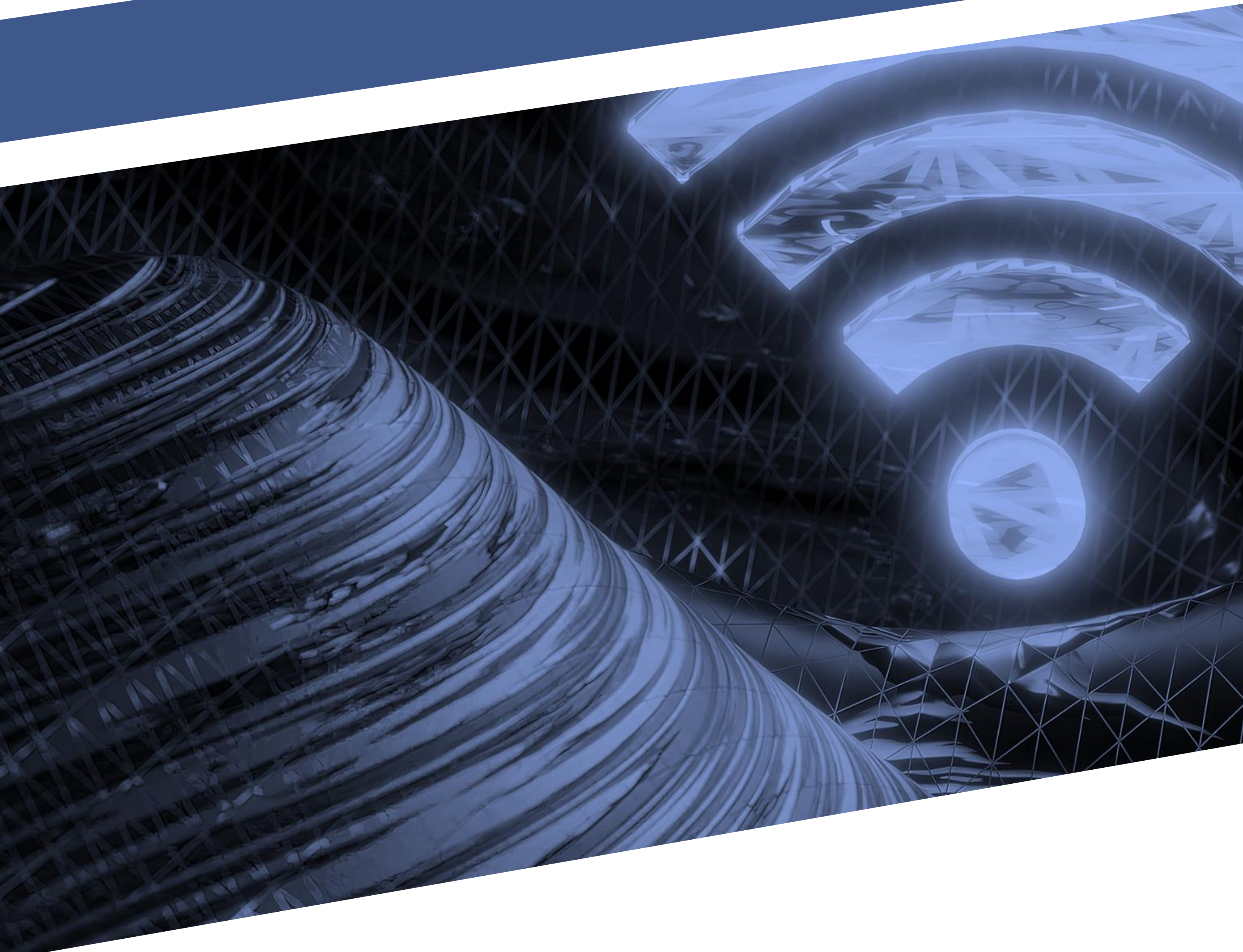
vantiva

THE VANTIVA ANTENNA LAB

DELIVERING OPTIMAL WI-FI EXPERIENCES THROUGH IN-HOUSE QUALITY TESTING AND DESIGN



The Critical Role of Advanced Antenna Design

Antenna design, positioning, and isolation are crucial to the overall performance of a Wi-Fi device — and the root of many challenges and constraints during the engineering process.

Wireless technology has become a mainstay of the modern home network. Consumer demands like reliable, high-speed bandwidth and the ability to support many devices simultaneously without congestion or lag, anywhere in the home, all drive Service Provider demands for high-quality Wi-Fi® products. With more features, capabilities, and applications coming to the market with the emergence of Wi-Fi 7, delivering products that can handle the workload seamlessly is more critical than ever.

Service Providers are always looking for ways to improve the end-user experience, cost-effectively — beginning with the careful design and engineering of products to maximize performance. This is a daunting task, requiring careful attention to how each aspect of the product interacts or interferes with another, especially regarding antennas.

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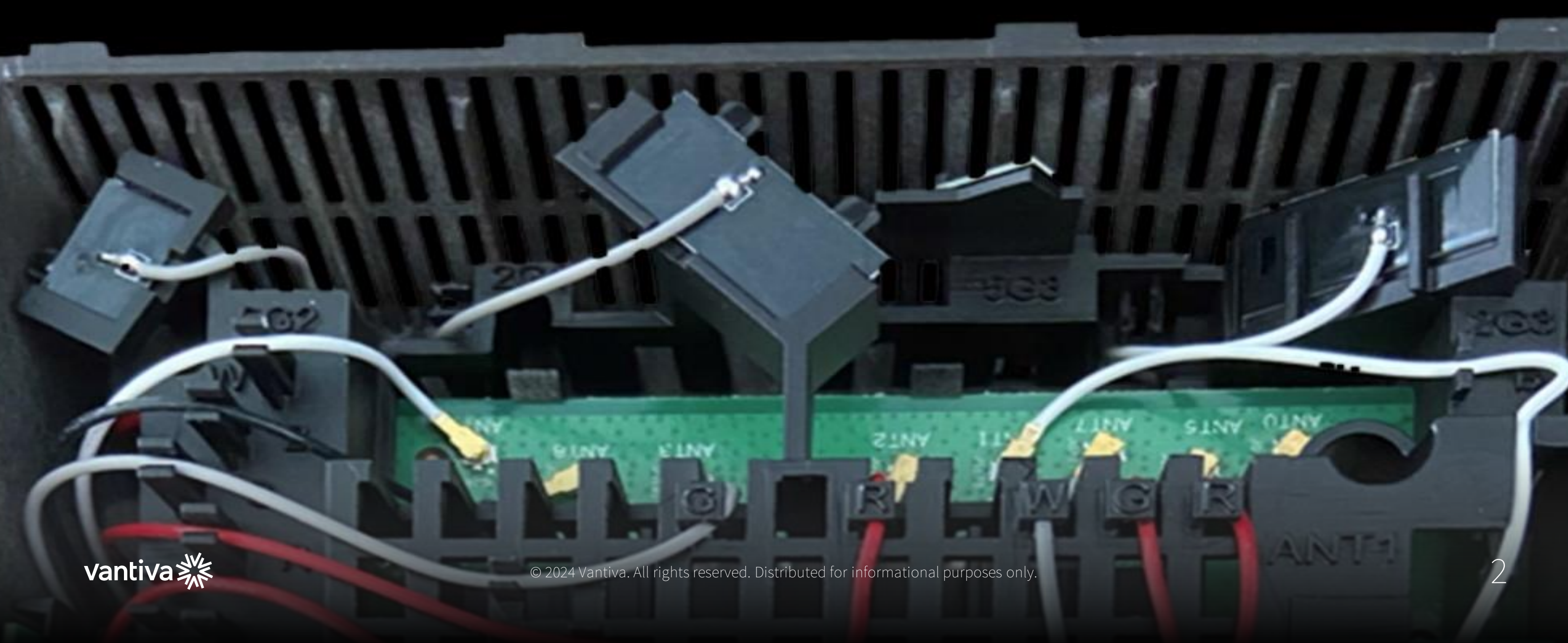


Challenges of the Engineering Process

Form factor

Fueled by sustainability efforts and modern design, **devices today are becoming increasingly compact**. Thermal control in these smaller devices can increase the size of heat sinks and spreaders, leaving even less room for antennas. Not only can the reduced space interfere with the installation and integration of multiple antennas and proper coexistence with radios, but it also creates challenges with managing antenna radiation diversity — affecting data transmission and, in turn, bandwidth and network reliability.

To reduce both the use of plastic and the carbon footprint of our FWA gateways, Falcon5G™ had to be no larger than 204mm x 89mm x 129mm while homing no less than 15 antennas.

Specs & cost

Careful considerations must be made when implementing antenna technologies based on intended application, required performance, and cost. **Our dedicated Lab helps off-set these costs while still providing a high-quality product**.

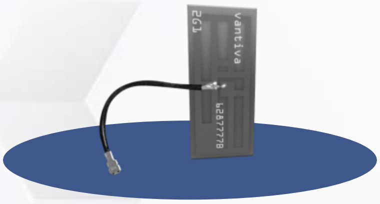
Designed as a starter GPON solution, Gazelle™ S2 achieved the perfect balance between antenna/FEM power and the overall affordable cost of the device.

Radiation, polarization & gain

To reach all areas of the home, quality antenna systems feature omnidirectional radiations and polarization diversity for optimal performance. Omnidirectional radiation ensures the antenna sends and receives signals uniformly in all directions, providing consistent coverage throughout the home. **To attain desired polarization and gain, the size, shape, and orientation of the antennas must be thoughtfully considered and optimized**.

To provide maximum throughput, Cobra5G™ is equipped with an 8- antenna surround system combining omnidirectional antennas and directional antennas.

Overcoming Engineering Challenges



Phase 01: Simulation

Using modern technology like computer-aided design (CAD) software or 3D electromagnetic simulation tools, **engineers can model the antenna geometry, physical properties, and operating conditions**. In a simulation environment, they can predict parameters including radiation pattern, gain, polarization characteristics, and impedance matching then explore various design options for best results.

Phase 02: Prototyping

Once a suitable design has been identified through simulation**, a prototype can be fabricated rapidly from materials and techniques consistent with the intended application**. The prototype should always align as closely as possible with the design specifications found during the simulation process.

Phase 03: Laboratory assessments

The finished prototype can now enter into lab testing to **assess previously mentioned parameters like radiation, polarization, gain, impedance as well as bandwidth and efficiency**. To collect measurements and information, labs use specialized equipment that may include an anechoic chamber, Wi-Fi shielded boxes, network analyzers, spectrum analyzers, and more — delivering valuable data on overall performance with insights into necessary modifications or adjustments.

Overcoming Engineering Challenges

Vantiva owns real homes all over the world dedicated to testing and comparing antenna performance of CPE, ensuring the company achieves wireless excellence in all its product ranges.

Phase 04: Field testing

Once the prototype meets acceptable parameters in lab testing**, it can be deployed into a real-world environment like a home or apartment.** Under these practical conditions, performance is evaluated by assessing factors that might include multipath interference, signal attenuation due to obstacles, and environmental effects. Engineers can measure signal strength, quality, and coverage in different locations within the target environmental parameters.

Phase 05: Data analysis

By analyzing data collected from lab and field testing, **engineers can evaluate the antenna's performance within desired specifications, identify discrepancies in measurements versus expectations, and make any adjustments necessary**. By refining antenna geometry, manipulating feed structures, or switching out materials, engineers can achieve optimal design and performance.

Phase 06: Validation & certification

After these stages are complete and the antenna system meets performance requirements, final validation and certification can begin. Rigorous final testing must be performed to achieve compliance with industry standards and regulations. There may also be additional certification required for specific applications or industries.

Vantiva's Dedicated Antenna Lab

Vantiva provides unique expertise in antenna design, testing, and cost alignment, drawing from our dedicated Antenna Lab, with multiple locations and testing sites across France, the USA, and China.

The innovative Lab works closely with component suppliers, chipset partners, and customers to conceptualize, design, and optimize antennas, covering a wide range of standard technologies including Wi-Fi, DECT, RF4CE, Bluetooth®, Zigbee, Z-Wave®, 4G/LTE, 5G, GPS, 433/868MHz radios, and NFC.

On-site anechoic chambers, 3D electromagnetic simulation tools, and multiple real-world testing sites allow our experts to analyze electrostatic discharge (ESD), electromagnetic interference (EMI), signal integrity, and radio coexistence issues. Understanding the significant impact of these elements on antenna performance underlines the importance of quality design and testing.

Let's take a closer look at the challenges engineers face during the design and testing stages ⟶

Challenges in Design & Testing Stages

Electrostatic discharge

Electrostatic discharge often occurs when static electricity builds up on an object or surface, creating a sudden flow of electricity between two charged objects by way of contact, electrical short, or dielectric breakdown. When an ESD event happens near an antenna system, performance and reliability can suffer in various ways, including damage to electronic components, degradation of signal quality through changes in the electrical properties of antenna elements which can affect impedance, radiation pattern, or frequency — reducing overall efficiency and performance. Severe ESD events can cause instability or even result in complete failure of the antenna system.

Challenges in Design & Testing Stages

Electromagnetic interference

Electromagnetic interference is just what it sounds like — interferences caused by undesired radiated signals that can disrupt normal functioning, degrade performance, or result in errors or failure. EMI can create increased noise levels, distortion, or other unwanted interfering signal, impacting the radios' ability to communicate properly. Similarly, EMI from devices operating on nearby frequencies can cause frequency distortion, spectral overlap, or signal blocking, degrading the overall wireless system performance. EMI sources near an antenna can also alter significantly the sensitivity of the wireless receiver, resulting in signal deterioration and coverage gaps.

Radiation, polarization & gain

Proactive measures can be taken during the design process or with adjustments made post-testing to combat both ESD and EMI and maintain antenna performance and reliability. These include:

Shielding and isolation

To prevent the antenna system picking-up interfering signal and noise and to immunize it against electrostatic or electromagnetic events, shielding materials or enclosures can be used to isolate antennas and create a protective barrier.

Filtering

Utilizing frequency filters like bandpass or notch filters can block unwanted signals and minimize interferences radiated by the antennas, safeguarding the system performance and efficiency.

Grounding

Proper grounding of antenna components can reduce unwanted currents resulting in an ESD or EMI event, effectively protecting the system from disruptions and damage.

Placement & positioning

Careful consideration of antenna placement and positioning — away from other electronic components and sources of EMI — can greatly minimize interference and noise.

The Vantiva Antenna Lab continues to invest heavily in testing sites, tools, and technologies to deliver products with market-leading performance. By executing this all in-house, Vantiva can produce high-quality products that meet customers' cost and performance demands and deliver a superior consumer experience.