

China Unicom's 5G-Advanced trial in Beijing demonstrates a new deployment paradigm

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Beijing Financial Street – the most valuable and the most challenging area for a mobile operator

Beijing Financial Street (BFS), also known as China's Wall Street, is the country's financial powerhouse, housing more than 1,900 financial institutions in 2022, including 175 corporate headquarters and 16 Fortune Global 500 companies, according to the "2023 Financial Street Development Report." These institutions span banking, securities, insurance, financial infrastructure facilities, and more and also include China's central bank and all financial regulatory commissions. By the end of 2022, the total assets of financial institutions in the area had reached CNY138.7tn, accounting for one-third of the country's financial assets.

Therefore, BFS is one of the most valuable areas for every Chinese mobile operator. They must do their best to guarantee the area's quality of services. However, the BFS area is also among the most challenging deployment areas for mobile broadband networks.

There are more than 60 huge buildings, many with glass curtain walls, in the 2.59 square kilometer area. This makes the radio propagation environment in the area very complex. On the other hand, the population density in the area is also one of the highest in the world. More than 120,000 people per square kilometer in the area generate tremendous traffic pressure on mobile networks. According to China Unicom Beijing Branch (Beijing Unicom), utilization of its 5G network in this area is already over 70% during peak hours four years after it launched 5G commercial services.

Beijing Unicom trials 5G-Advanced in BFS with a 3D layered deployment model

Beijing Unicom collaborated with Huawei to deploy a 5G-Advanced pilot network in the BFS area. New frequency bands and new technologies are being introduced to the pilot network to meet growing traffic demand and guarantee the quality of services. Beijing Unicom hopes that the consistent premium user experience in the high-value area can differentiate it from rivals. The pilot could also be a reference model for China Unicom's future 5G-Advanced rollouts.

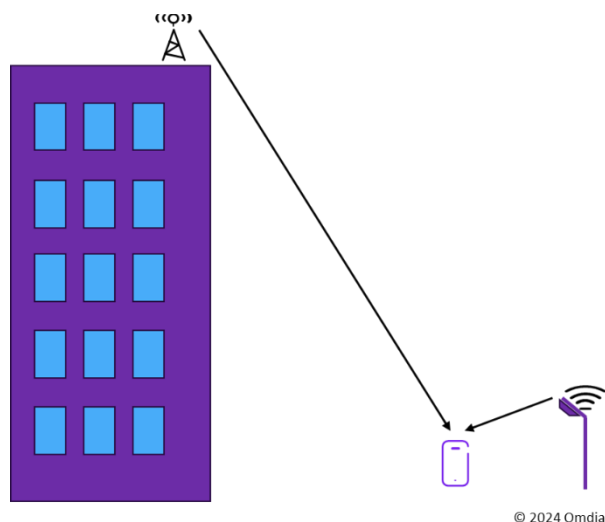
Beijing Unicom aims to achieve a 10-fold improvement in network performance over its current 5G network. Therefore, it leveraged interband carrier aggregation technology to combine the high-frequency band with the carriers in the low-frequency band. Through the aggregation, a 10Gbps peak data rate has been achieved.

Another performance objective of the 5G-Advanced pilot is to achieve a 5Gbps continuous experience in the BFS area. This is even more challenging than the peak data rate objective considering the complex radio propagation environment and the limited link budget of the high-frequency band. Therefore, Beijing Unicom and Huawei together deployed a series of technologies to implement the premium user experience, such as the extremely large antenna array (ELAA) and smart beam management.

Huawei's third-generation ELAA active antenna unit (AAU) can support more than 1,000 beams. In combination with the smart beam management algorithm, the narrow beam can accurately track the user's movement and significantly improve the signal-to-interference ratio (SIR) to achieve an excellent user experience.

Based on the capability of ELAA and smart beam management, Beijing Unicom designed a 3D layered architecture for the 5G-Advanced network in the BFS area to coordinate macro cells on the top of the roof and microcells on the lamp pole. The coordination between multiple transmit-receive points (M-TRP) can give users a consistent experience in the complex radio propagation environment.

Figure 1: Illustration of M-TRP coordination between macro cell and micro cell



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The ELAA, smart beam management, interband CA, and M-TRP coordination together enable Beijing Unicom to build a 3D layered 5G-Advanced network in the BFS area to provide a premium user experience. In late January 2024, this Omdia analyst experienced the 5G-Advanced pilot network. An average data download rate of 5.50Gbps was achieved during a 20-minute test drive.

5G-Advanced serves ultra-high traffic scenarios and empowers real-time video program production

Besides the 5G-Advanced pilot in the BFS area, Beijing Unicom has also deployed a 5G-Advanced trial in Beijing Workers Stadium, a landmark stadium with more than 68,000 seats. Deployed inside and outside the stadium, 5G-Advanced cells were used to support ultra-high traffic levels during big events, particularly to empower a flexible real-time video program production.

China Media Group (CMG) is China's state media company for radio and television broadcasting. It has deployed 200 5G-capable electronic news gathering (ENG) systems to facilitate news reporting. Now, CMG is launching an ultra-high definition shallow-compression encoding and real-time video production system for live broadcasts. The new system requires up to 880Mbps uplink data transmission bandwidth and end-to-end latency of no more than 30ms.

The 5G-Advanced system deployed in the stadium can provide over 4Gbps uplink data rate, supporting simultaneous transmissions of multiple cameras. This significantly improves the flexibility and cost-effectiveness of the live broadcast service, because leased-line connectivity limits the camera deployment flexibility, and satellite-based connectivity is around 10× more expensive.

CMG is satisfied with the trial results and will extend the 5G-Advanced-capable ENG system to more program production areas; it even plans to build a full-wireless studio for esports programs.

Summary

Beijing Unicom's 5G-Advanced pilots show that the technology can dramatically improve mobile network performance and meet growing demands from consumers and vertical sectors by introducing high-frequency bands and new multi-antenna solutions. More importantly, the pilots demonstrate how an operator can achieve consistent premium user experiences across diverse frequency bands in a dense urban environment.

Beijing Unicom's practice illustrates the value of a 3D layered deployment model, which coordinates radio resources across beams, carriers, cell sites, and deployment layers by leveraging advanced solutions such as smart beam management and M-TRP transmissions. The new deployment model can enable mobile operators to fully use the spectrum resource in high-frequency bands, providing a consistent experience across the network coverage area.

The deployment model requires a tight collaboration between mobile operators and equipment vendors. As Yang Lifan, vice president of Beijing Unicom, pointed out: "The key factor of a successful deployment is the deep convergence of a vendor's advanced technologies and an operator's network operation capabilities." The 3D layered model enabled by tight operator-vendor collaboration will create a new paradigm of mobile network deployment. We expect to see the paradigm adopted by more operators when 5G-Advanced rollouts are extended.

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