



Creating the Future of Global Connectivity Solutions with 5G Fixed Wireless Access

Introduction

Global investment into wide-scale network connectivity has been growing in recent years, from smart cities and factories to last mile service provision in hard-to-reach locations. Increasingly, service providers and governments are also aiming to close the digital divide by providing access to high-speed, reliable data services across a variety of contexts.

One of the key challenges with realizing this vision is the difficulty of building out physical wireline infrastructure. Laying fiber is often a costly and time-intensive process. In many instances, the business case for providing wide-scale connectivity to certain areas is also lacking, which means that service providers have little incentive to create infrastructure in those areas. A promising solution to this issue is to provide network connectivity through Fixed Wireless Access (FWA).



What is Fixed Wireless Access (FWA)?

With FWA, homes and businesses can connect to the network without a physical fiber connection using easily installed Customer Premises Equipment (CPE). This reduces the cost to both service providers and customers. Figure 1 below illustrates this concept, showing how CPE connects via a fixed access point in the area.

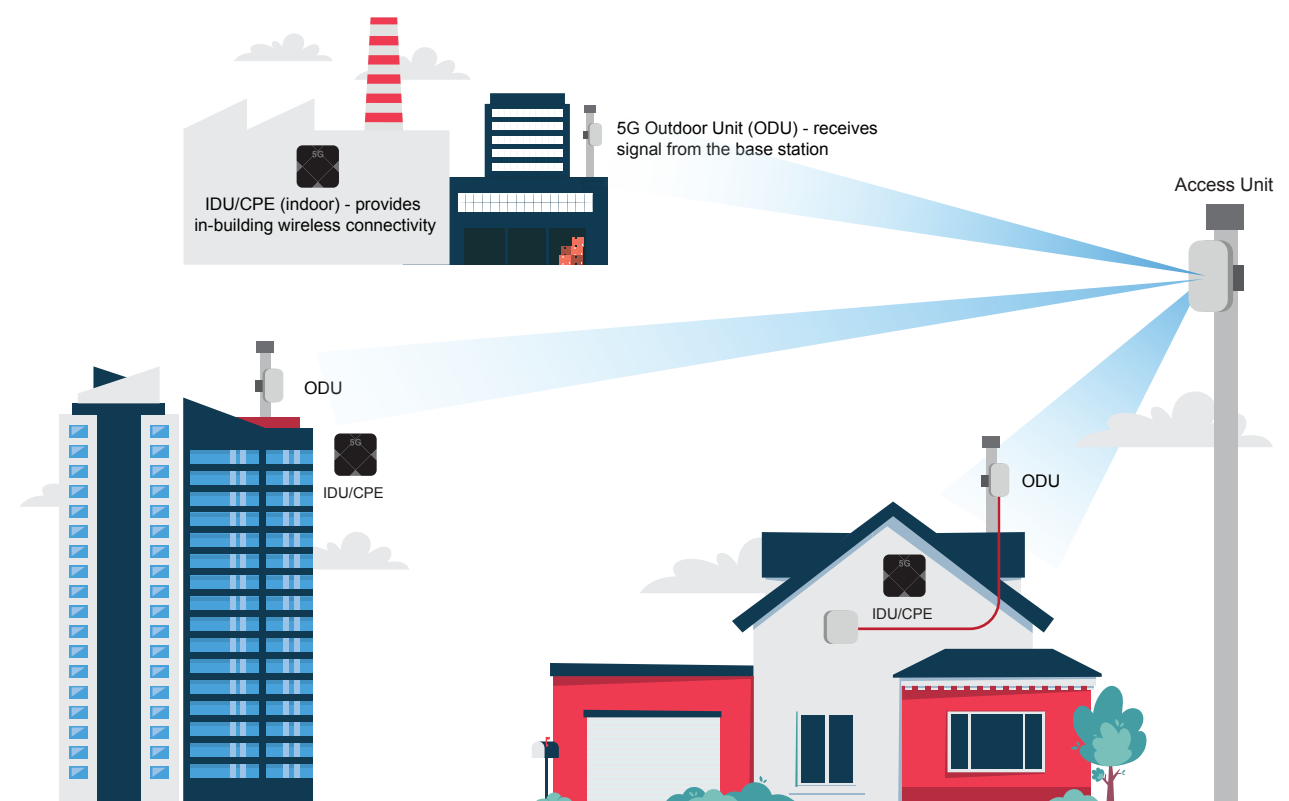


Figure 1: FWA Connectivity Using Easily Installed Customer Premises Equipment (CPE)

The advent of 5G has bolstered the use of FWA solutions. With the support of 5G, FWA networks can offer high-capacity, low-latency data services that enable ubiquitous, wireless connectivity. In this whitepaper, we explore the confluence of FWA and 5G technologies and how these pave the way for a rich range of use cases, from providing last mile connectivity to underserved communities to powering the smart factories and offices of the future.

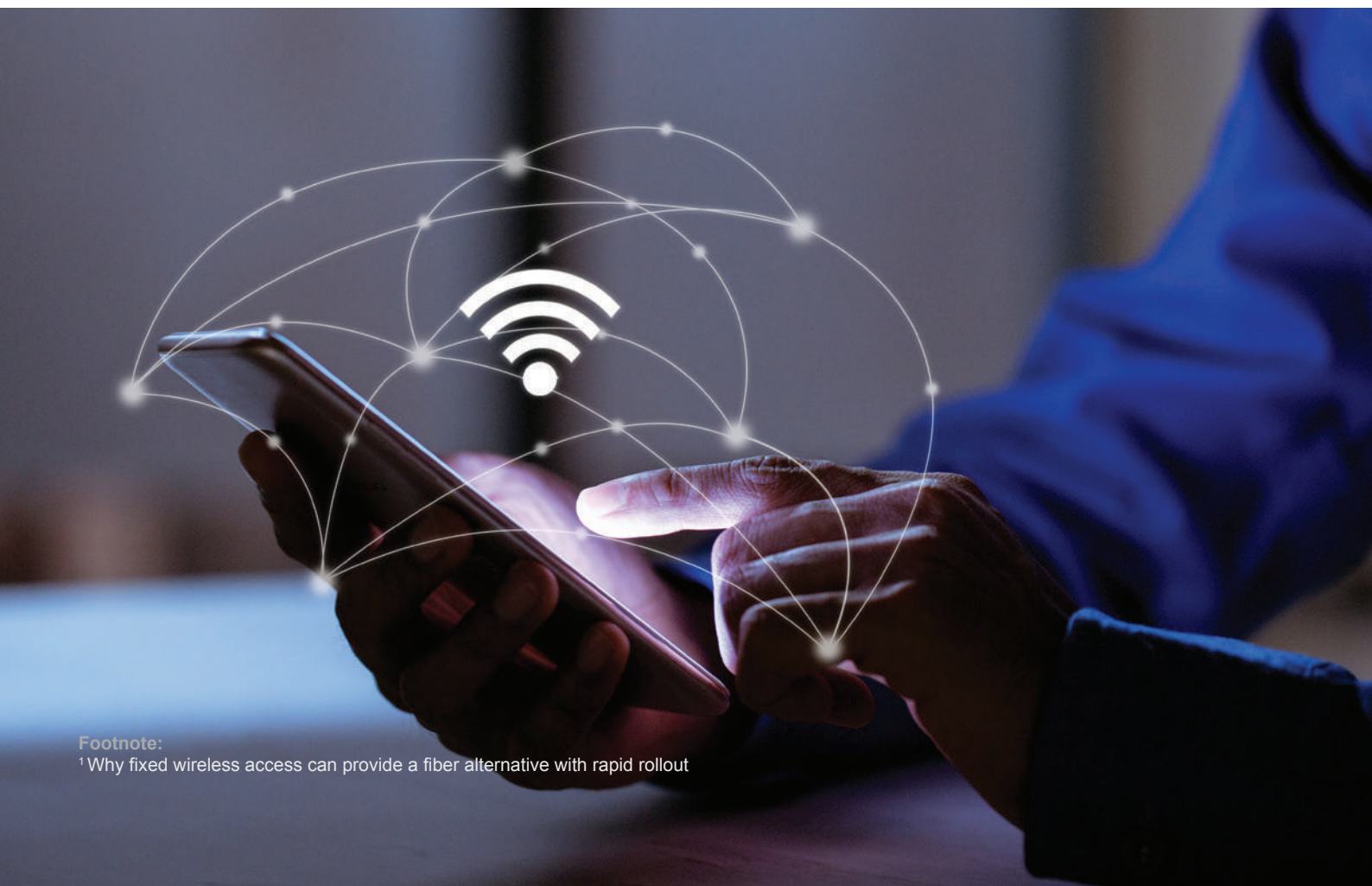
The Evolution of FWA

As a technology, FWA is not a new concept. FWA products have existed for many years, typically as 4G LTE and LTE-Advanced (LTE-A) offerings. But while 4G FWA offers a viable basic product, especially in areas that would otherwise lack connectivity options, general uptake of the technology has been low due to built-in constraints.

For example, 4G FWA offers inferior performance (i.e. speed and throughput) when compared to cable and fiber-to-the-home (FTTH). Along with restrictive data caps, these factors have slowed broad market adoption of the technology. Nevertheless, 4G FWA still plays an important role in providing connectivity in emerging markets.

Accelerating FWA Connectivity with 5G

With the introduction of 5G, FWA has become a compelling alternative to existing high-speed connectivity options across the globe. Powered by 5G, FWA can offer 10 times the bandwidth and 10 times lower latency than 4G solutions. In recent trials, for example, 5G FWA mmWave services delivered download speeds of 1Gb per second, placing them on par with top-tier fiber offerings¹.



Footnote:

¹Why fixed wireless access can provide a fiber alternative with rapid rollout

These gains in speed and performance mean that 5G FWA could become a preferred option in many scenarios, including urban homes, educational institutions, workplaces, smart infrastructure, and entertainment venues.

In addition, the reduced infrastructure requirements of 5G FWA enable the rapid and seamless provision of services like private networks and last mile connectivity. By some estimates, 5G FWA may be able to reduce last mile installation costs by as much as 40% compared to fiber².

Enhancing the 5G FWA Offering

Several key technologies support the development of 5G FWA and its ability to deliver high-speed, low-latency connectivity with reduced infrastructure requirements. Among these are MIMO (multiple-input multiple-output), the use of “high band” mmWave frequencies for service delivery, IAB (Integrated Access and Backhaul), network slicing, and advances in Wi-Fi connectivity.



Footnote:

²5G For FWA (Fixed Wireless Access): 2017-2030 Opportunities, Challenges, Strategies & Forecasts

MIMO (multiple-input multiple-output)

Network infrastructure based on MIMO uses multiple antennas on a single base station to transmit and receive signals. This method bolsters system efficiency and throughput, generating strong performance gains consistent with the 5G experience users expect. Massive MIMO systems also enable functionalities like multiplexing (multiple data packets transmitted in one signal without interference) and beamforming (directed signals) to consistently provide a high level of service.

mmWave

Another critical consideration in 5G deployment is the limited bandwidth available at Sub-6GHz frequencies and in the mid-band range. High band mmWave frequencies offer large tracts of spectrum that allow for higher data speeds (up to 10 Gbps) and ultra-low latency.

Using mmWave-enabled devices, service providers and equipment vendors can therefore provide unparalleled performance, and adoption of this technology is already accelerating rapidly. For example, in the July 2022 FWA survey conducted by GSA (Global mobile Suppliers Association), 88% of CPE vendors surveyed reported that they either already had an mmWave product or were planning on developing one within the next few years³.

**Footnotes:**

³ Fixed Wireless Access - FWA Survey July 2022

IAB (Integrated Access and Backhaul)

IAB allows individual nodes (like micro cells needed for 5G services) to provide both data access and backhauling services as part of the larger network. While this would traditionally be facilitated by fiber connected to each node, mmWave cells can easily relay data wirelessly for a much more flexible backhaul solution.

Network Slicing

Performance can also be enhanced by dividing a network band into smaller “slices”. Using network slicing, 5G FWA services can be tailored to each customer, for customizable throughput, coverage, and reliability that don’t affect other users.

Wi-Fi 6/Wi-Fi 7

The advent of Wi-Fi 6 (which uses the 2.4 and 5GHz bands), and in particular Wi-Fi 6E (which uses the 6GHz band) additionally enable fiber-like speeds across FWA connections. Wi-Fi 6 achieves this with throughput four times greater than that of Wi-Fi 5, with far lower latency.

On the horizon is Wi-Fi 7, which utilizes all three bands and offers greater theoretical range. Importantly, Wi-Fi 7 also uses the new Multi-Link Operation (MLO) feature to combine bands for even higher speeds and ultra-low latency.



The Growing FWA Ecosystem and Market

As these technologies show, there is already a vibrant ecosystem associated with the provision of FWA connectivity. 5G FWA presents an exciting opportunity to revolutionize data access and connectivity solutions for service providers, device vendors, chipset companies, and module suppliers like Fibocom.

In time, these services may become the dominant offerings in the market, as their performance increasingly rivals – and eventually outstrips – traditional wired offerings.

Market Trajectory

Demand for FWA data services and devices has already grown rapidly in recent years. Recent data from Ericsson, for example, shows that FWA connections will exceed 100 million by the end of 2022, and that this number will more than double (to nearly 230 million, representing 15% of fixed broadband connections⁴) by 2027. 5G FWA connections specifically are projected to reach 110 million by 2027, or half of total FWA connections.

Service Provision and Subscriptions

The number of service providers offering FWA products has also increased over the past three years. For example, in the FWA outlook section of their June 2022 Mobility Report, Ericsson found that “more than 75 percent of service providers surveyed in over 100 countries are now offering FWA services”. Figure 2 illustrates the increasing number of service providers offering FWA services since August 2019.

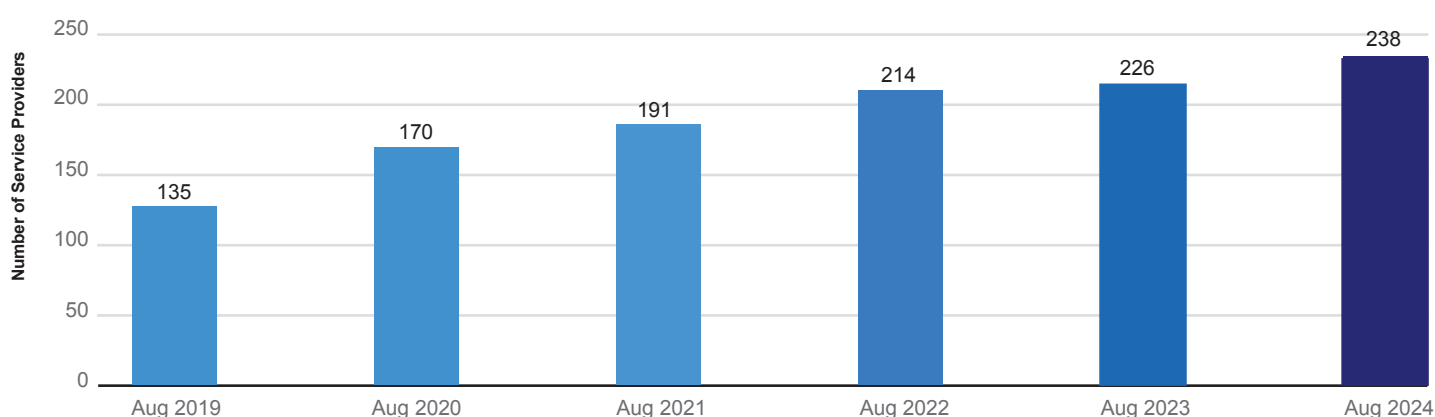


Figure 2: Global Number of Service Providers Offering FWA
(Adapted from the [Ericsson Mobility Report](#))

Similarly, 4G and 5G FWA subscriptions are expected to reach 462 million by 2030, with 5G FWA growth expected to outstrip 4G by as soon as 2025⁵.

Footnotes:

⁴ Ericsson Fixed Wireless Access Outlook

⁵ FWA to exceed 460 million subscriptions by 2030

Devices

Naturally, the market for FWA devices has increased in step with surging service demand. In their July 2022 report, GSA indicated that shipments of FWA CPE are expected to grow to 22 million units by the end of 2022. Over the same period, shipments of 5G FWA CPE are projected to rise to 7.6 million units, nearly double the 3.6 million shipped in 2021. Meanwhile, cumulative revenue for FWA CPE is expected to increase to US\$200 billion between 2022 and 2030⁶.

The largest markets for FWA device shipments over the 2021-2022 period are Asia-Pacific (APAC), Europe, and the Middle East and Africa (MEA), as illustrated in Figure 3:

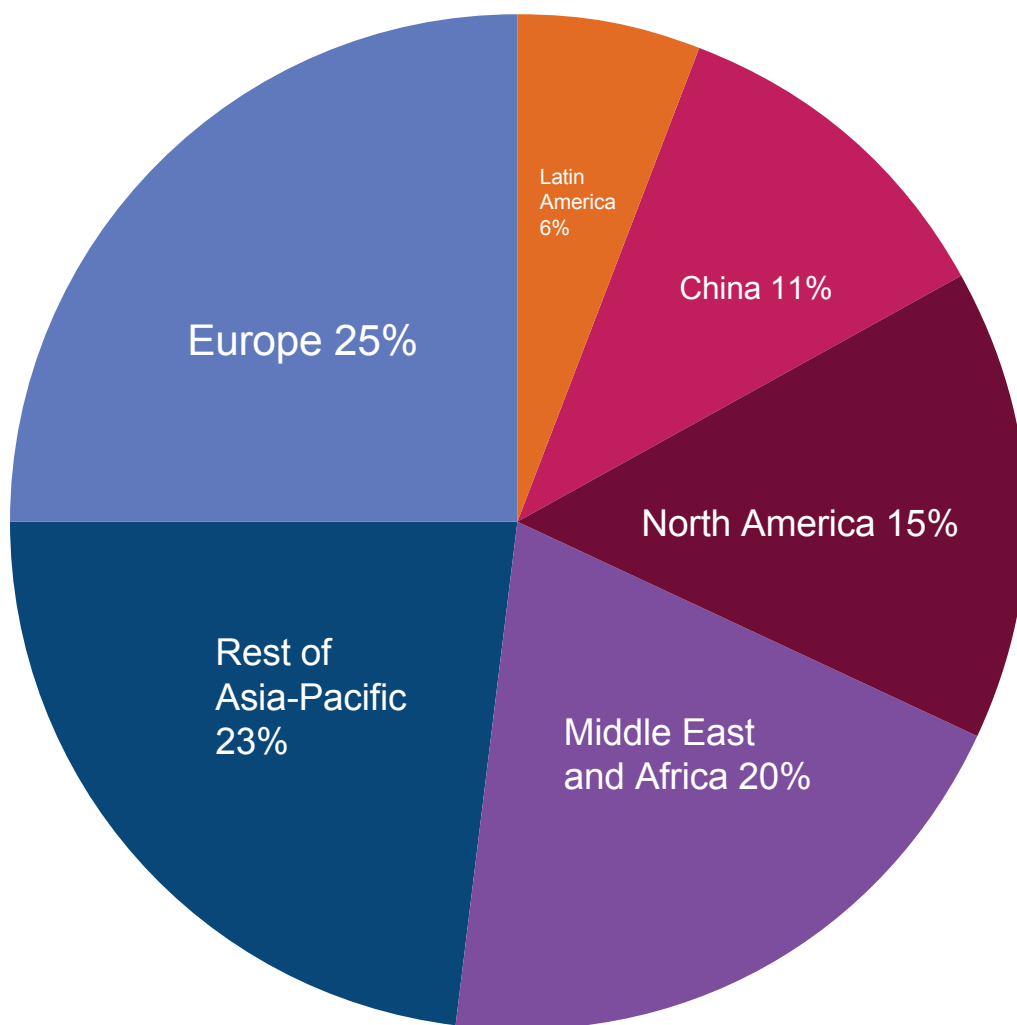


Figure 3: Global FWA CPE Shipments by Region (Adapted from [GSA FWA Survey July 2022](#))

Footnote:

⁶ Fixed Wireless Access - FWA Survey July 2022

Limitations and Challenges of 5G FWA

To achieve the true potential of 5G FWA, networks must be able to provide seamless, high-speed, high-capacity data services that outpace even wireline offerings. While broader spectrum available at higher frequencies, such as mmWave, can meet this requirement, high-frequency bands have their own limitations.

At high frequencies, wavelengths are shorter and, as a result, signal propagation is limited (e.g. about 500m for mmWave). Line of sight is a further restriction, as high-band signals are easily blocked by foliage and buildings. These restrictions make it challenging to provide sufficient coverage.

In addition, installing adequate infrastructure to support 5G FWA is difficult when dealing with short signal ranges, and due to the fact that networks require multiple smaller cells to provide quality service. At the same time, however, it should be remembered that FWA also offers an advantage in terms of infrastructure due to the standalone nature of FWA CPE. In most cases, customers can install this equipment themselves and connect in a matter of minutes, rather than waiting for time-consuming and costly fiber installation.



How Key Market Players are Rising to the 5G FWA Challenge

Advances in FWA technology and pioneering research throughout the ecosystem mean that these challenges to adoption are likely to be short-lived. Many companies have already begun to deploy 5G FWA and mmWave solutions, aiming to be the first to market with high-performance, ubiquitous, wireless connectivity offerings.

Network Operators

With recent sales of bandwidth in the C-band (4-8GHz), 700MHz-3.3GHz, and mmWave (24-100GHz) frequencies, several network operators have spent billions of dollars securing large sections of spectrum. Operators like AT&T and Verizon are already rolling out 5G mmWave services, along with other big players across the globe

Module and Chipset Vendors

Pioneering partnerships between communications module manufacturers like Fibocom and chipset companies like MediaTek also mean that the adoption of core technology underlying 5G FWA and mmWave deployments has accelerated rapidly in recent years. Modules like Fibocom's FG360, for example, which is built with MIMO, throughput, and coverage in mind, are boosting 5G FWA adoption.



Additionally, Fibocom, in partnership with other wireless technology leaders such as Qualcomm, is driving new FWA deployments with a growing range of FWA-enabled modules and module solutions tailored to support specific use cases. In each of these cases, modules can be customized to requirements to prioritize functions like lower power consumption, high throughput, or enhanced security.

Device OEMs (Original Equipment Manufacturers)

OEMs are also increasingly focused on the 5G FWA market. In addition to producing 5G-enabled CPE devices and phones, some manufacturers are also developing the underlying technology to support these deployments. An example is Samsung's investment in developing "beamforming" to extend the range of mmWave signals and allow them to be bounced to devices that are out of line of sight.

Building the Future with 5G FWA Connectivity

In the coming years, ubiquitous access to data will become the new global standard as we transition towards a more sustainable, inclusive, and interconnected world. 5G FWA networks are set to become a key enabler of that global connectivity, across a diverse set of use cases, from Industrial Internet of Things (IIoT) deployments to advanced enterprise applications, smart cities and homes, and data provision in emerging markets.

Personal and Home Connectivity

On the individual level, Mi-Fi devices offer an individual, portable connectivity solution that can tap into 5G FWA services to provide localized, ultra-fast Wi-Fi. These devices, in addition to u-Fi, can provide vehicle connectivity or serve as the go-to option during work or leisure travel.

Easily installed indoor or outdoor CPE extends the benefits of FWA to homes and families. In many cases, the installation process is as simple as placing the device near a window and switching it on for a near-instantaneous, high-performance home connection.



Industry and Enterprise

With 5G, and particularly mmWave, wireless enterprise solutions can easily meet the throughput and latency needs of individual businesses while simultaneously making it less costly to maintain a private enterprise network. FWA also extends enterprise-level connectivity beyond the office. This meets the increasing need for catering to multiple locations as hybrid work practices and fully remote personnel become the new corporate standard.

For manufacturers, 5G mmWave opens the door to IIoT deployments at scale, smart factory automation and monitoring, and Ultra-Reliable Low-Latency Communications (uRLLC) to ensure maximum operational efficiency.



Lifestyle and Entertainment

In crowded public venues like shopping centers and stadiums, 5G FWA can add value for individual users while still ensuring high-performance connectivity overall. This paves the way for immersive personal experiences such as augmented and virtual reality (AR/VR) feeds during sports matches, personalized shopping, and retail advertising tailored to individual shoppers.

Emergency Deployments

In emergency and first-response scenarios, 5G wireless access enables rapid deployment of temporary networks. This allows first responders to quickly establish mission-critical communications, improving their ability to direct resources and efforts in the most beneficial way.

Fibocom Wireless Communication Modules

Fibocom is the leading global supplier of wireless communication modules designed with 5G, mmWave, and LTE FWA connectivity in mind. Our modules are already making the scenarios discussed above a reality in factories, offices, homes, and neighborhoods around the world.

Using our embedded OpenCPU solution instead of an external MCU (microcontroller unit), Fibocom's FG160 module empowers FWA applications such as Mi-Fi and indoor/outdoor CPE, while greatly reducing power demands. In addition, Fibocom works closely with our OEM partners to provide customizable components, such as PCBAs (printed circuit board assemblies), designed to meet the specific needs of their product lines.



FX170(W) Series

- FM170, FG170, FM170(W), FG170(W)
- Air Interface: 5G
- In addition, (W) modules support 5G Sub-6GHz and mmWave: 8CC CA up to 800MHz
- Supports 4X4 MIMO in a low-frequency band for improved spectral efficiency/coverage
- 5G Sub-6GHz compliant with 3GPP release 16 (also supports 4CC CA connectivity and up to 300MHz of spectrum)
- Supports multi-constellation GNSS receiver (GPS/GLONASS/BeiDou/QZSS/Galileo)
- Supports Power Class 1.5 (PC1.5) HPUE, increasing uplink speed and coverage, for improved cell edge performance
- Designed to provide fiber-like wireless connectivity for FWA, IIoT, private networks, cellular vehicle-to-everything (C-V2X) and other massive data scenarios



FG160 and FM160

- Air Interface: 5G, 4G, 3G
- High data throughput for use with cellular terminals such as CPE, STB, IPC and ODU
- Embedded OpenCPU (optional) for reduced power demand at compact size, 160MHz bandwidth, 4096 QAM and Wi-Fi 6E
- Supports multi-constellation GNSS receiver for high-performance positioning and navigation
- 5G NR Sub-6 band compliant with 3GPP release 16
- eMBB and low-latency service for IoT, FWA, and other massive data requirement scenarios



FG370

- Air interface: 5G Sub-6
- 3GPP R16 Compliant
- Supports 4CC CA up to 300MHz, DL, 2CC CA up to 200 MHz, UL 8RX/PC1.5/Low band 4x4 MIMO
- FWA-dedicated 5G Module Solution
- Dual-band 2x2 Wi-Fi 7 for Mi-Fi (BE6500), Tri-band 4x4 Wi-Fi 7 for CPE (BE19000)
- Wi-Fi 7 Capabilities for CPE (10GbE)
- Supports High Position GNSS(GPS/GLONASS/Beidou/Galileo/QZSS)
- High-speed performance for FWA, CPE, and other massive data scenarios



FG360

- Air Interface: 5G, 4G, 3G
- New generation models designed with FWA in mind, enabling higher data throughput and coverage at improved cost-performance
- Supports 4x4 Load Balance (LB) and E-UTRAN New Radio-Dual Connectivity (EN-DC) for simultaneous LTE and 5G connectivity
- Supports EN-DC, 4x4 MIMO and PC2&PC1.5 HPUE
- Built-in quad-core and 2GHz ARM Cortex-A55 CPU
- Supports 5G SA and NSA network architectures
- High-speed performance designed for FWA, CPE, gateway, and industrial monitoring



FM101 and FG101

- Air Interface: 4G, 3G
- Supports more than 20 LTE frequency bands and 3 different communication modes (Cat 6, Cat 12, and Cat 13)
- FM101-CG module exclusively designed for CBRS-based network applications
- Supports multi-constellation GNSS receiver (GPS/Galileo/GLONASS/BeiDou) for high-performance positioning and navigation
- Optimized LTE-A module suitable for IoT applications that require high data throughput, such as FWA devices, STB, ODU, and PDA
- High-speed connectivity for FWA applications, intelligent security, and Industry 4.0 operations

Reimagining Data Connectivity with Fibocom and 5G FWA

As manufacturers of high-quality wireless communication modules, Fibocom is at the frontier of next-generation network solutions that will make data access ubiquitous and empower users across a variety of personal and business contexts. In partnership with other industry leaders, we aim to realize the promise of 5G FWA connectivity to enable a smarter, more interconnected, and more sustainable future globally.



Get Started with Fibocom

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