

# RFID CASE STUDY: Los Angeles Marathon

In collaboration with



## Impinj Technology Wins at the Finish Line

**Customer:** The Los Angeles Marathon began in 1986, attracting 10,688 registrants. It has since become the fourth-largest marathon in the country, with 12,000 race day volunteers required to support more than 20,000 participants. Since 1986, the LA Marathon has raised over 27 million dollars for charities. It's a massive logistics undertaking (requiring among other things, the closure of 12 freeway on-ramps, 4,053 city barricades, 40,000 no parking signs, 55,000 gallons of water, 9,500 gallons of Gatorade®, and 2,500 trash cans). Over one-half million people watch the televised coverage of this marathon, the 7th largest in the world.

**Challenge:** For these large races, organizers have extensive logistics to coordinate and welcome new technology that facilitates smoother race operation. They want simple setup, quick clean up, and as few suppliers to manage as possible. And the most critical logistical aspect of any race is the accurate course timing of all participants. A common race timing method uses a plastic-encased, low-frequency tag. These tags are manufactured independently of other race identification materials such as bib numbers, requiring extensive pre-race effort to match each timing tag to the entrant's information. To read tags, cumbersome mats must be placed at timing locations, and runners funneled over them. An alternative involves creating read zones by erecting structures with antennas mounted overhead. Race participants must travel under these read zones wearing tags specifically angled away from the body to support consistent reads. While these solutions work with varying degrees of accuracy, timers at the LA Marathon welcomed the chance to try a new UHF Gen 2 RFID system created by ChronoTrack, a timing and tracking equipment company. ChronoTrack's solution promised to be at least as accurate as the best solution available, much easier to use, very durable, and less costly.


**RFID Solution:** Leading up to the LA Marathon, ChronoTrack worked closely with Impinj, a leading supplier of UHF Gen 2 RFID solutions, to create and perfect their modular timing system. When the system successfully debuted at the LA Marathon, race organizers were very enthusiastic.

**"We easily saved between fifteen and twenty thousand dollars, had a smoother race operation, and heard nothing but praise from race participants..."**

**Terry Collier**  
Executive Race Director, LA Marathon



# UHF Gen 2 RFID is on a run

 Conducting trials of their timing system at actual road races, ChronoTrack continually refined the system. By its LA Marathon debut, ChronoTrack's solution accurately recorded 99.84% of all race participants, easily matching previous timing methods.

The timing system involves four main components: UHF Gen 2 RFID tags, reader antennas encased in urethane ramps, Speedway® readers, and timing controllers.

ChronoTrack's unique tag design integrates with the runner's bib for easy printing, yet peels off easily on race day.



## Unique UHF Gen 2 tag design

ChronoTrack located the RFID tag on the shoe to provide more consistent tag reads. They experimented with various methods, initially using a tag attached to the shoelace. However during the trials, ChronoTrack noticed runners tying it underneath their laces to minimize movement. The under-laces position negatively affected the read rate consistency. ChronoTrack went back to the drawing board to create a design where they could achieve good read rates, and with only one way to attach the tag to the shoe. Their "D" timing tag achieved these goals with a UHF Gen 2 RFID inlay attached to a piece of plastic that has a small adhesive strip on one end. (ChronoTrack worked with the label manufacturer, MPI Label Systems, to find a durable adhesive assured to remain in place for the entire race.) Runners bend the plastic into the "D" shaped form, which allows the tag to be firmly and uniformly attached while enabling strong, consistent reads.

To further ensure tag read consistency at the LA Marathon, race directors placed posters throughout the Expo facility with tag attachment instructions and included the same information in the entrants' bib packets. Volunteers also wandered around the complex with a sample tagged shoe. The morning of the race, volunteers monitored the starting corrals, checking

runners to make sure they had pulled the tag off their bib and applied it correctly. LA Marathon Executive Race Director, Terry Collier, estimated that they reached 99.9% of the participants using this multi-pronged approach.



UHF Gen 2 RFID tag on a runner's shoe is an easy and inexpensive way to manage race results.

## Tag Reader Antenna Setup

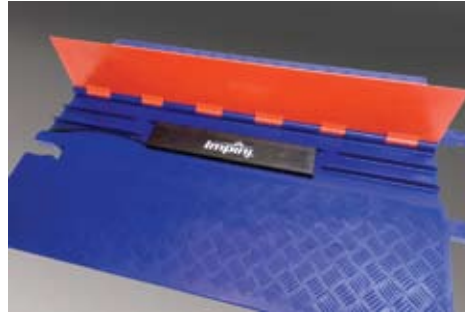
The tag's on-shoe location makes the road the most logical, effective, and low-cost option for placement of the reader antennas. To obtain a durable yet low-cost solution, ChronoTrack selected low road ramps with planar reader antennas. After testing their design concept with plywood road ramps, ChronoTrack turned to commercially available urethane cable protectors to encase the reader antennas. By placing the antennas end-to-end, the

ChronoTrack system can monitor road surfaces ranging from 42 inches up to 56 feet wide. With the proven success of the cable protector system, ChronoTrack made further improvements to comply with the American Disabilities Act (ADA), custom-designing ramps with embedded antennas for manufacture by a third-party vendor.

In Los Angeles, as race participants ran past the starting line, they crossed two 48-foot long ramps (primary and secondary).

Each contained 16 UHF antennas that were connected to four Impinj Speedway® RFID readers. Participants' start time registered as they crossed the starting line, although the gun may have gone off seconds to minutes earlier. For the 10K, one-half marathon, 30K and finish line read points, ChronoTrack used two 24-foot antenna road ramps (primary and secondary) to obtain splits and total race timing data for runners. Each of these ramps was embedded with eight antennas connected to two Speedway readers.

To further improve performance at future road races, ChronoTrack enlisted Impinj to custom design an application-specific reader antenna. Impinj's design, the Threshold™ antenna, has a planar form factor of 46 x 9 x 2 cm that fits readily into a urethane ramp. These Threshold antennas provide extended, continuous read zones when linearly distributed head-to-tail and can withstand the impact of up to 100 kg objects.



The Impinj Threshold antenna installed in ChronoTrack's custom-designed road ramp.

## ChronoTrack Controller

To support the timing function, ChronoTrack loaded the custom application partition on the Speedway reader with proprietary software. Custom-designed ChronoTrack controllers manage the transfer of race participant tag information obtained by the Speedway readers when runners cross the road ramps. The ChronoTrack controllers transfer the timing data via a variety of options. One method uses the cellular GSM modem within the controller box. Another way is to hardwire the controller via Ethernet to a nearby laptop. Or, if an 802.11 wireless network footprint is available in the vicinity, the controller can use it.

The ChronoTrack controller takes the raw timing data obtained by the Speedway reader and puts it into a format that is compatible with most scoring software packages. Scorekeepers work with race directors to determine the best method for sharing race data with participants.



ChronoTrack's rugged, portable controller manages the Impinj's Speedway reader operation.

## ChronoTrack Timing Solution

ChronoTrack's solution is lighter and less expensive than previous timing methods. Most important to organizers and participants—the tags are disposable. Runners no longer need to stand in long lines to “tag check” their timing devices, or to return them after completing the race. The LA Marathon race directors enthused about the ChronoTrack solution saving time, money, and equipment.



Runners cross a beta version of the road ramps during the “Pat’s Run” in Tempe, Arizona.

Another advantage is that the read system's modular form allowed race directors to determine a read point's width and readily change it if necessary.

Incorporating ChronoTrack's “D” timing tag into the bib meant race organizers could order an integrated bib and tag for each participant. The label manufacturer encoded the bib number into the RFID chip within each tag at the time of

**Race check-in took hours instead of days, required fewer employees (and volunteers) to manage, resulted in no lines, and saved race organizers between 15 and 20 thousand dollars.**

printing. The peel-off portion of the bib that included the RFID chip became the tag that runners attached to their shoes.

ChronoTrack's system easily matched the accuracy of previous timing solutions, and they expect significant improvements as runners become more accustomed to the "D" tag. To further improve results, ChronoTrack plans to deploy more Impinj-designed reader antennas, and switch to Impinj's new Monza 3 tag chips.

"ChronoTrack's solution contributed to the best LA marathon in its 23 year history and I'm very pleased. Our third party timing verifier told us it was the most accurate timing method he'd ever seen, and he compared it against the same method used to time the Olympics. Both race setup and clean up were much easier—hours instead of days, we needed fewer volunteers and far less equipment. We easily saved between fifteen and twenty thousand dollars, had a smoother race operation, and heard nothing but praise from race participants. Definitely a win-win solution for me."

**Terry Collier**  
Executive Race Director, La Marathon

FOR MORE INFORMATION ABOUT THE COMPANY INVOLVED IN THIS CASE STUDY, PLEASE VISIT:

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