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White Paper

The State of Private Wireless

Unlocking Reliability and Stability in
Industrial Environments

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Market Summary

The Private Cellular Network equipment market will grow to more than \$7 billion by 2028, including a combination of business ‘stolen’ from Wi-Fi and new business created by adoption of industrial automation. The PCN market growth will also be widespread, with at least 13 vertical market sectors contributing to solid market growth.

In broad categories, the Industrial Private Cellular market (focused on “heavy” industries) and the ‘Light Enterprise’ Private Cellular market (focused on ‘light’ or ‘carpeted’ enterprises) represent two common types of use cases for private wireless.

Industrial cases are often asset-heavy and covering large outdoor areas that require wide-ranging and reliable wireless connectivity for workers and specialized systems such as automated robots or guided vehicles. The “Light Enterprise” cases are human-centered and more indoor in nature including video surveillance, inventory and production management applications as well as emerging neutral host services. The lighter, indoor applications involve cooperation between Private Cellular, public cellular services and Wi-Fi, while the heavy-duty outdoor cases typically lead to Private LTE or Private 5G independent of any Wi-Fi coverage.

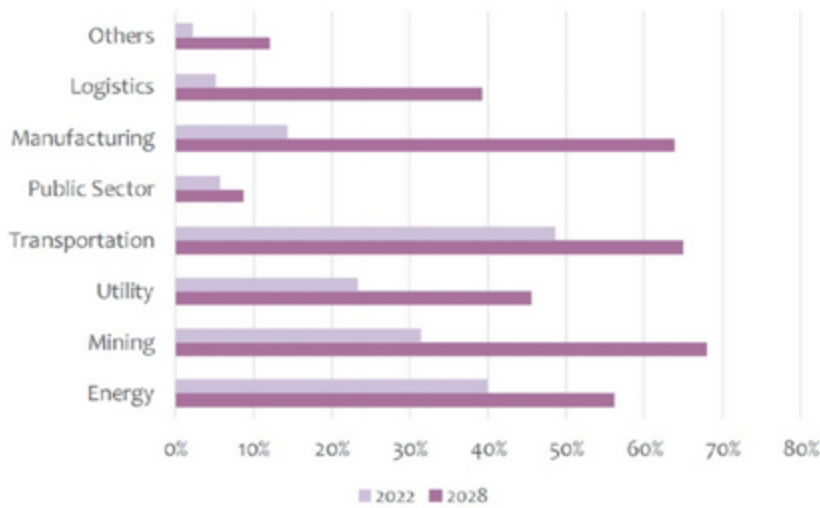


Figure 2 - Percentage of Wireless spending on Cellular technology, by Industry Segments

Industrial networks are mission-critical by nature, so it is not surprising to see heavy-duty businesses like Mining and Energy leading the charge away from Wi-Fi and toward longer-distance links with high reliability. The other sectors will follow, driving adoption from the top 10% (the early adopters) to the next 30% of the market and more. This market is moving very quickly from “a few big industrial players” into the mainstream.

Primary Use Cases

There are several high-level use cases driving enterprise adoption of private cellular networks in the Private Wireless industry verticals. We have seen a few more, but general use cases driving private networks remain largely the same – around mobility, wide-area coverage, deterministic connectivity, and security. Some of the specific use cases include the following:

- Premise Security – connecting surveillance cameras for the physical security of premises
- Video and Computer Vision – AR/VR-assisted diagnostics in industry 4.0 applications
- Fixed Wireless Access – broadband connectivity for access and Wi-Fi offload and back haul in campus networking; “cable replacement” where wired cabling is economically prohibitive, such as digital signage outdoors
- Mobility – autonomous guided vehicles (AGVs) in manufacturing, logistics warehousing, and mining automation; remote control and operations of mobile vehicles and robots in mining
- Remote Control & Monitoring – remote control of high-value assets (e.g., medical and industrial equipment) and sensor networks for predictive maintenance of critical assets to avoid downtime
- Connected Workers – improve worker productivity through better “push-to-talk” communication tools and data tools such as mobile scanners



MARKET DRIVERS

In the Industrial Private Cellular market, we see two broad macro market forces providing a tailwind to the adoption of private cellular networks across the industry sectors that make up this market segment.

Public Infrastructure Investment

Perhaps this is a direct result of the global pandemic, the end of LifeCycle of aging public infrastructure, supply chain realignment from geopolitical tensions, or combinations of all of those factors.

Digital Transformation Projects

The second macro driver of private networks is the combination of numerous digital transformation projects undertaken by companies in the private sector. With rising global trade tensions, many large companies are looking to realign their supply chains to de-risk their heavy reliance on China. As part of this effort, some are on shoring their manufacturing or distribution base to other regions. To make operations more efficient these companies are investing in digital technologies and automation tools, including private networks, to make their operations more efficient. In some sectors like Utilities and Railways, there is a growing acknowledgment and desire to align the next-generation infrastructure based on LTE/5G technology that provides a sustainable ecosystem of supplier base for years to come.

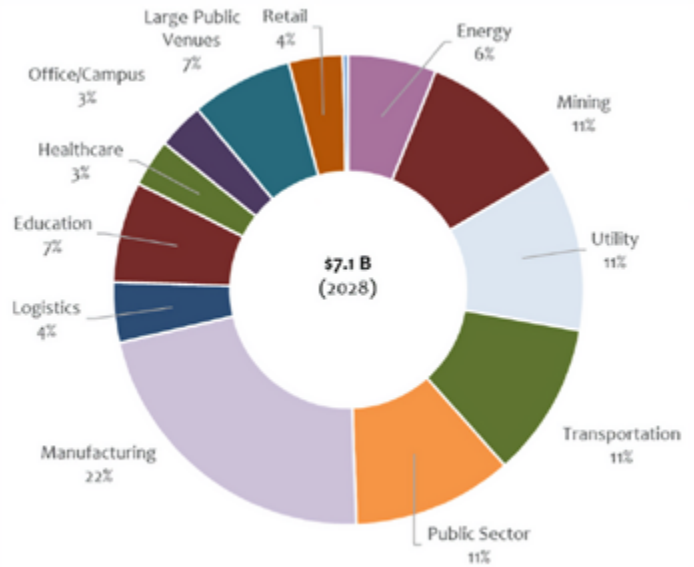


Figure 3: Private Cellular Equipment Revenue by Vertical Sector

A critical challenge in private networking is the complex nature and/or perception of operating private LTE and 5G networks. While a network operator with tens of thousands of highly skilled employees running a 5G network may not be a considerable challenge, it is a different matter for an enterprise with no telecom expertise. Enterprises have self-managed their IT infrastructure - buying separate hardware and software components, integrating them, and operating the infrastructure on their own. While this self-managed IT model has worked for decades, many are seeking a better and cheaper way to consume IT and OT applications.

One good example of Private Wireless that fits the “self-managed IT model” comes from Celona. Many other vendors approach the Private Cellular opportunity with large networks that are scaled down for the enterprise, and the result is a complex network that can require a few days to set up. Celona takes a turnkey approach, and a typical Celona network can be fully deployed and operational in a matter of hours - leveraging existing LAN infrastructure, IP network services and QoS framework the enterprise already has in place. This kind of IT-friendly setup is the key to “crossing the chasm” from early adopters to mainstream customers.

TECHNOLOGY CONSIDERATIONS

While Wi-Fi will continue to play a vital role in enterprise campus networking – especially for basic broadband access – for advanced OT applications, many enterprises plan to add private LTE or 5G.

For use cases requiring low latency, reliable connectivity with predictable throughput, broader coverage, mobility support, and robust security, a private cellular network is a better fit. In this way, Wi-Fi and private LTE/5G networks will co-exist to support the entire breadth of IT and OT applications.

To achieve the higher reliability and stability of Private Cellular, licensed or shared spectrum is key.

Government regulators see the potential benefits of enterprise 5G networking in business-critical industrial-grade applications, so momentum for more shared spectrum options has been gaining traction across the globe. Also, various industry groups, such as MFA, On Go Alliance, 450 MHz Alliance, and other ecosystems, have made spectrum access for private networks more available.

Locally licensed shared spectrum is now available in many countries, such as the CBRS band in the USA and dedicated “local” spectrum bands for enterprise and industrial use. These “local” spectrum bands can typically be obtained through a light-touch administrative process. As regulators see the potential benefits of 5G networking in mission-critical, industrial applications, momentum is building across the globe to allocate dedicated local spectrum for the industry.



Deployment Models

Mobile Experts envisions three deployment strategies to support different usage models:

1. Fully Private, On-Premise – This deployment model is essentially creating a wireless local area network (WLAN) based on LTE/5G technology instead of Wi-Fi. Here, all LTE/5G network infrastructure elements are locally installed on-premise.
2. Hybrid Public-Private – This deployment model is a hybrid approach between the “fully on-premise” approach as described above and the “full cloud service” approach described below. As one example, certain network infrastructure elements could be locally hosted on-premise, such as radio access network (RAN), while other infrastructure functions like Core Network are hosted in the cloud. This deployment architecture provides some levels of control over data security while providing aspects of the full cloud service model.
3. Cloud-based Service (Operator-Managed Private Wireless) – This deployment model represents a usage model in which an enterprise subscribes to a “Private Wireless-as-a-Service” (PWaaS) delivery from a managed service provider. This is analogous to a cloud service model in which enterprises can subscribe to a private wireless connectivity service from a mobile operator, for example. Here, all network infrastructure elements are owned and managed by the operator, and the operator provides PWaaS through end-to-end network slicing or network sharing. (Note that the operator could choose to place radios on-premises or could choose to use its public network, i.e., Network Slicing.)

In addition to three possible deployment models, Mobile Experts tracks three distinct business models, reflecting the ownership of the network elements. Roughly 70% of the Private Cellular market today falls into the “Enterprise Direct” business model, where the enterprise takes ownership of the network, spectrum, and devices, as well as taking responsibility for the application integration.

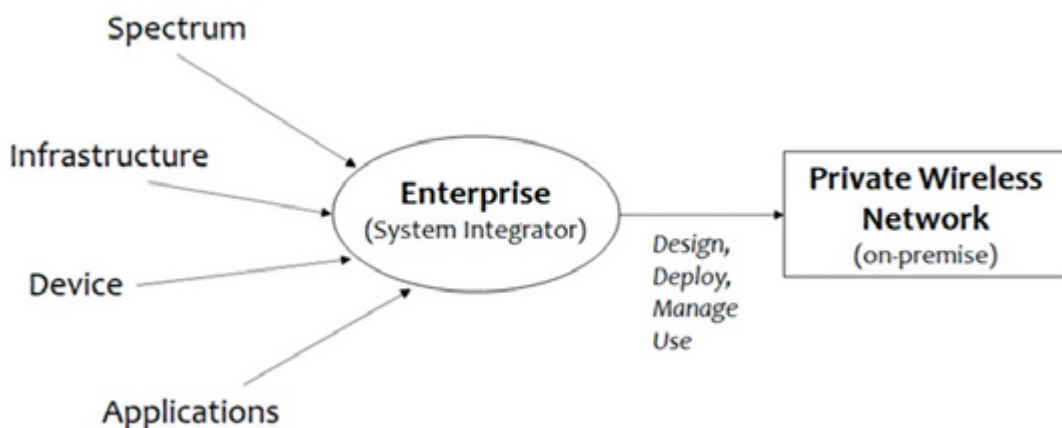


Figure 4: Enterprise Direct Business Model

The entire private LTE/5G network infrastructure is normally hosted onsite in this business model, including the RAN and core networks. In addition, an enterprise can deploy a private LTE/5G network on dedicated spectrum for full autonomy - or using local or shared spectrum. For example, enterprises in the USA use CBRS (Band 48) to set up private cellular networks, using either LTE or 5G.

Outside the U.S., in regions such as Europe, 4G/LTE service isn't available, so enterprises leverage bands N77 and/or N78 within the 5G spectrum.

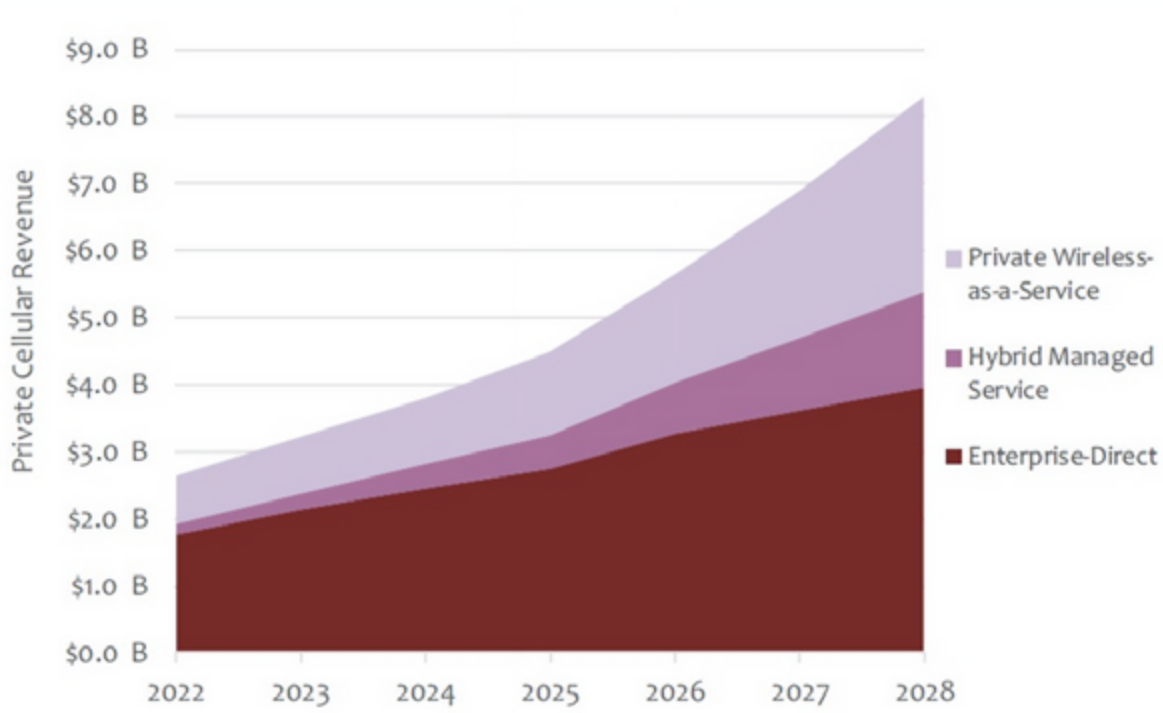


Figure 5: Private Cellular Revenue by business model

PRIVATE CELLULAR NETWORKS IN MANUFACTURING

Manufacturing is the most promising vertical industry for private 5G networking – by 2028, manufacturing apps will represent 28% of overall industrial private cellular revenue.

Large manufacturers are leading private network deployments today. They have large IT and OT resources and budgets to take on these private network projects and have adopted the enterprise-direct model to stand up 5G standalone networks.

The promises of highly secure and reliable 5G wireless networking can provide considerable benefits in a complex factory environment requiring various wired and wireless technologies (e.g., Industrial Ethernet, Fieldbus, etc.). Gaining a few percentage points in operational efficiency and reducing unplanned downtimes can yield \$ billions in cost savings, as well as productivity gains. As a result, there has been a keen focus and interest among large automobile manufacturers in private 5G networks for predictive maintenance and efficient production flows.

Major manufacturers such as Volkswagen, BMW, John Deere, and others are good examples of companies that have successful pilot deployments and moving on to wider deployment on commercial assembly lines.

PRIVATE CELLULAR NETWORKS IN LOGISTICS

Warehousing and logistics are integral to the e-commerce supply chain, and the demand for warehouses became quite clear during the pandemic. Logistics companies grappled with labor shortages and needed an efficient flow of goods and data to automate the process and provide transparency in the supply chain. This implies that companies need to employ digitization and automation to expedite the flow of goods within warehouses and during transits. Efficient flow management of warehousing and logistics is seen as a competitive differentiator, and retailers are demanding transparency from everyone in the supply chain. The logistics industry is responding by employing digitization and automation to expedite the flow of goods. In this digital transformation effort, private LTE and 5G networks promise greater capacity, lower latency, and higher security than alternatives like Wi-Fi and LoRa.

In particular, in warehouses the use of AGVs has become quite common during the past two years, as the number of AGV vendors and the variety of tools has expanded greatly.

The high degree of maturity for devices and the obvious need for reliable wireless connections has made the AGV the fastest-growing application in the Private Cellular market.





CONCLUSION

Overall, the state of the industry is very encouraging. Many proof-of-concept projects have been completed during the past year, leading now to commercial projects with significant ROI for the enterprise. Logistics and Manufacturing are emerging as application areas with the widest applicability and strongest growth, while Mining and Energy represent well-established markets with mainstream customers today.

This market is already growing quickly, and it has become clear that growth will accelerate as Private Cellular is increasingly offered as a turnkey product or service, with pre-integrated radios, core networks, edge computing, and cloud-based orchestration. The ROI is proven. The technology is ready. And the business model is coming together – a little differently in each vertical sector. The golden age of wireless is coming to every business.



Use Case studies

celona.io/case-studies



TCO and ROI Calculator

celona.io/tco-calculator



Comparison with Wi-Fi

celona.io/CS-Distr-MSB



Custom demo

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