

# RACE|RESULT SETS THE PACE FOR RUNNERS WITH NEW UCODE 8® RAIN RFID TRANSPONDER AND ZEBRA FX9600 RAIN RFID READERS

Success Stories



Walking, jogging, and running are some of the most popular and most widely practiced athletic activities worldwide, and the number of people participating in distance races – be it a 5k fun run or an ultra-marathon covering 160k or more – is on the rise.

The data-gathering site Statista reports that, in the U.S. alone, more than 30,000 races were held in 2016. Marathons and other types of races are now regular features in most major cities worldwide, and many runners have a personal tick list of name-brand events they'd like to participate in someday.

Event managers work hard to attract sponsors and athletes and rely on the latest, most innovative technologies to enhance the race-day experience. In particular, present-day races often use radio-frequency identification (RFID) solutions, which include passive UHF (aka RAIN) RFID readers and transponder tags, to generate precise time-stamps for each athlete. To record individual race times, every race participant wears an RFID transponder tag that has a unique ID and communicates with RFID readers positioned at the start, the finish, and at various key points along the way, so runners can gauge their pace with split times.

### ACTIVE VERSUS PASSIVE RACE TIMING

Active transponders, which use a coin cell battery, tend to be bulky and quite expensive, so event managers typically retain ownership of the tags and have athletes return them after the race. Active transponders are known for their durability and water resistance, but can cause bottlenecks near the finish line when racers need to return tags, and can create an expensive logistical challenge if participants neglect to return the tag before leaving the course.

Passive transponders, on the other hand, do not need a battery to operate (they use energy provided

by the RFID reader), and are far less expensive than active tags, so event managers don't need to ask for them back after the race. Passive tags have the added benefit of being relatively lightweight and flexible, too, and can attach directly to the race bib, so athletes don't have to deal with extra gear such as a wristband tag or a plastic tag unit threaded through their shoelace.

### A TOUGH ENVIRONMENT

The three advantages of passive transponders – flexibility, size, and cost – have made them popular with event managers and athletes alike, but the race-day operating environment can impact the accuracy of data transmission. For example, if too many athletes pass the reader at once, some of the tags may get missed, due to a lack of sensitivity in the reader or the tag (or both), which results in inaccurate or lost transmissions.

Liquids are another issue. Exposing the tag to moisture, in the form of human sweat or raindrops on a wet day, can detune the tag's antenna. Detuning can change the characteristics of the tag's antenna, resulting in data transmissions that are unreliable or even fail.

### CHALLENGE

To optimize the performance of their passive RFID transponders, which time athletes during competitions, race|result aimed to create a lighter, more durable, and more accurate solution.

### SOLUTION

- ▶ A completely new design, based on NXP's latest UCODE 8 RAIN RFID technology, with a specially tuned antenna, an improved production process, and thinner mounting foam.
- ▶ Zebra FX9600 fixed RAIN RFID reader, designed with Zebra's NextGen RFID radio and industry leading Receive Sensitivity, which help achieve maximum visibility of runners during the race.



### BENEFITS

- ▶ Greater precision, with high-sensitivity readers that capture runners more accurately.
- ▶ Fewer misreads, with a tag antenna designed to work close to the human body.
- ▶ Better tag adhesion, with waterproof glue that stays put even in wet conditions.
- ▶ Significant savings on shipping and logistics, with a solution that's 50% thinner.



“For their passive transponder, race|result chose UCODE 8, the latest generation of NXP’s **ultra-low-power RAIN RFID chip.**”



The human body itself can interfere with antenna operation and cause detuning. Passive tags were originally developed for use in the supply chain, for things like inventory control and warehouse management, and are mostly designed for use with inanimate objects like boxes and palettes. Tags attached to cartons and containers, moving from warehouses to trucks and retail outlets, don’t typically have to deal with the kinds of antenna interference that can come from human tissue.

As a way to lessen the impact of antenna detuning when repurposing passive tags for use with race bibs, developers have started protecting tags with a foam spacer. The spacer, which typically measures between 3mm and 5mm in thickness, increases the distance between the tag and the wearer, thereby lessening the detuning effect caused by human tissue and moisture.

A thick spacer can improve tag performance in tough operating conditions, but the added bulk can be a negative in other respects. Not only does it make the race bib stiffer and more awkward for athletes to wear, it means fewer bibs can fit in a carton. That translates into higher shipping costs when delivering bibs to the event site, more boxes to store before distributing race packs during registration, and a larger environmental footprint overall. Even a small or mid-size event can involve thousands of racers, so the logistical costs and resources used can multiply quickly.

### **READY FOR THE RACE COURSE**

To address the various drawbacks of using passive transponders mounted on race bibs, the German company race|result, already known as a technology leader in sports time keeping and race-management solutions, sought to create a completely new passive transponder, specifically designed to meet the needs of race managers and the athletes they serve.

The company’s design team went back to the beginning and fully redesigned their solution. It took 15 months to complete the effort, but race|result succeeded in creating a reader and tag combination that takes race timing to a new level. Their new solution, based on the industry-leading UHF passive (aka RAIN) RFID standard ISO 18000-63, offers precise timing with even large numbers of athletes, fewer misreads when exposed to human tissue, better adhesion to the bib in wet conditions, and a significantly thinner profile for dramatically reduced shipping and storage costs.

### **THE LATEST READER TECHNOLOGY**

The race|result solution uses an optimized combination of high-sensitivity readers and tags. On the reader side, race|result selected Zebra, a global leader in data capture and track and trace innovation. They chose the Zebra FX9600 RAIN RFID reader, which delivers industry best RFID performance and the highest receive sensitivity in the market.

Race|result uses the 8-port version of the FX9600 reader. The FX9600 switches very rapidly between ports, so operationally it looks as if all 8-ports are in simultaneous operation. This is very critical, especially at race start stage where thousands of participants cross the starting line in a matter of minutes. The FX9600 reliably registers each racer to start individual timing.

The FX9600 is designed with Zebra’s NextGen Radio ASIC and is providing best-in-class performance which allows race|result to offer the highest results to their customers. This ASIC also uses about 20% less power than similar competitive readers, which allows race|result’s boxed reader solution to track race participants for a much longer duration.



## NEXT-GEN TRANSPONDER TECHNOLOGY

For their passive transponder, race|result chose UCODE 8, the latest generation of NXP's ultra-low-power RAIN RFID chip. RAIN (aka UHF passive) RFID is a globally supported, industry-backed wireless technology that connects billions of everyday items to the internet, enabling businesses and consumers to identify, locate, authenticate, and engage each item.

UCODE 8, which is NXP's implementation of the RAIN RFID specification, offers a wide frequency range, with EPCglobal compliance, so it can be used anywhere in the world. It also delivers higher anti-collision rates, for improved accuracy even when there are many tags present at once. UCODE 8 also offers a sensitivity rating that is at least 1 dB better than competing technologies, meaning the tag is more likely to wake up and transmit accurately even if it's relatively far away from the reader.

The developers at race|result took advantage of a special UCODE 8 feature, called "Self Adjust," to make the tag's data transmission even more robust and reliable. The Self Adjust function maximizes chip sensitivity by selecting from one of three input capacitance levels at start up, so the tag is better able to transmit data accurately over a wider set of environmental conditions.

## A BREAKTHROUGH IN SIZE

Through an extensive testing process that involved tightly controlled measurements in an EMI chamber, the developers at race|result found a way to use a much thinner foam spacer. Taking advantage of the high sensitivity of the UCODE 8 IC, which needs less power to operate and therefore can be closer to the body, race|result changed the antenna's characteristics and counter-tuned it for the presence of human tissue. The result is a transponder that performs better, not worse, when worn near the body, yet is half the thickness of the thinnest solutions currently available.

Shrinking the foam spacer from 3 mm to 1.5 mm simplifies handling in production, creates a bib that is easier to wear and, perhaps most important, doubles the number of bibs that fit in a box. Given the very high volume of shipments that race|result makes each season, and the number of race bibs

handed out by event managers, the slimmed-down foam spacers offer significant savings in terms of resources and energy.

## MORE RUGGED ASSEMBLY

The tags are assembled using a production process that reflects close oversight by race|result, and meets strict specifications for quality and performance. The assembly process even uses a special adhesive, chosen specifically for its water-resistant bond when applied to Tyvek, the material used for most race bibs. The moisture-resistant adhesive lets athletes perform at their best, without worrying about their transponder coming loose, no matter what the weather.

## BETTER EXPERIENCES, INCREASED ENGAGEMENT

Taken as a whole, with readers and tags optimized for race-day performance, the new race|result solution lets event managers offer precision timing in a cost-effective, easy-to-use format. Athletes can be confident that their bibs will be both comfortable and durable, and that their race times will be recorded accurately. At the same time, thinner bibs let event promoters improve their logistics while demonstrating sensitivity to environmental issues relating to transport costs and use of scarce resources.

These benefits add up to help make races more attractive to athletes and improve the race-day experience. And that, in turn, can help generate the kind of racer loyalty that reinforces event brands and increases sponsorship.

## RELATED LINKS

### RACE|RESULT

[www.raceresult.com](http://www.raceresult.com)

### ZEBRA FX9600 READER

[www.zebra.com/us/en/products/rfid/rfid-readers/fx9600.html](http://www.zebra.com/us/en/products/rfid/rfid-readers/fx9600.html)

### NXP UCODE 8 TAG IC FAMILY

[www.nxp.com/products/identification-and-security/smart-label-and-tag-ics/ucode/ucode-8-8m:SL3S1205-15](http://www.nxp.com/products/identification-and-security/smart-label-and-tag-ics/ucode/ucode-8-8m:SL3S1205-15)

