

An aerial photograph of Levi's Stadium during a game. The stadium is packed with fans, many wearing red. The field is green with '49ERS' written in red on the turf. The sky is blue.

CASE STUDY: LEVI'S STADIUM

Bay Area Football Fans Experience the Best in Mobile Communications on Game Day



The Teko DAS Platform from JMA Wireless Ensures Cellular Coverage and Capacity at Levi's® Stadium

Overview

Levi's® Stadium, home of the San Francisco 49ers, not only offers WiFi to enable many cutting-edge applications, but it also deployed a DAS (Distributed Antenna System) solution from JMA Wireless to ensure robust cellular coverage and capacity when 68,500 or more fans converge on the facility for a variety of sporting events and stadium shows.

Situation: Offering the Best in Mobile Communications Means Overcoming Many Challenges

Currently, almost 4.7 billion people -- or over half of the world's population today -- are cell phone subscribers.¹ Almost a third of these subscribers access the Internet with their mobile devices and a growing number use them to share their experiences and stay informed via social media sites.² The traffic from smartphone users alone is expected to grow 325% by 2018.³ These subscribers want to be able to call, text and stream video anywhere,

“ We needed to provide an extremely flexible and robust cellular communications solution that could be deployed quickly; therefore, we selected the leading-edge Teko DAS solution from JMA Wireless.”

**>> Steve Dutto
President
DGP**

anytime; therefore, Levi's® Stadium knew that it needed to ensure robust cellular coverage and capacity even when hosting capacity crowds.

However, providing cellular coverage and capacity is never an easy feat. Ensuring mobile communications at Levi's® Stadium was no exception. In order to be successful, many obstacles had to be overcome in a very short period of time. Similar to most sports venues, Levi's® Stadium is composed of concrete and steel, not the most receptive materials for wireless communications. Furthermore, the steel beam construction was exposed, presenting an additional concern regarding the aesthetics since the antennas would be visible. Coverage and capacity was needed for public safety communications as well as for network operators, such as Verizon.

Additionally, the mobile communications network had to compete with technology obstacles outside of the stadium as well. On a daily basis, Levi's® Stadium has to deal with significant interference from seven cellular antennas on nearby office building rooftops as well as from the Santa Clara Convention Center, which is located directly across the street. Also the surrounding flat, open landscape of Santa Clara increased the ability of these signals to interfere with the wireless coverage in and around Levi's® Stadium.

Solution: Teko DAS - The Powerful Technology Behind Mobile Communications at Levi's® Stadium

According to the 2014 State of the Stadium Survey, almost 94% of all NFL stadiums have at least a partial DAS implemented and over 70% have a full DAS solution deployed. In order to be the high-tech sports venue that it planned to be, Levi's® Stadium knew it needed to deploy a DAS solution. DAS Group Professionals (DGP) was selected as the systems integrator for this high profile project. DGP offers many years of experience deploying DAS solutions in hotels, casinos, airports and even for San Francisco's BART train system. The deployment schedule was tight and became even tighter when a soccer game was added to the schedule for August 2. Steve Dutto, President of DGP, knew he needed not only a DAS

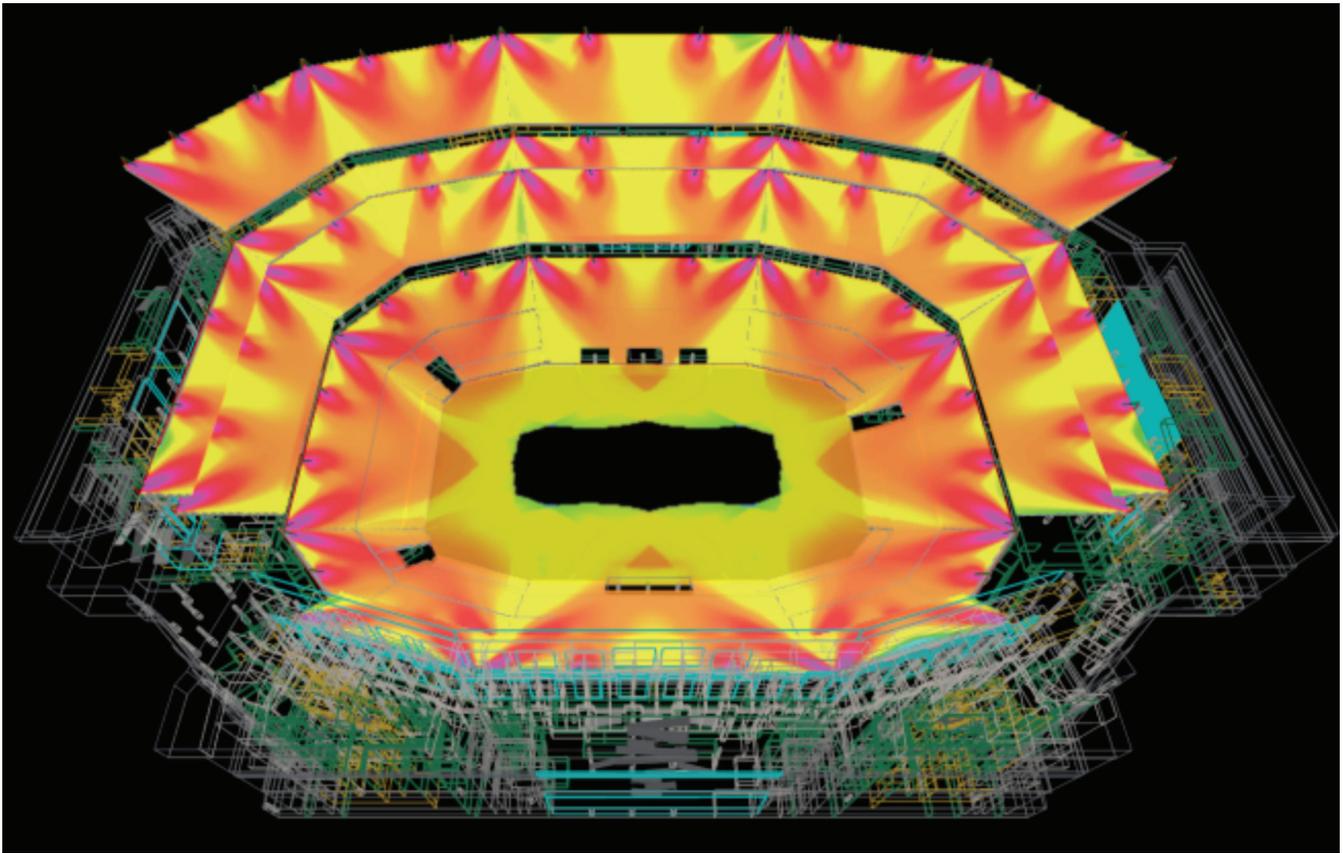
solution manufacturer, but a true partner to work with on this very important project; therefore, he turned to mobile communications innovator, JMA Wireless.

Defining the Teko DAS

The Teko DAS is a versatile and modular platform, which provides reliable wireless coverage and capacity for indoor and outdoor environments. The solution's rack mounted Master Unit combines LTE Advanced, UMTS and other high speed technologies with multiple bands to deliver robust mobile communications that adapts to a venue's needs on an event-by-event basis. The Master Unit simultaneously drives throughout the facility and surrounding outdoor areas both high power and low power Remote Units (RU) by way of an integrated platform and common optical transceivers, sub-racks, power supply and supervision modules. The solution supports the various power level units automatically and brings the proper level to the BTS (base transceiver station), which is located in a wiring room or data center. There is no need to balance the gain. It is simply plug and play.

Unlike many competitive solutions, the RUs are connected with a minimal number of fibers, which is accomplished by three technologies developed and produced internally by JMA Wireless:

- **WDM (Wavelength Division Multiplexing):** WDM filters are integrated in optical modules, which allow a single fiber per remote unit to be used to support two different wavelengths for uplink and downlink transmissions.
- **Point-to-Point Link:** With a single fiber, up to 16 remote units belonging to a sector and one MIMO (multiple input multiple output) path can be connected. A star topology is used to connect all RU locations throughout a facility.
- **DWDM (Dense Wavelength Division Multiplexing):** DWDM mux/demux are integrated in the head-end rack at the BTS hotel and in the remote location to further minimize the number of fibers needed. With DWDM filters up to four sectors or 64 total remote units can be supported by a single fiber, as compared to the 64 separate fibers often required by the competition.



The Decision to Deploy a Dual DAS

DAS solutions are either built by a major cellular carrier or in this case a third-party “neutral” host such as, DGP. DAS Group Professionals deployed the dual Teko DAS solution to support the multiple carriers and bands. However, before this wireless communications system could be operational a lot of planning first had to occur. The engineers utilized 3D designs of the stadium to map the potential signal coverage and power requirements, which ensured the accurate placement of antennas in various locations throughout the venue.

Antenna placements are crucial, not only to ensure adequate signal strength, but also to guarantee that various antenna signals do not interfere with each other. As mentioned previously, the Levi’s® Stadium DAS also competes with signals from seven surrounding cellular antennas on office buildings and antennas in the Santa Clara Convention Center, which is located directly across the street. The antennas in Levi’s® Stadium were wired to the Remote Units (RUs), which are the power amplifiers. These RUs were then connected back to a central location via fiber optics.

The Teko DAS supports multiple carriers and multiple bands, but the mobile communications network in Levi’s Stadium is a bit unique in that carriers elected to deploy separate DAS solutions. With this dual DAS structure, two antennas sit side by side at points throughout the venue. In total, 770 antennas were deployed. To maximize the bandwidth the stadium also was divided into 54 zones, which support all of the mobile carriers.

This map illustrates the amount of signal power that is beamed from proposed antennas to different locations in the stadium.

Antennas: 770
Carrier RUs: 336
Public Safety RUs: 12
Coax: 20 miles
Fiber: 18 miles
Zones: 54



“ People attending our games want to be able to continue using their mobile devices as they always do – to make voice and video calls, share text messages and images, and engage friends via social networking. Whether it is cellular or WiFi, our vision has always been to provide our fans with solid connectivity. The JMA Wireless team, along with DGP, has helped us build a great cellular network that allows our guests to maintain connectivity to their respective cellular provider service while at Levi’s® Stadium.”

>> Anoop Nagwani
Head of Technology
San Francisco 49ers

Result: Significant Coverage and Capacity Needs Easily Met

Since its inception, the Teko DAS has answered the demands of its users. According to reports from the stadium’s tech team, the DAS network carried 1.02 terabytes of wireless traffic for the two preseason games alone, which is on par with the activity experienced at previous Super Bowls. During this time few, if any, calls were dropped or did not connect.

The antennas can be redirected remotely to better support coverage and capacity in densely populated areas of a venue. This feature already has proven to be a huge success. For example, rapper, Snoop Dogg, performed at half time during the home opener. Many people throughout the stadium streamed video and took photos of his performance which were then texted or posted to social media sites. This was a true test of the Verizon 4G LTE connection, which demonstrated speeds of 26 Mbps down and 9 Mbps up. It also stands as a testament to the powerful and unique capabilities of the Teko DAS.

About JMA Wireless

JMA Wireless is the leading global innovator in mobile wireless connectivity solutions that assure infrastructure reliability, streamline service operations, and maximize wireless performance. Employing powerful, patented innovations their solutions portfolio is proven to lower the cost of operations while ensuring lifetime quality levels in equipment and unrivaled performance for coverage and high-speed mobile data. JMA Wireless solutions cover macro infrastructure, outdoor and indoor distributed antenna systems and small cell solutions. JMA Wireless corporate headquarters are located in Liverpool, NY, with manufacturing, R&D, and sales operations in over 20 locations worldwide. For more information see jmawireless.com

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Sources:

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3VNI Mobile Forecast Highlights, 2013-2018

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