

# Leading the 5G IoT Race: Key Industry Insights Series 2. 5G Private Networking

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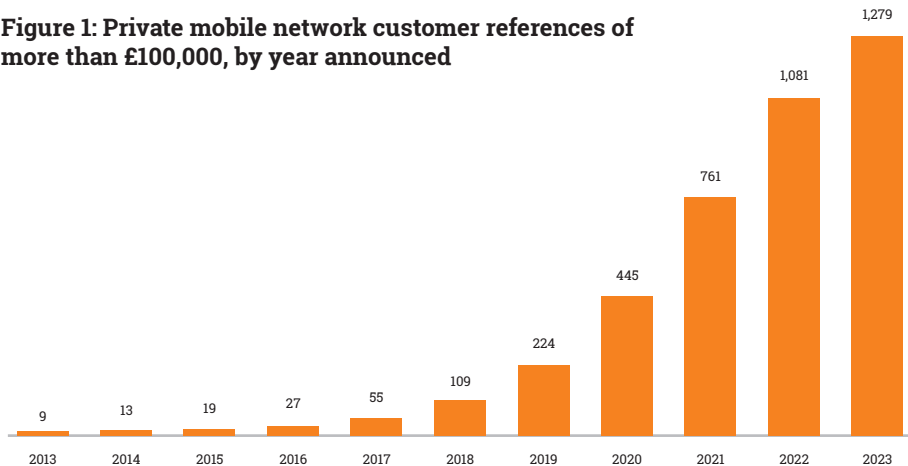


The use of Private Cellular Networks (PCN) has grown at a modest pace over recent years, but this is now set to change dramatically as use of 5G picks up over the next few years. Analyst forecasts indicate spend on these networks increasing substantially, from \$1 billion in 2023 to nearly \$10 billion globally by 2028 (Juniper Research), with the number of private networks deployed reaching over 60% growth per annum (Analysys Mason) in the period, rising from 1000+ such networks in 2022 to 13500 by 2026.

# 1. The growing case for private 5G

Use of 5G for public networks is already reaching high numbers. As of August 2023, GSA identified 265 live 5G networks worldwide, 45 live 5G standalone networks, and expected 45% population coverage by end 2023. An update in November 2023 showed that in 2022, 321 new private network customers categorised by GSA were announced. This number eclipsed net growth in previous years, with 2021 representing 312 announcements. It should be noted that slowdown in the number of announcements is not representative of slowing growth in market activity – rather, existing customers are continuing to scale trials to multisite deployments, and announcements will greatly vary in the size of contract value. Figure 1 shows customer announcements grew at a compound annual growth rate of 81% from 2017 to 2022.

**Figure 1: Private mobile network customer references of more than £100,000, by year announced**

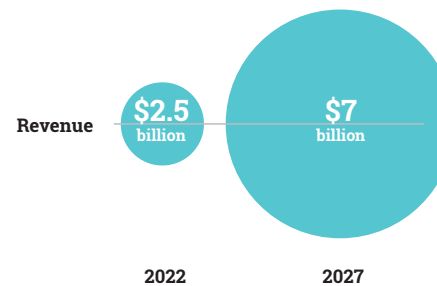


Source: Private-Mobile-Networks November 2023 Summary Report - GSA )

A further forecast from Omdia indicates that revenue from 5G Enterprise private networks will reach nearly \$7 billion by 2027, up from \$2.5 billion in 2022, and ABI Research predicts that the total number of digital factory terminal connections will reach 4.7 billion by 2030, up from just 500m in 2023.

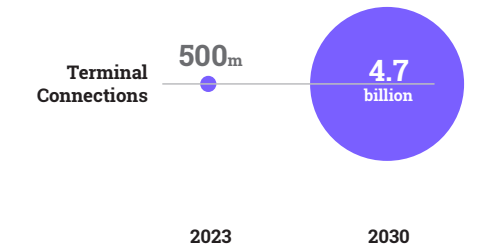
What all of these forecasts have in common is strong expectation that the evolution to private 5G will significantly open up the private network market over the next few years.

**Revenue from 5G Enterprise Private Networks**



Source: Omdia

**Terminal Connections of 5G Enterprise Private Networks**

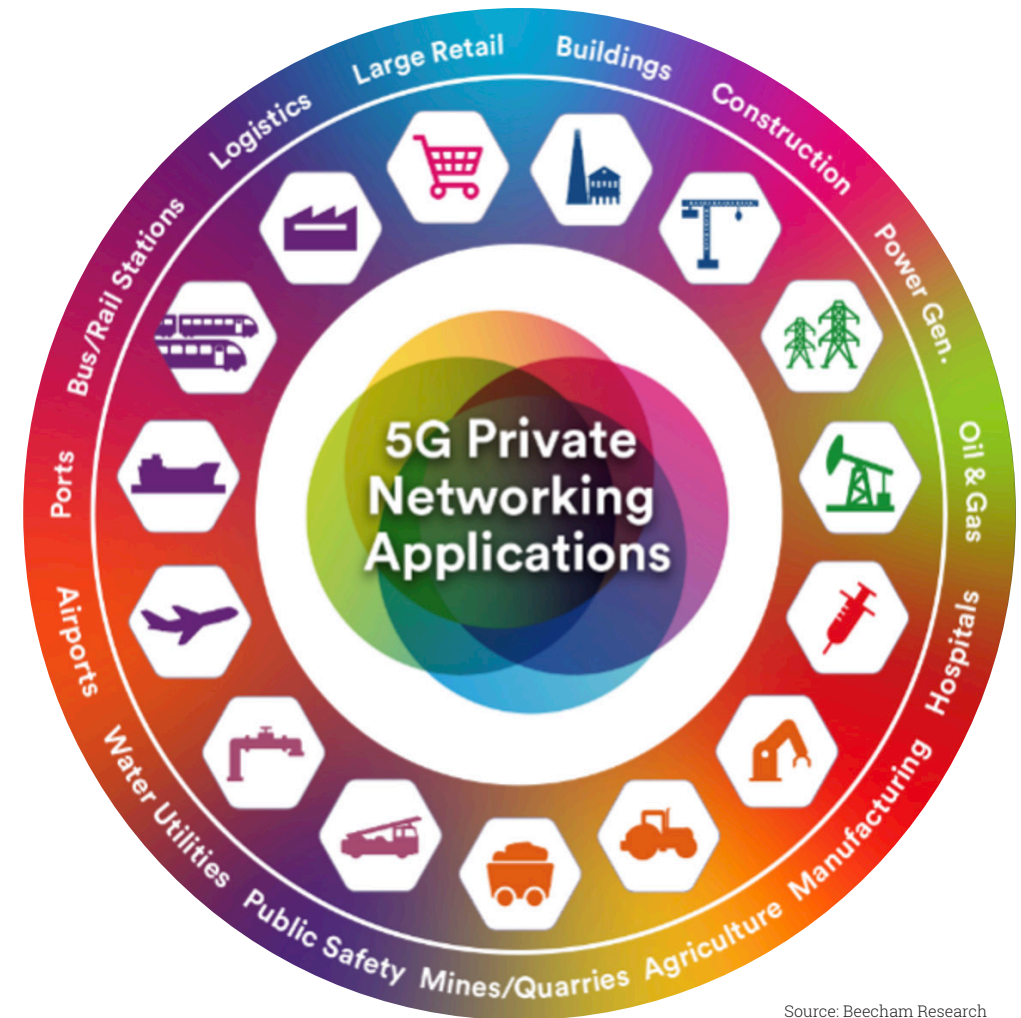


Source: ABI Research

## Why is that?

IoT in business operations has the proven ability to boost operational efficiency, improve product and service performance, and enhance operational agility. The overall result is a significant uplift to a company's competitive offer and its bottom line. IoT has truly moved from 'nice-to-have' as a low cost, remote monitoring activity to 'strategic necessity' in many business operations as the emphasis moves more towards control and automation. This trend is set to continue at a fast pace over the next decade.

As a result, in the coming years, constraints on existing network capacity will mean that industries must increasingly turn to dedicated private options to meet their needs, especially in terms of digital transformation and the increasing demand for IoT connectivity. Frontrunners in the adoption of Private LTE and Private 5G include industries such as oil and gas, and mining which rely on critical communications to coordinate their operations in real time. Areas requiring high levels of security and data throughput, such as airports and ports are also early adopters, along with smart manufacturing and smart logistics facilities.



Source: Beecham Research

## 2. What are the benefits of Private 5G Networks?



Private 5G can be deployed in several different ways – isolated, shared and network sliced, as follows:

**Isolated network** - The entire private network is owned and operated by the user and completely isolated from the public network.

**Shared network** - A hybrid configuration that leverages part of the telecom service provider's infrastructure together with private network elements, such as additional Radio Access Network (RAN) elements to ensure the required site coverage.

**Private network slice under public network** - The private network is realized by network slicing. This leverages the operator's existing public network infrastructure and offers private connections through the software-defined network slice.

Private 5G networks are a means to an end, that end being the conversion of massive amounts of IoT data into actionable local and distributed information and intelligence that is securely accessible for authorised personnel and third parties in corporate ecosystems. Private 5G networks are part of the broader organisational trend towards digital transformation. The term digital transformation refers to the deep integration of digital enabled processes into all aspects of an enterprise, along with

an associated cultural change. The key objective is to enhance customer experiences by implementing fundamental operational changes. Private 5G, with its combination of greater device density, high bandwidth and low latency services, enables transformative connectivity, which in turn allows enterprises to realise their transformation strategy.

In this way, private 5G is a catalyst to elevate industrial operations. The main benefits of private networks for business operations include:

- Consistent localised campus coverage, both indoors and outdoors, designed to meet on-site needs.
- A highly secure environment, with enhanced network security and data remaining on-site.
- The provision of enough network capacity to meet connectivity and data handling requirements at all times.
- Local management control over network traffic and use, including seamless integration with enterprise IT/OT.
- Very high and controllable network reliability.
- Predictable and ensured low latency – data control.
- High data throughput and support for high density devices

An example of how private 5G can aid operations is illustrated in the case of coal mining.



As the chart indicates, key challenges for coal mining include – a harsh underground environment, high costs, low productivity, with safety supervision needing to be improved as safety of personnel is the top priority. Operation activities where private 5G can make a substantial contribution are in Monitoring, Inspection, Communications, Control, Drive and Location, in at least 12 key application areas.

Within the 5G framework, Massive Machine Type Communications (mMTC) can support up to one million devices per square kilometre; Enhanced Mobile Broadband (eMBB) can transmit data at 10 gigabits per second; and Ultra Reliable Low Latency Communications (URLLC) offers extremely low, down to 1ms latency. These services are set to drive the expansion of a

massive hyperconnected ecosystem where networks serve the connectivity requirements of very large numbers of low power consumption devices, with acceptable performance trade-offs between speed, latency, and cost.

Private 5G is essentially a wireless LAN that delivers unified connectivity and a secure means of wireless communication within a specific area. It functions as a wireless extension of an enterprise's wireline LAN.

To implement private networking requires wireless spectrum, and the chart below shows current examples of local spectrum licensing or sharing for 17 different countries worldwide to illustrate the extent of spectrum allocations that have already been made.



Source: GSA, MFA

Indicating the growing activity in the supply side to support these increasing activities, new players and business models have emerged in the private 5G market, including cloud computing enterprises such as Microsoft, Google and AWS. Relying on their

public cloud advantages and industry user resources, these have acquired and collaborated with communication network suppliers and telecom operators to launch cloud centric 5G industry applications and services.


### 3. Fibocom 5G Private Network Case Studies

Fibocom is active in the 5G private networking market and the following case studies illustrate some of these activities.

#### A. Smart Manufacturing Factory


## Fibocom 5G Private Network Use Case – Manufacturing Factory

A Large Factory in China



MBB 5G Module  
FM650 FG652

5G Smart Module  
SC151 SC171



AI quality inspection  
AI Incoming Material Identification  
AGV Scheduling  
Forklift dispatching  
Industrial Computer IoT  
Robot IoT  
MES dashboard  
Visual intercom  
Energy & environment monitoring  
PDA  
Production line monitoring  
Barcode scanner  
Security monitoring  
Positioning  
Facial recognition

**Network Level**

Ultra UL Bandwidth: Gbps  
Stable Low Latency: 30ms@99.99%  
High Reliability: 99.99%

**Production Level**

Production Capacity: 17%  
Inventory: 50%  
Labor Cost: 30%

**Standard Level**

Construction Guideline of 5G Smart Factory in China

*E2E 5G Applications create a new industry benchmark.*

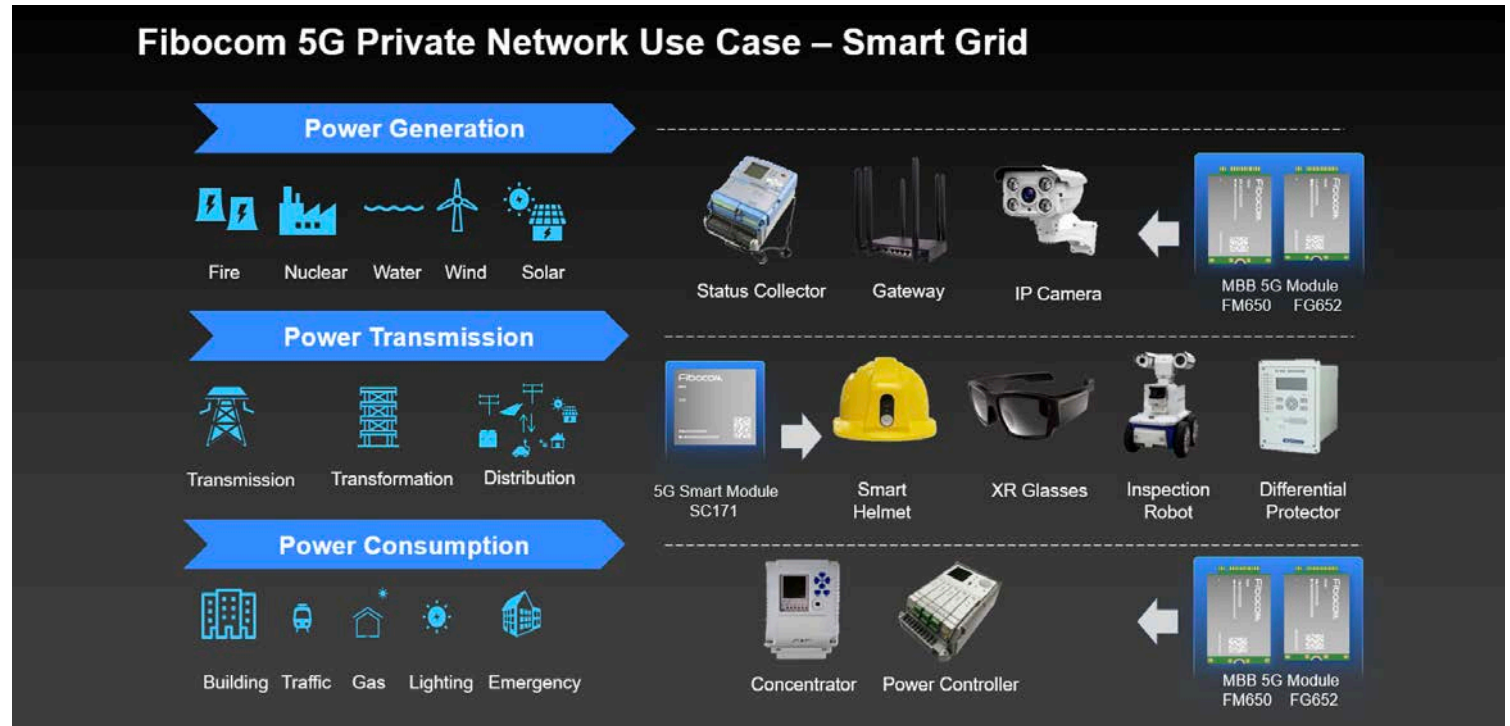
Joint Cooperation with China Telecom operator and ICT Manufactures  
Accomplished and Started Operation in August, 2022

**2500+** connected 5G terminals across **15** application scenarios

This large industrial park was facing a series of problems such as low production efficiency, high costs pressure, market shrinkage and outdated technology. A joint cooperation was formed involving Fibocom together with network operator China Telecom and the ICT Manufacturer to deploy a 5G private network for this huge industrial park. Fibocom 5G broadband modules FM650 and FG652, which supports the private network bands in China

were built into networking gateways, CPE and ODU. In addition, 5G smart modules SC151 and SC171 were adopted in their smart terminals such as PDAs, PTT-over-Cellular radios, wearable cameras and mobile robots, This has enabled support for rich video, image, data and voice applications. These activities have led to achieving 50% improvement in stock, 17% increase in production efficiency and 30% savings in labor cost for this industrial park.

## B. Power Equipment for Smart Grids



The construction of smart grids is gradually increasing the size of power distribution networks, and the digitalization of power grids is accelerating. The power equipment is facing an upgrade in demand and functionality. Fibocom 5G modules FM650, which supports the private network bands in China and 5G smart module SC171 have empowered our customers who develop terminal devices for the power industry to achieve commercial scale. They have also helped the power industry to be highly

efficient, environmentally friendly, energy-saving, low-carbon, and intelligent. From power generation, through to transformation, to transmission, to distribution and to consumption, the utility company in China is facing challenges such as data synchronization, transmitting real-time HD video for grid patrols and more. By integrating with the 5G module, it can greatly improve accuracy, save labor cost, and improve efficiency.

## 4. Fibocom recent announcements related to 5G private networks

Fibocom has introduced a series of 5G modules that support the private radio bands in regional markets, for example:

FM160-EAU (Europe, Asia Pacific, Australia) 5G module supports n28 (700Mhz)/n78 (3500MHz) bands for other regional markets:

Fibocom 5G Module FM160-EAU to be the First 3GPP R16-Compliant Module Receiving ANATEL Certification Shenzhen China – February 15, 2022 – Fibocom announced that its 5G module FM160-EAU has been certified by ANATEL, the National Telecommunications Agency in Brazil. Complying with the 3GPP Release 16 (R16) standards, FM160-EAU is the first R16-compliant 5G module receiving this certification, which is an important milestone of the product's entry into the Brazilian market.

ANATEL certification is a mandatory step for wireless communication products gaining access to the Brazilian telecommunications market. Completion of this ANATEL certification ahead simplifies customers' deployment process, laying the foundation for Fibocom's FM160-EAU to support multiple IoT applications in Brazil.

Powered by the Qualcomm Snapdragon® X62 modem chipset, Fibocom's FM160-EAU is an NR Sub-6 module backward compatible with LTE-TDD, LTE-FDD, and WCDMA network standards. The module supports NR CA, delivering maximum downlink rates of 3.5Gbps and uplink rates of 900Mbps under 5G, ideally suitable for IoT applications that require high data throughput such as IIoT, C-V2X, HD live streaming, telemedicine,

etc. The Fibocom FM160-EAU module adopts M.2 form factor measuring 30x52x2.3mm, which is compatible with Fibocom's 5G module series FM150.

Along with abundant functionalities such as digital audio, VoLTE, and VoNR, the Fibocom FM160-EAU module supports multi-constellation GNSS receiver, including GPS, GLONASS, BeiDou, and Galileo, which provides high-performance positioning and navigation while greatly simplifying product design. Meanwhile, it supports multiple operating systems (Linux/ Android/ Windows), various Internet protocols as well as industry-standard interfaces, allowing much flexibility and ease of integration for customer's application.

"We are excited to see FM160-EAU to be the first R16-compliant 5G module certified by ANATEL," said Gene Santana, VP of Overseas Carriers Certification Dept., Fibocom. "FM160-EAU is a high-value 5G module providing better 5G network experience for mass data scenarios. Fibocom will continuously empower the digital transformation and bring wireless connectivity to a broader range."

A further version – FM160-JK for Korea – supports n78 (3500MHz)/n79 (4500MHz) bands.

In addition, and as noted in the case studies above, the company also has a range of smart modules for terminal devices. For 5G, these are the SC171 and SC151, used for a wide range of devices such as Industrial PDAs, Drones, Access Control, Robots, and In-vehicle infotainment applications.



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## 5. One-on-one interview with Fibocom

*Following on from these announcements, the author of this report (RDW) interviewed Shirley Tang, Director of MTC Product Marketing at Fibocom (ST) to understand in more detail how Fibocom is meeting market needs for 5G private networking.*

**RDW: who are the most important stakeholders for 5G private networking that you look to support in the market?**

**ST:** We seek to support key stakeholders such as the telecom operators/MNOs, the MVNOs, infrastructure and base station vendors, and traditional ICT vendors – including Nokia, Ericsson, NEC and so on. In addition, the cloud technology enterprises such as Google, Amazon and Alibaba are also important for us. Then the big manufacturers who use 5G private networks for their own operations and vertical industry users – for example in mining, ports, airports, power utilities, and digital smart cities, since these are the final beneficiaries of 5G private networking.

**RDW: what do you see as the most important performance issues that must be supported for 5G private networking now and in the future?**

**ST:** The first big issue is interconnection. Because the networks, the base stations, the terminal devices and the gateways will be provided by different manufacturers. Each manufacturer has their own protocols, which are often different. This means the devices from different manufacturers may not work well together so that interconnection protocol should be the most important performance issue for 5G private network vendors.

Then there is compatibility. 5G private networks set up as new technology, which is needed to be compatible with 4G/5G public networks and other existing private networks such as Tetra system (widely used in EU countries), and PDT system (in China). The private network users always require a unified, integrated, and efficient management system; so, the compatibility with existing networks is very important.

Other performance issues are timing synchronization and security. Security is well-established for isolated private networks.

There is a further issue – not so much performance-related – of frequency resources. Frequency resources especially in European countries are quite limited and quite expensive.

**RDW: So how does Fibocom meet these challenges?**

**ST:** 5G private network has really only got going in the last two years. So, I think firstly we would like to propose drafting an interconnection agreement with 5G private network associations, for example GSMA and 5G ACIA (Alliance for Connected Industries and Automation) in Germany. I think all related manufacturers, including Fibocom, should follow this interconnection agreement, to ensure all devices from different manufacturers can interwork with each other.

Fibocom is a module developer and manufacturer. Our core element is the chipset. So at the start of the design process we will discuss clearly with the original chipset manufacturers about the compatibility and interconnection issues. It is very important to work closely with our chipset partners on these challenges.

Besides that, we also need to work together with private network users concerning the issues of interoperation, compatibility and security. We are aiming to understand their requirements better and integrate the related protocols into our modules during our R&D process, to avoid the issues mentioned above as much as possible.

**RDW: Your press releases talk about modules you have available for 5G private networking. Can you give examples of how these are being used?**

**ST:** Yes. Fibocom 5G modules have been adopted for private network gateways and routers, which have been used for a China power utility, coal mining operations and some large smart digitalized manufacturers. We also launched modules dedicated for the private network market worldwide, supporting the regional private network bands.

**RDW: Are you supporting other connectivity types for private network besides 5G? For example, 4G and Wi-Fi. Are you looking to integrate any of these with your 5G implementation?**

**ST:** We have a series of 4G smart modules integrated with Wi-Fi & Bluetooth for smart terminals which are used in vertical industries private networks.

Normally, several wireless communication technologies are integrated and work together when building a 5G private network. So Fibocom integrates multiple connectivity technologies into individual modules, including but not limited to 4G, 5G, Wi-Fi, Bluetooth and GNSS to meet different customers' requirements.

**RDW: What support do you provide for Wi-Fi?**

**ST:** We have series of 4G & 5G smart modules integrated with Wi-Fi & Bluetooth for smart terminals which are used in vertical industries private network. Fibocom is also developing Wi-Fi modules supported with Wi-Fi 2.4G & 5G, 6E and Wi-Fi 7, so that we can provide more professional and more complete 5G FWA solutions, which will be used in gateways and routers for private networks.

**RDW: Can you cater for roaming between public and private networks with this?**

**ST:** Yes, the gateways integrate public and private cellular modules and protocols. Multi-mode smart modules integrate public and private cellular protocols for multi-mode PN terminal devices, which can cater for roaming between public and private networks.



## 6. In conclusion

After modest growth in recent years, analyst forecasts predict substantial pickup in growth is now in prospect for 5G private networks over the next few years. IoT in business operations has the proven ability to boost operational efficiency, improve product and service performance, and enhance operational agility. 5G private networks are part of this trend towards digital transformation.

These expectations are highlighted by increasing acquisition and investment activity among market players, as they position themselves for growth in this market. Cloud computing enterprises, telecom service providers, industry giants and others are highly motivated to expand the 5G private network market based on their own core strengths in cloud, network and application areas. Supporting these trends, Fibocom has

introduced private network modules covering 4G and 5G Sub-6GHz. In addition, and importantly for private network build-out, the company has also introduced a range of smart modules for 4G/5G terminal devices.

With private cellular networks set to become the new gold standard across a range of industries and applications, device manufacturers are increasingly incorporating PCN network accessibility into their flagship products. Fibocom, in partnership with chipset companies and other IoT pioneers, is proud to be at the cutting edge of this innovation, driving the development and adoption of LTE and 5G PCN-compatible wireless modules. With these technologies in place, we envision networks that are not only smarter, but will also deliver a safer, more efficient, more connected future.