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Photo courtesy DFW Airport

Public-Safety Coverage at DFW Airport

A distributed antenna system (DAS) provides access, along with flexibility and scalability, to meet existing and future requirements.

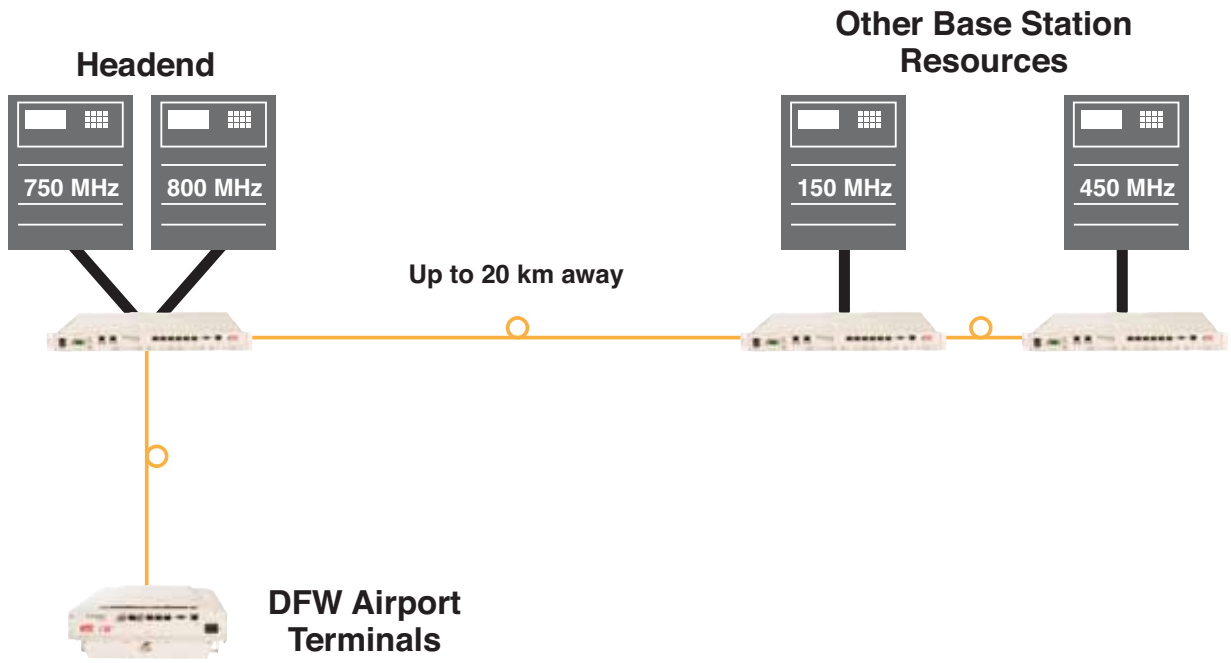
By Lance Craft

Public safety is highly dependent on the ability of first responders and other emergency personnel to communicate effectively in emergency situations. The lack of coverage deep inside a building can cost first responders valuable time and mean the difference between life and death in some cases. For public areas such as airports, stadiums, hospitals and hotels, the requirement for a resilient public-safety communications infrastructure is vital because these venues often have a high density of wireless users that may cause interference during an emergency situation.

Dallas/Fort Worth International Airport (DFW Airport) is one of the busiest airports in the world. DFW Airport maintains critical communications infrastructure (CCI) to provide RF communications for all airport divisions. The CCI consists of numerous radio system platforms, including networks for U.S. Customs and Border Protection (CBP), various airlines, and fire and police officials.

The airport also has in-building distributed antenna system (DAS) and bi-directional amplifier (BDA) deployments. DFW Airport has made numerous upgrades to improve its CCI within the five active passenger terminals during the past 20 years. Cumulatively, the improvements have positively impacted RF propagation within the coverage area, but some communications dead spots remain. In addition, similar to other commercial aviation facilities, the passenger terminals have a horseshoe-shaped architectural design, resulting in shadowing around the exterior perimeters of the terminals.

Digital Aggregation of Signal Sources with No Loss



DFW Airport needs a solution that provides public-safety coverage and access at all times, with the flexibility and scalability to meet the airport's existing and future requirements. To address coverage issues and overcome the physical obstructions caused by the layout of the service area, DFW Airport also requires a fully digital, quad-band solution capable of transporting all frequencies over a single fiber. The aggregate transmission delay between the RF input at the headend and RF transmission at all antenna points must not exceed 40 microseconds to minimize latency. The system must also support expansion, modification and addition of existing and future terminal buildings without a complete overhaul of the existing architecture. Lastly, the system must be future-proof and support additional frequency bands and expansion to Long Term Evolution (LTE) single input single output (SISO) without costly replacement of the cabling infrastructure.

The Coverage Solution

A digital DAS was a natural candidate to satisfy all of DFW Airport's requirements and future-proof its investments in its communications infrastructure. As a global provider of the advanced all-digital DAS, coupled with the expertise of its team, Dali Wireless partnered with DFW Airport to design, install and maintain a digital DAS to provide wireless coverage and access throughout all of DFW Airport's terminals for public safety.

The system comprises a headend and medium- and high-power remote units. The end-to-end digital DAS safeguards against signal degradation over the distance of the fiber and provides superior signal performance compared with similar wireless access technologies. This is important because two sets of base station resources are located remotely from the DFW Airport's headend where the signal is distributed to all the terminals. Conventional analog systems will require double conversion of signals because the RF-over-fiber signal causes massive signal degradation when traveling across great distances. However, with an all-digital solution, the two base station resources can be aggregated digitally and fed through a single fiber to the headend to distribute the signal to all 12 million square feet of the five terminals.

This capability highlights the flexibility and scalability of a digital DAS platform, which is ready to adapt to any future needs of DFW Airport. For example, with the long reach of digital DAS, the same radio source at the headend can serve DFW facilities and office buildings within a 20-kilometer radius. Additional remotes and antennas are added without interruption to the existing distribution network.

The system supports all the frequency bands in a consolidated digital platform with a signal level of -95 decibel-milliwatts (dBm) at greater than 97 percent coverage. The coverage was extended beyond the exterior perimeters of the passenger terminals to avoid shadowing. To ensure mission-critical communications is protected at all times, a fault-tolerant deployment architecture was designed with fiber diversity, redundancy and automatic failover capabilities. A collocated active hot standby host protects the primary host unit. With added intelligence, the remote can detect a loss of signal when the primary host fails or when the primary fiber is cut. The remote will then automatically disable the primary optical port and enable the standby

optical port. The second fiber connection from the standby host to the remote also provides fiber diversity to avoid single-point-of-fiber failure. This redundant configuration can be incrementally added without impacting the current deployment. Such high availability is the first of its kind and advanced in the industry.

Broadband and Testing

In addition, the simulcast is designed such that signals from all antennas are normalized to reduce interference to a minimum. With digital DAS, delay can be set in the digital domain through a graphical user interface (GUI). All of the calibration is done through the GUI so that the antenna can be placed where needed to optimize the signal performance. This also fulfills one of DFW Airport's requirements: The aggregate transmission delay should not exceed 40 microseconds. It will become important when DFW Airport deploys public-safety communications over LTE, which has a more stringent delay requirement.

With DFW Airport expecting to upgrade to LTE in the future, the airport needs a system that is flexible enough to accommodate the expansion without replacing the cabling infrastructure, which is costly and would disrupt existing services. With the emergence of bandwidth-heavy public-safety applications, such as live two-way video feeds and high-definition (HD) camera surveillance, DFW Airport needed a system that is robust enough to offer the required bandwidth for media-rich public-safety applications. With an all-digital platform, DFW Airport will be empowered to scale to meet LTE requirements and easily adapt to existing and new requirements, including the First Responder Network Authority (FirstNet) and Project 25 (P25) Phases 1 and 2.

Installation and testing are expected to be completed by summer of 2016. To ensure a fully functional wireless network capable of handling the stringent requirements of public-safety applications, DFW Airport will perform functional system and coverage acceptance tests. For the coverage acceptance test, each frequency band's coverage area will be divided into uniform test tiles no larger than 25 by 25 feet; and each tile sector will be tested to meet a mean signal level of at least -95 dBm with a mean signal-to-noise ratio of 18 decibels (dB). This tile-by-tile acceptance test, mandated by the airport, will ensure complete coverage with maximum capacity and the elimination of dead spots.

At the completion of this project at DFW Airport, first responders and other emergency services personnel will have a clear, secure and resilient public-safety network critical for essential communications during emergency situations. ■

DFW Airport Numbers

5 Terminals

12 Million Square Feet Coverage

25-by-25-Feet Test Tiles

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