AntennaWare
Made To Wear

Unlock the Wireless Performance of Wearable Devices

By: Dr Gareth A. Conway
Dr Matthew K Magill
AntennaWare Co-founders

Innovators in Antenna Technology for the Next Generation of Wireless Wearables

Introduction

Conductive platforms make wireless communication difficult, when the device is mounted close to the structure. Just like metal, the human body appears electrically conductive to electromagnetic waves. However, with an understanding of the challenges highlighted in this article, you can avoid the connectivity performance issues, stay ahead of the curve and give your customer the wireless experience they deserve.

The competing demands on wireless wearables

As the popularity of wearable devices with wireless functionality continues to grow, so too does the demand for ever smaller devices, lower power, higher data rates, longer ranges, lower latency and higher reliability. By far the most common interoperable wireless protocol used in modern wearable devices is Bluetooth, alongside other wireless technologies operating the 2.4 GHz Industrial, Scientific and Medical (ISM) frequency band such as ANT+ and Wi-Fi.

To address the performance limitations and network congestion surrounding the 2.4 GHz band, the world is moving both up and down in frequency - 6 GHz+ for bandwidth, reduced latency for real-time data and localisation, and 1.9 GHz to improve communication range performance. Current IoT type applications are increasingly utilising wireless continuous monitoring in their systems, with delays or dropouts in communication potentially significantly deteriorating end-user experience. These devices are usually battery operated, sometimes with low capacity, low peak current coin cells, which further enhance the engineering design challenge, as follows:

1. Increase wireless range and reliability so we can have continuous, uninterrupted communications
2. Do so without simply increasing transmission power (due to battery limitations)
3. Not rely on a multiple receiver infrastructure/ receiver redundancy/ cost
4. Not rely on a multiple packet transmissions/packet redundancy
5. Finally, guarantee that the device will work on the entire population or on any platform.

Workarounds don’t address the fundamental challenge

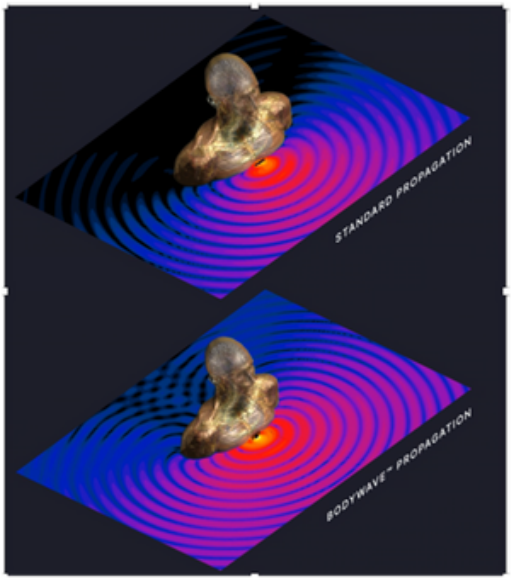
Many advances have been made to try and address the challenges, from advanced protocols, innovative diversity algorithms and for some applications a common solution has been to simply increase the link budget on the transmitter end by maximising the transmission power of the device. However, this comes at the expense of increased board space, increased system complexity, increased BOM cost and greatly increased power consumption. Wearable applications, in which a wireless devices is placed in close

proximity to the surface of the human body, produces a set of specific challenges which make wearable device design a unique case in the IoT space.

For wireless wearable performance, antenna choice is key

In the context of Electromagnetics, the human body presents a high permittivity, conductive and therefore lossy dielectric, which makes wearables an entirely different use case compared to free space mounted IoT applications. Even the most advanced wireless chipsets will have to produce an RF signal at some point and in doing this will be subject to the losses produced by shadowing and absorption by the human body.

The antenna is the primary component that interacts with the environment and is most affected by the platform for which it is in mounted on, yet, they are often an afterthought. A different approach is needed, and crucially, if not designed with these challenges in mind, can have severe consequences in terms of deployable performance. Therefore, to improve the performance of wireless wearables, the right antenna is key.



Body blocking shadow zone with standard antenna approaches versus reduced blocking with Bodywave™ technology

Antenna challenges

The antenna is one of the most vital components of any wireless system. It is responsible for converting an in-circuit guided EM wave produced by a transmitter into a free-space, propagating EM wave. There are a number of metrics which are important when considering an antennas performance but for difficult platforms (such as the human body), the top 3 are: input impedance stability, total radiation efficiency and the correct radiation pattern to meet the propagation needs of the application.

An antenna that is agnostic to the platform holds the key to unlocking the wireless performance and differentiating your product's performance. To mitigate the effects of near-field coupling from the antenna to the tissue, and the absorption of energy into the tissue, the antenna must be decoupled from the platform. PCB printed antennas and exposed ceramic chip antennas are not the right approach. They were never designed to be placed close to a difficult platform and thus radiate inefficiently. The waves need to be launched differently, and the antenna needs to be isolated from the tissue by the PCB ground-plane. The challenge is to do this from a physically small and low-profile antenna. Off-the-self antennas traditionally don't meet these needs.

By overcoming the challenges of body blocking, AntennaWare's proprietary, patented antenna technology demonstrates step-change improvements in link budget performance of between 10 and 20 dB in comparison to conventional antennas such as close fitting printed and chip antennas. Meaning wireless wearables using AntennaWare's BodyWave™ antennas could receive a wireless performance boost of a combination of: over double the communication distance, significantly reduced power consumption/ battery size, or simply give more robust and reliable quality connectivity, which is core to audio, sport and healthcare applications.

BodyWave™ antenna Vs Traditional antenna

Traditional Antenna
Limited Wireless Coverage

- Limits quality of performance
- Limits deployability
- Higher infrastructure costs
- Reduces ability to scale application into larger markets
- Product performance - uncertainty risk
- The problem more prevalent as the world moves up in frequency

BodyWave™ Antenna
Complete Coverage

- AntennaWare's technology solves the coverage and reliability problem
- Patent protected geomotry that produces BodyWaves
- Platform agnostic solution
- Significant performance advantages over alternatives

To take the guesswork out of the wireless performance of wearable devices and maximise the potential for competitive advantage of a reliable, quality wireless connection, it's becoming even more important to carefully consider the choice of antenna. Nothing impacts your brand as much as a poor wireless connectivity experience.

Next Steps:

Discover more about Bodywave™ antenna: antennaware.co.uk

Download Bodywave™ Antenna specifications: antennaware.co.uk/product/bodywave

Get in touch for your representative:

Audio/Gaming/AR/VR
Jonny McClintock
jonny@antennaware.co.uk

IOT/Medical/Sports/Other
Gordon Petrie
gordon@antennaware.co.uk

AntennaWare

antennaware.co.uk

Contact us

General enquiries:
info@antennaware.co.uk

Sales enquires:
Gordon Petrie gordon@antennaware.co.uk
Jonny McClintock jonny@antennaware.co.uk