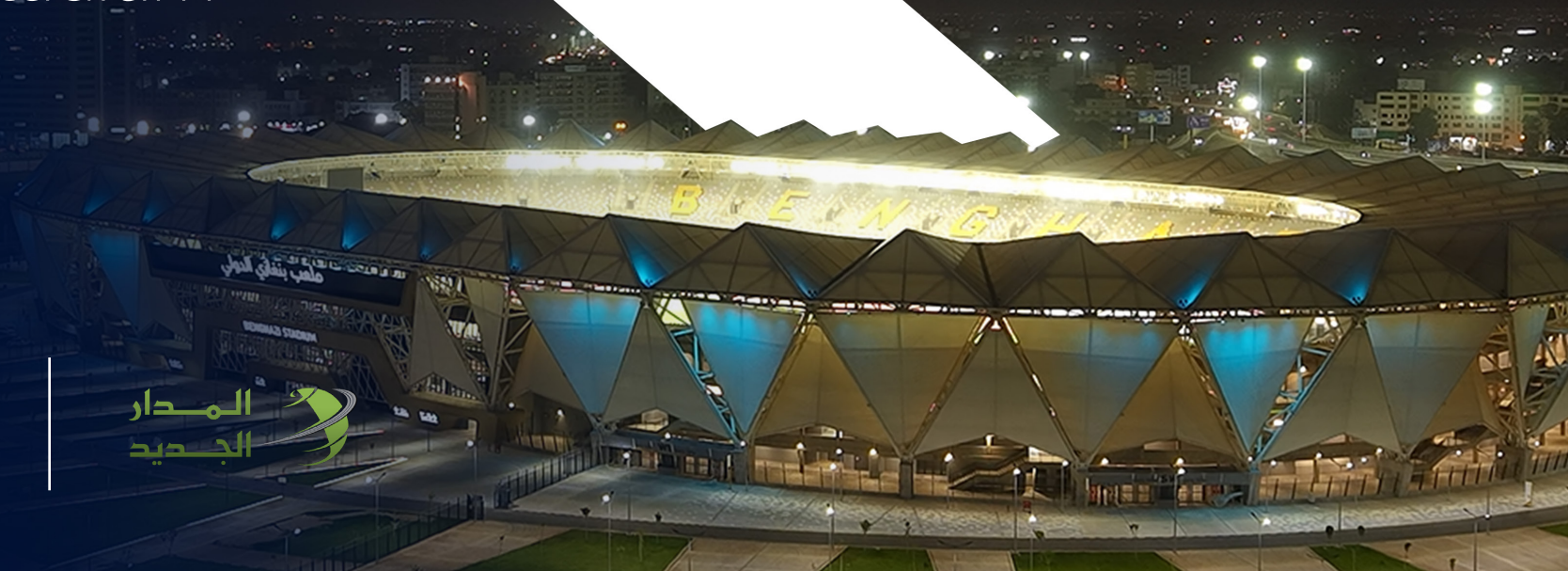


CASE STUDY

Al Madar leverages
Nokia's innovative
capacity solutions to
deliver exceptional
mobile performance
during peak stadium
event

NOKIA

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Delivering a flawless mobile experience at Benghazi Stadium was not just a technical milestone—it was a commitment to our customers, our brand and the future of digital connectivity in Libya. This project was an opportunity to prove that even in high-pressure, high-density environments, Al Madar can lead with confidence. With Nokia as our trusted partner, we were able to set a new national benchmark for network performance, customer experience and technological innovation. We're proud to showcase what's possible when world-class engineering meets local ambition.”

Abdelrahman Ahmed Arnaouti

Benghazi Branch Manager
Al Madar

Al Madar, one of the top two telecommunications providers in Libya with over 7 million subscribers, was presented with an important opportunity to demonstrate its technological leadership and network performance capabilities. The renewed Benghazi National Stadium, a 42,000-seat venue regarded as a national treasure, was scheduled to host major public events, which demand flawless mobile connectivity.

Stadium environments pose unique challenges for mobile networks due to high user density, low mobility and uplink-heavy data use—mainly from real-time video and image uploads. While the open design of stadiums reduces physical obstructions, it also complicates signal containment and interference management due to signal overshoot and limited structural boundaries. Al Madar aimed to set a new benchmark for in-stadium mobile performance at the Benghazi stadium. In partnership with Nokia, it delivered a best-in-class network to enhance user experience and reinforce Al Madar's leadership in Libya's telecom market.

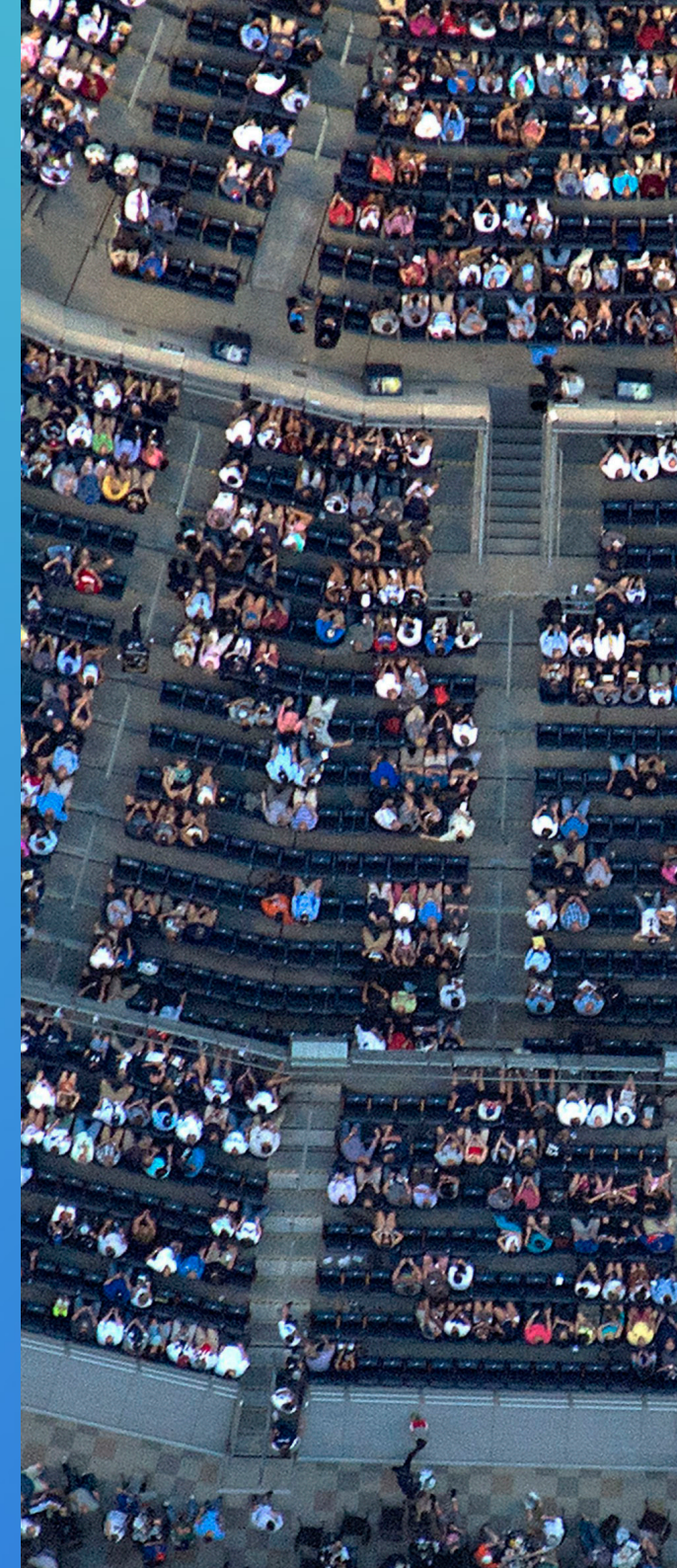
OBJECTIVE

Set a new national benchmark for mobile performance during peak stadium event

Al Madar's primary objective was to deliver **an exceptional mobile user experience during high-traffic** events in the newly renovated Benghazi National Stadium. The operator sought to showcase its ability to provide high-capacity uplink performance in challenging conditions, while also ensuring that voice traffic and basic LTE connectivity remained stable and reliable for all users.

More specifically, Al Madar aimed to highlight the success of its collaboration with Nokia by demonstrating the

tangible value of our Stadium LTE Solution and high-capacity solution for LTE network enhancements. The deployment also needed to account for **scalability, reliability and future-readiness**. It had to serve tens of thousands of simultaneous users without degradation, incorporate energy-efficient technologies and support long-term evolution toward 5G. Ultimately, Al Madar wanted this project to serve as a model **deployment for future high-density urban and event-based use cases** across Libya.



SOLUTION

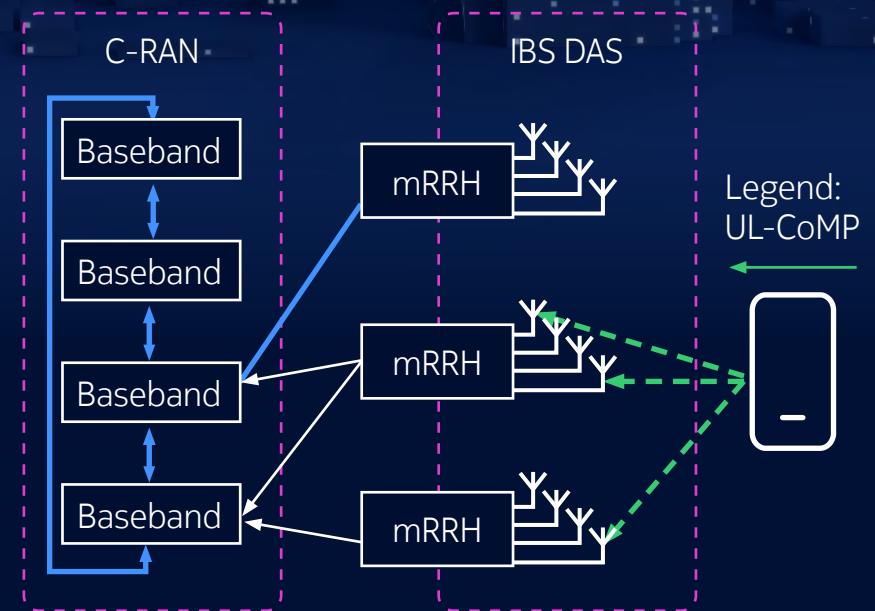
High-density LTE and 5G-ready network built for stadium-scale performance

To meet Al Madar's requirements, we deployed a comprehensive Stadium LTE Solution featuring our advanced **Centralized RAN** (C-RAN) architecture with uplink **Coordinated Multi-Point** (UL CoMP) capabilities. **This design incorporated AirScale baseband modules, micro RRHs and an IBS DAS system** (indoor-building solution - Distributed antenna system), tailored for high-density environments. In parallel, our high-capacity solution with multi-beam technology was also integrated to boost overall throughput and spectrum efficiency.

The solution was engineered to address the stadium's specific conditions: high uplink traffic, low user mobility and variable crowd density. The network design ensured strong coverage across all seating zones, concourses and VIP areas. Peak throughput tests recorded **835 Mbps downlink and 98 Mbps uplink**—sufficient to support heavy content sharing during events.

Our architecture also emphasized **reliability and redundancy**, with multi-layer fallback mechanisms to maintain service continuity. The network was designed to scale efficiently based on crowd size and to operate in energy-saving mode during low-traffic periods. Most importantly, **all deployed equipment is**

5G-ready, allowing for seamless integration of future upgrades. The holistic, forward-thinking approach ensured that Al Madar's investment would yield sustained benefits far beyond the initial event deployments.



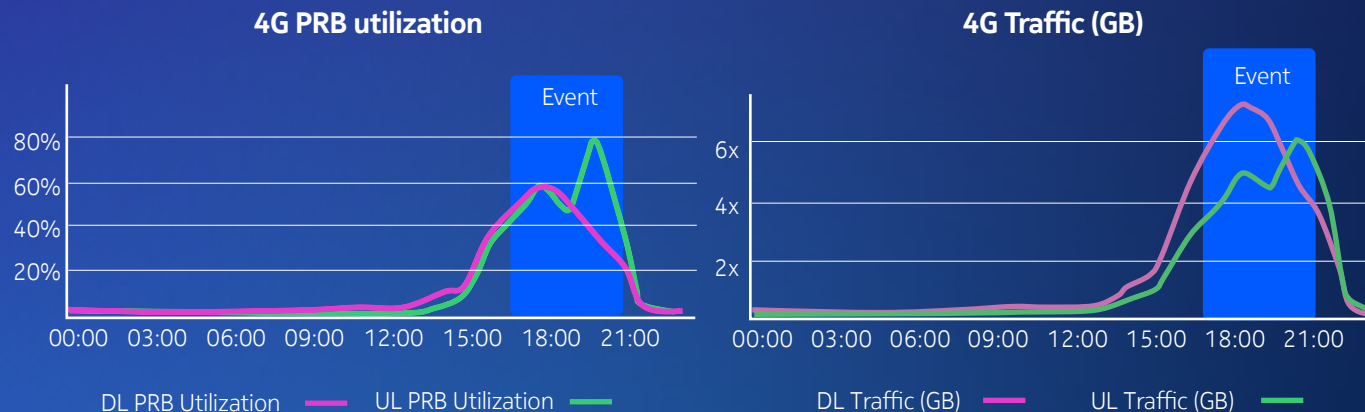
Uplink Coordinated Multipoint (UL-CoMP) receiver combines the best signals from several antennas, helping to mitigate interference, as well as improve throughput and capacity.

RESULTS

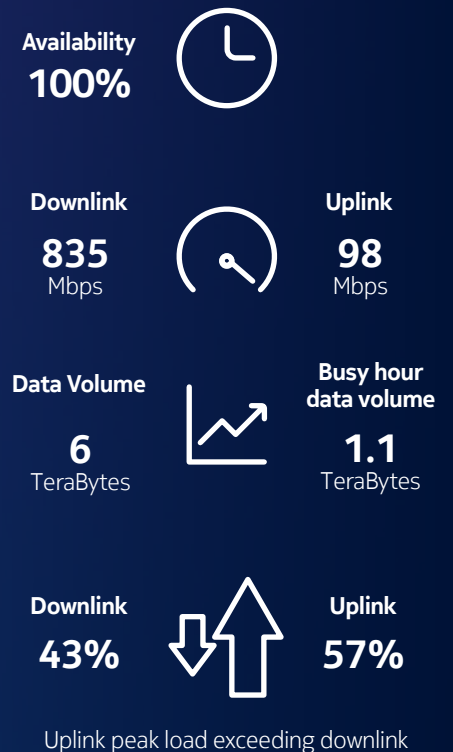
Exceptional network performance and efficiency under high-demand conditions

The network deployment in Benghazi Stadium delivered outstanding results, validating the joint effort between Al Madar and Nokia. During the launch event, the stadium network managed over 6 terabytes of LTE data traffic in a single day, with **1.1 TB** during the busy hour alone. Impressively, **the uplink traffic exceeded the downlink**—accounting for **57%** of the peak load, a clear

indicator of users' realtime sharing behavior. The system maintained **100%** availability throughout the event, with peak throughput reaching **835 Mbps** on the downlink and **98 Mbps** on the uplink. These figures confirmed that our infrastructure could handle extreme network stress while maintaining performance.



The solution effectively managed the surge in uplink traffic

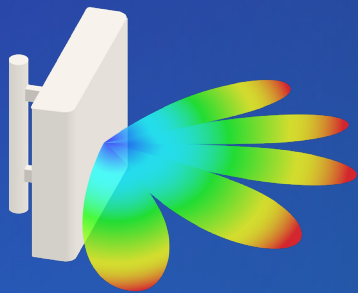


RESULTS

Significant boost in capacity and spectral efficiency with Nokia High-Capacity solution

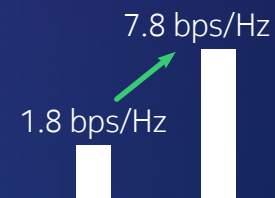
Additionally, our high-capacity solution, leveraging multi-beam technology, has been successfully deployed in the Al Madar network to address previously unserved traffic demand, particularly in dense urban environments.

The impact has been substantial. At a site where the high-capacity solution was deployed, spectral efficiency surged from **1.8 bps/Hz to 7.8 bps/Hz**. Busy hour traffic more than tripled, rising from **32 GB to 104 GB**, while daily **traffic volumes quadrupled** to exceed **4 TB**. The number of RRC-connected users per site also doubled, greatly enhancing the network's ability to support simultaneous connections.



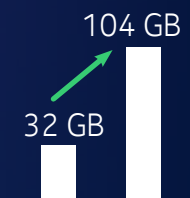
Multi-beam antenna
boosts capacity

Spectral efficiency



4x

Busy hour traffic



3x

Data volume



4x

RRC connected users



2x



GLOBAL PERSPECTIVE

Scalable innovation built for global challenges, proven in local contexts

Our Stadium LTE solution, particularly its C-RAN and UL CoMP technologies, has become a leading example for delivering high uplink capacity in challenging environments such as stadiums and mass events. These solutions were developed specifically to **address the unique demands of uplink-heavy scenarios**, where thousands of attendees are simultaneously uploading content to social media or streaming live from their mobile devices.

Globally, many network solutions struggle with the inverse nature of traffic during events—most are optimized for downlink-heavy usage. **Our offering stands out by transforming uplink noise into usable throughput**, delivering not only improved performance but also energy efficiency, which extends smartphone battery life and reduces network strain.

The success of the Stadium LTE solution in **Benghazi Stadium project demonstrates the adaptability of our global solutions to localized markets**. Nokia and Al Madar are capable of replicating this model in other high-density venues. The Benghazi project serves as a case study not just in technical achievement, but also in strategic foresight and global best practices.



For more information, visit the [Small cells webpage](#).

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Nokia is a global leader in connectivity for the AI era. With expertise across fixed, mobile, and transport networks, powered by the innovation of Nokia Bell Labs, we're advancing connectivity to secure a brighter world.

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