



Ultra wideband meets Aesthetic light design



Challenge

In today's connected homes, smart lighting systems are evolving to provide more than just convenience—they enhance energy efficiency, security, and user comfort by responding dynamically to real-time data. One of the key technologies enabling this transformation is Ultra-Wideband (UWB), which offers precise indoor positioning, allowing lights to react intelligently based on the occupants movements. However, to harness the full potential of UWB in smart lighting, we face a number of antenna design challenges.

Solution

At Quarterwave, we believe the key to success lies in creating customized solutions. The diverse range of UWB applications makes it impossible for off-the-shelf products to fully meet the demands. Our tailored approach ensures that each specific requirement is addressed with precision.

As much bandwidth as required

The frequency range of UWB spans from 3.1 to 10.6 GHz, but does the antenna need to cover the entire spectrum? At Quarterwave, we say no. Only channels 5, 6, 8, 9, and 10 are globally usable, covering the key markets of the US, EU, and China. This reduces the required antenna bandwidth significantly from 7 GHz to 2 GHz, simplifying the antenna design while also enhancing its performance.

Seamless connectivity meets aesthetic design

Quarterwave has successfully integrated a cutting-edge UWB antenna into a ceiling light fixture, seamlessly addressing connectivity needs in smart home and IoT applications while ensuring an appealing design. Utilizing advanced miniaturization techniques, we fit the UWB antenna discreetly within the fixture without compromising performance. Our innovative materials enhance signal propagation and reduce interference, allowing multi-band support for Wi-Fi and Bluetooth.

A standout feature of this integration is the broad radiation pattern of the UWB antenna, which provides extensive room illumination and optimal connectivity throughout large spaces. This design not only elevates the functionality of lighting solutions but also enriches the user experience, exemplifying Quarterwave's commitment to delivering tailored solutions that meet the evolving demands of our customers.

Summary

The requirements for a UWB system are not trivial, making it essential to develop a tailored solution. Achieving this requires a deep understanding of the underlying physics, which is where Quarterwave excels.



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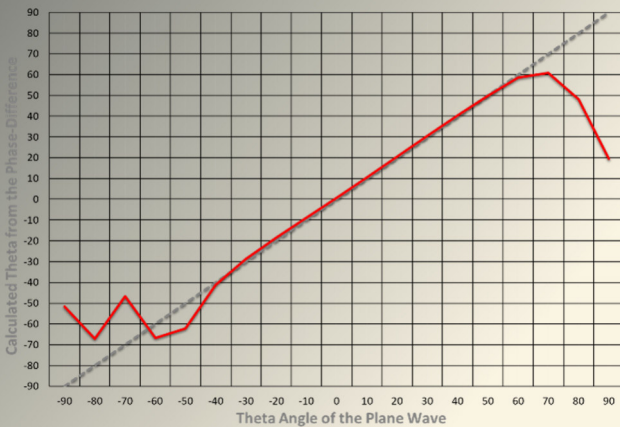


UWB application examples

Example 1: Tackling AoA Challenges with Dual-Antenna Solutions



UWB Antenna Direction Finding



Challenge

Designing UWB antennas poses significant challenges, particularly for accurate Angle of Arrival (AoA) detection. The wide frequency range of UWB often leads to compromises in antenna size, efficiency, and gain, directly affecting AoA precision. Small design variations can introduce considerable errors, making optimized antenna performance essential for reliable localization.

Solution

Quarterwave has developed a dual-antenna system that significantly improves AoA accuracy in UWB radar. By employing two antennas, this design enhances spatial resolution and reduces errors in AoA measurements. Optimized for UWB, the system ensures consistent, reliable performance across the frequency range, even in demanding conditions.

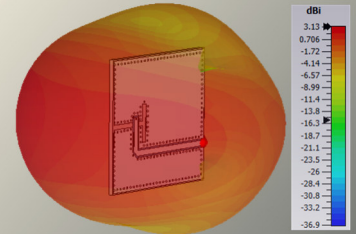
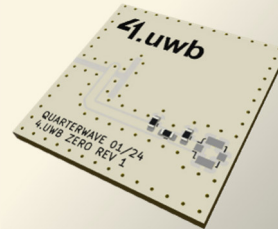
Example 2: The Advantages of Slot Antennas in Device

Challenge

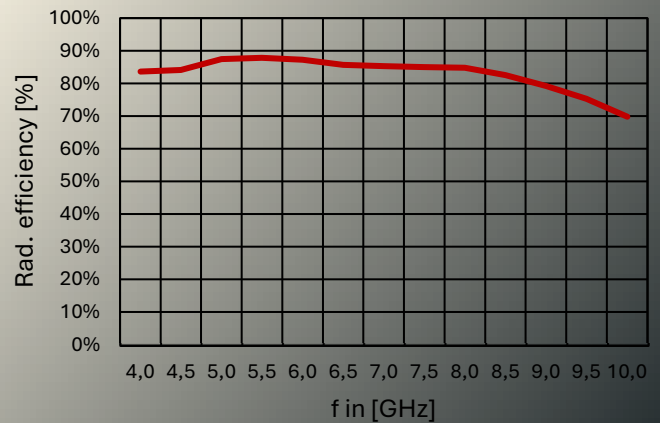
Modern devices, such as smart keyless systems, face significant challenges in antenna integration due to their limited space. This constraint often necessitates the use of smaller antennas, which can compromise radiation efficiency and reduce the overall range of the system. Additionally, the proximity of nearby components and enclosures can further hinder antenna performance, resulting in signal interference or loss, ultimately affecting the reliability of the device.

Solution

Slot antennas offer an innovative solution for modern devices, allowing seamless incorporation into enclosures without compromising design or functionality. Their compact form enables integration into or onto metal surfaces, making them particularly well-suited for space-constrained applications. Additionally, our slot antennas are available at no extra cost, providing access to high-performance technology that enhances overall device efficiency.



UWB slot antenna rad. efficiency



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