Leading the 5G IoT Race: Key Industry Insights Series 1. Fixed Wireless Access

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5G Fixed Wireless Access (FWA) is a wireless broadband technology that utilizes the 5G network to provide high-speed internet access to homes and businesses. It is gaining popularity as an alternative to traditional fixed-line broadband technologies, such as cable or DSL, especially in areas where wired infrastructure is not available or is prohibitively expensive to install.

The resurgence of FWA with 5G

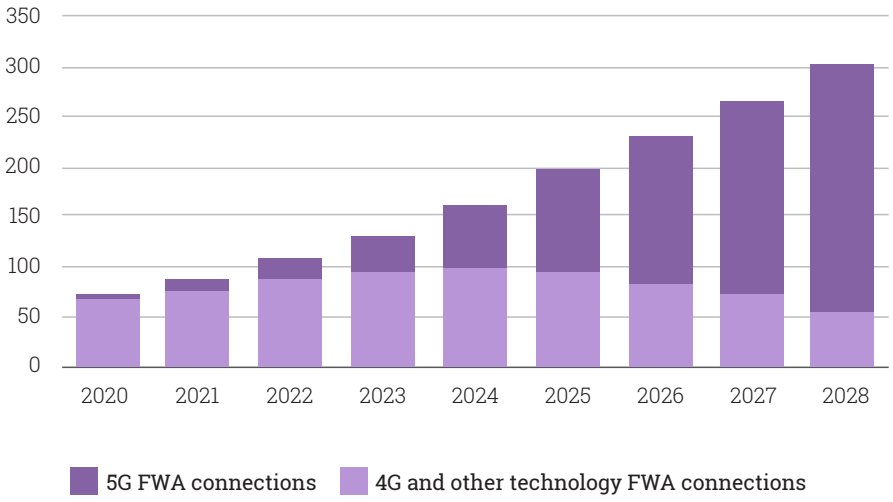
Many operators have deployed FWA selectively for decades to offer customers internet service, typically in underserved areas where wired internet connections are unavailable. Until now, FWA has not achieved widespread operator adoption outside of a few countries such as Austria and Finland. However, the introduction of 5G is changing that, with more governments now providing funding to address digital divides and the need for levelling up broadband access. In addition, more regulators are viewing 5G wireless as an acceptable alternative to wireline connections for delivering broadband internet services.

It is often challenging to justify broadband investments in less populated areas with few paying subscribers or inaccessible terrains such as mountains or islands. It is also challenging in cities where local laws and regulations may make it expensive and time-consuming to connect to customer premises. 5G FWA can provide an economical solution. Being wireless, it can reduce the massive upfront cost and time needed to secure permissions, dig trenches, lay last-mile fiber, and deploy technician-installed equipment at households and businesses.

In addition, operators can look to roll out 5G FWA using their new 5G mobile wireless networks as they are deployed, speeding up market entry. Many network operators worldwide are viewing 5G FWA as a way to expand revenue opportunities and help monetize investments in 5G and wireless spectrum.

According to Ericsson's latest Mobility Report, dated June 2023, there are now over 100 service providers offering FWA over 5G. Regionally, North America and Western Europe represent the highest adoption rates with nearly 70% of FWA service providers in those regions offering it over 5G. As shown in the chart, FWA connections are expected to grow from just over 100M in 2022 to 300M in 2028, an annual growth rate of 20%. By that time, 5G is expected to represent 80% of the total. This is a huge growth in prospect.

FWA connections (millions)



Source: Ericsson Mobility Report June 2023

In fact, operators have many deployment options depending on their service area demographics, spectrum availability, and technology portfolios. For example, in dense city locations, 5G FWA can be used to augment existing fixed or mobile phone networks to offer pop-up wide area networks, such as for small or medium businesses networks, live events, or construction sites. It also can enhance redundancy and surge capacity. As the recent pandemic has shown, using wireless connections as a gap filler and backup for fiber to provide uninterrupted internet access is growing in importance. FWA can also be offered more broadly as a competitive alternative to existing home internet, such as in a suburban area with no or few other options. In most cases, operators will selectively roll out 5G FWA in those areas where they have suitable spectrum, excess wireless network capacity, and adequate supporting infrastructure, but also where fixed wireline is otherwise uneconomical or slow to deploy.

These scenarios raise a number of challenges for MNOs (Mobile Network Operators), as follows:

1. In order to meet the diverse needs of different customer segments, telecom operators need to clarify the customer segmentation for refining the strategy, including FWA end-device and network services. For instance, customers have different speed requirements based on different scenarios.

2. To cater to the distinct requirements of enterprise and consumer-level customers, telecom operators are assigning different network performance and feature characteristics to FWA hardware. Enterprise-level customers may prioritize higher security, customization, and dedicated bandwidth, while consumer-level customers may place more emphasis on pricing and entertainment performance.

3. Operators are intensifying their utilization of the C-Band by managing and upgrading mid-band 5G networks. This strategy aims to provide broader coverage and enhanced network performance, particularly to meet the connectivity needs of consumers residing in remote suburban areas.

Fibocom's recent announcements to drive 5G FWA forward

Four recent announcements illustrate Fibocom's continuing work to improve the 5G FWA experience and the opportunity for MNOs:

1. In February 2023, the company announced a collaboration with MediaTek for a 'Fast-to-deploy' 5G FWA solution based on the FG370 module.

   The innovative "Fast-to-deploy" 5G FWA solution includes the reference designs of two forms of FWA devices, CPE and mobile hot spot, integrating with Fibocom 5G Sub-6GHz module FG370, significantly simplifying the hardware design of FWA devices and reducing the time to market. Leveraging multiple key features of the latest advanced Wi-Fi 7 technology, the CPE supports tri-band Wi-Fi 7 solution delivers a high throughput and seamless in-home connectivity, while the mobile hot spot supports dual-band Wi-Fi 7 solution brings a reliable and stable network connectivity for mobile hotspot users.

   The module supports 4CC CA (Carrier Aggregation) and up to 300MHz of spectrum on the downlink, as well as 2CC CA and up to 200MHz of spectrum on the uplink. This significantly improves the utilization of spectrum resources and ensures an extended 5G coverage. In addition to new features such as 8RX (Receive Antennas) and Power Class 1.5 (PC1.5) High Power User Equipment (HPUE), the FG370 module is capable of delivering maximum 7.01Gbps on the downlink and 2.5Gbps on the uplink. This will help CPE and Mobile hotpot customers to implement the migration from previous generation to the newest platform in a very short term, bringing ultra-fast gigabit experience.

   "The advent of 5G has bolstered the use of FWA solutions, huge opportunities come with challenges, the utilization of 5G spectrum, the complexity in device design, and the reliability of network connection are the obstacles of FWA roll-out," said Simon Tao, VP of MBB BU at Fibocom. "By working closely with MediaTek, we have achieved several product milestones ahead of the market. We believed that by launching the reference design for both CPE and mobile hot sport, FWA customers worldwide can upgrade to the latest 5G solution smoothly and easily, significantly reduce the time to market and maximize the ROI."

2. In June 2023, the company introduced a new 5G FWA solution based on the latest generation 5G modules FG190 and FG180. The solution offers a wide range of flexible configurations and multiple enhancements to CPE and mobile hot-spot customers, significantly reducing the complexity to deploy advanced 5G solutions and accelerate the time to market.

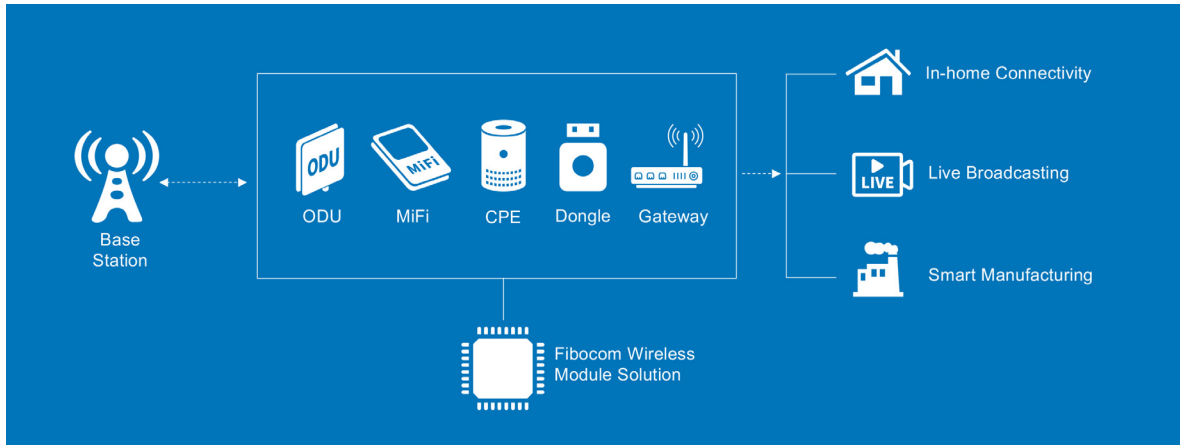
   Powered by the Qualcomm Snapdragon® X75 and X72 5G Modem-RF System, Fibocom FG190 and FG180 is compliant with 3GPP Release 17. With Snapdragon®X75, Fibocom FG190 supports 5G Sub-6GHz and mmWave dual-connectivity, thus capable of NR 10CA with up to 1000MHz bandwidth in the mmWave spectrum, and NR 5CA with up to 300MHz bandwidth in the Sub-6GHz, significantly elevating the maximum downlink speed to 10Gbps. Followed by the FG180, the module integrated with Snapdragon® X72, offers an agile solution for various 5G FWA customers by supporting up to 400MHz bandwidth of NR 4CA under mmwave bands, and 200MHz bandwidth of NR 3CA under Sub-6GHz. Both FG190 and FG180 have adopted LGA form factors, making both modules particularly suitable for a diversified FWA market.

   As 5G technology has improved, mobile broadband service providers are no longer limited to older technologies. They are looking for agile and high data throughput network connectivity solutions. The 5G FWA solution, specialized in CPE and mobile hot-spot use cases, embedded with Fibocom's latest generation 5G Sub-6GHz and mmWave modules FG190 and FG180. The 5G CPE solution is architected with a set of rich interfaces plus flexible dual-band/tri-band Wi-Fi 7 combinations. For example, an FG190 can simultaneously connect three PCIe and two USXGMII ports, in addition to the Wi-Fi 7 selections, CPE customers can adjust the combinations between QFW7114 and QFW7124 to utilize the band capacity from maximum BE21000 to BE5000. Regarding the wired configurations, either the10GbE+2.5GbE or 2.5GbE+2.5GbE could be the most recommendable and efficient options to unleash the full potential of cable access.

   The solution for 5G mobile hot spot offers a range of top-quality wireless performance to mobile scenarios. In support of a highly integrated WCN7851 chip, the multi-channel options will be utilized efficiently to increase the data rate. Depending on the requirements, the dual-band options can be switched to 2.4GHz/5GHz/6GHz to achieve maximum throughput up to BE5800. The seamless Wi-Fi 7 connectivity also benefits from the contribution of MLO (Multi-Link Operation) and 4K QAM modulation schemes, offering a highly reliable connectivity service, especially in congested environments like airport terminals, sports venues, and hospitals.

   In software design, the FG190 and FG180 is loaded with OpenWRT, which allows maximum customization for CPE and mobile hot-spot customers.

FWA has evolved from the traditional AP+Modem -based architecture to a new SoC-based architecture



3. Also in June 2023, the company demonstrated the 5G RedCap module portfolio. Along with the FG132 module series, the brand new FG131 series was introduced to scale up the 5G NR light deployment for use cases such as CPE, ODU, mobile hot-spot, and USB Dongle, etc.

   Leveraging ubiquitous cellular coverage, optimized power-saving, and reduced complexity, 5G RedCap is gaining more and more attention within the IoT industry. The newly launched Fibocom 5G RedCap module FG131 series offers a high-performance and ultra-reliable wireless solution for application scenarios that are cost-sensitive and power-enduring. Packaged in LGA form factor at the size of 37mm*39.5mm, Fibocom FG131 is pin-compatible with Fibocom LTE Cat 6 module FG101 and FG621 series that allows smooth migration from 4G to 5G RedCap. Compliant with 3GPP Release 17, it supports 5G SA and reaches peak rates of up to 226Mbps downlink and 120Mbps uplink theoretically. With these key features combined, the Fibocom 5G RedCap module FG131 series delivers a new level of 5G network experience while maintaining high reliability and cost-effectiveness, especially for terminal devices used in mobile scenarios.

4. In September 2023, the company announced that its FM160-NA 5G module had received certifications by all three of the leading operators in US. This will help customers in the North America market to reduce the time-to-market, accelerating the 5G FWA commercialization. The module supports NR Carrier Aggregation (CA) to optimize 5G user experience with extended coverage, boosting throughput, and increasing capacity. It is also backward compatible with LTE-TDD and LTE-FDD network standards. It delivers maximum downlink rates of 3.5Gbps and uplink rates of 900Mbps under 5G.

   The upgrade demand for higher data throughput for both 4G FWA service providers and early-stage 5G FWA service providers keeps growing. Customer Premises Equipment (CPE), as the access point to provide seamless and reliable connectivity service for homes, enterprises, and industries, is the key enabler in boosting FWA adoption. The FM160-NA module narrows down the digital divide for FWA customers by enabling gigabit connectivity for end devices such as CPE, ODU, mobile hot spot and USB dongles.

One-on-one interview with Fibocom

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Following on from these announcements, the author of this report (RDW) interviewed Simon Tao (ST), VP of MBB BU at Fibocom to understand in more detail how Fibocom is meeting market needs for 5G Fixed Wireless Access (FWA).

RDW: What are the key applications that Fibocom is addressing in this space?

ST: The global carriers, in particular, are looking to deliver the best broadband experience in FWA and build custom apps so their users – subscribers – can get the most out of their broadband networks. As a result, Fibocom offers small enterprises proper OS and tools like RDK-B (Reference Design Kit for Broadband) for flexibility and scalability. RDK-B is a standardised open-source software platform for broadband devices and services. For home users, the home controller 'hub' enables the smart home and provides ultra-reliable and Gigabit speed for applications like gaming and video streaming. In our work with the chipset makers, we use our experience to assist in developing support for these tools to help make broadband applications much easier to use and a smooth experience for users.

RDW: How big is FWA for high speed 5G use?

ST: We see FWA as the biggest high speed user application for 5G, both for the home and small business. This needs a high network capacity and data throughput, because in the home scenario there are often many users – the parents need to work and the children need to do online studying. In addition, there is growing use of smart phones and many other devices. The streaming download and upload need to be in parallel – simultaneous use – for good quality. The massive data use is becoming more common and only 5G can support the data requirement. To put this in perspective, 4G can support up to 30 connections at the same time but with that many connected devices the service slows appreciably. 5G can support up to 100 connection devices at once so has considerably more capacity.

RDW: What do you see as the most important performance issues that must be met to support these?

ST: This is where we add real value. 5 years ago, most of the CPE architecture was based around AT-based modems and command sets. The modem essentially just transformed the message for send/receive. But the evolution to System on Chip (SoC) architectures has moved many more tasks on to the modem – it now needs to provide the environment for all the applications, software and data coming in. The software needs smart memory and then CPU power is needed to run custom applications. In addition, we need to optimise use of power and the ability to maximise efficiency in response to customer use of applications.

The hardware may be in the home basement, so the network quality is sometimes very poor. We draw on our experience in use of massive data and in our experience of components from different vendors to create a set that utilises the main chipset to best advantage. The aim is to make sure that the uplink transmission power and the downlink sensitivity is optimised for best performance. In addition, we provide consulting services to our customers to make sure that the best performance is being achieved in the specific frequency bands required.

Everything we do is to give customers the best user experience on the transmission from uplink and downlink to make sure that, even if their network quality is very poor, they can still reach other networks.

RDW: To what extent do you get involved in software services?

ST: The software services are normally designed by our customers - the carriers and ODMs/OEMs. We also provide basic software samples to customers to make sure they can ramp up very quickly. The software ecosystem is evolving very quickly so we work with a number of software associates. We release the latest version of their software – open-source software – to all our customers so they can ramp up more quickly. This is especially the case for smaller and medium sized customers who often do not have the resources to keep up to date with all the software releases.

RDW: How does Fibocom meet or exceed the requirements in this market?

ST: Fundamentally, everything on the hardware side is doable. The choice of components used has an impact on performance of the uplink and downlink, as well software tools. Firstly, we have more than 10 years of experience in working with the most advanced carrier and OEM requirements to make sure that our products are stable and perform well. Secondly, we have stringent quality control and have been working for a long time with international customers who have very strict quality controls, in particular the top PC suppliers. The Tier 1 carriers also have very strict quality requirements. We utilise our experience and knowledge in different segments to make sure that the reliability is very high. Thirdly, we have local services for supporting customer devices. R&D and certification is also a key strength of ours because for more than 10 years we have provided network certification for all the carriers at certification lab.

We support Tier 1 carriers all over the world, in every region, working closely with more than 50% of all Tier 1 carriers. This means we are confident we can cover the most stringent field requirements.

RDW: How do you see the market need developing in the FWA market over the next few years?

ST: New requirements are always happening, especially for the FWA segment which has been moving very fast over the last 3 years as a result of the Covid pandemic – much more home working and home studies behaviours. We are continually assessing new requirements and analysing the changes required. We see that a key area, from the home to the small and medium sized business, is that users need more connection reliability for each device. When working in the home or small office scenario or even working in a public area, 5G network slicing together with other new technologies can provide higher levels of support for each end user to get a good channel to connect to the network. The connection speed can also be guaranteed by software so the user can be provided with at least their minimum requirement for that.

Another area is device protection. If people are using their devices outside, we need to put more material protection in the device to make it more robust. We need to consider the whole device for heat, power consumption, humidity and other parameters. We do a lot of work to optimise the heat on devices.

RDW: Is that an industrial grade?

ST: Depending on the scenarios and environmental requirements, Industrial grade is a higher grade that most Tier 1 carriers normally need. There are customers in some regions, for example Southeast Asia and Africa, that look for lower cost, so we have different grades depending on the local market need.

RDW: Do you see new standards coming up in the marketplace that you will need to adopt?

ST: We are involved in a lot of innovation. For example, our advanced research on the hardware side is covering areas of more advanced 5G chipset use for Carrier Aggregation. We are working on new chipsets based on Qualcomm and Mediatek for that. We are also looking at the Wi-Fi 7 requirement since 5G is getting the data input from the base station and there is a need to transfer the data from IoT devices using Wi-Fi. For this, the Wi-Fi speed needs to match with the 5G speed. Since 5G can go to 10Gbps, only Wi-Fi 7 can match that. Also, Wi-Fi 7 has a lot of base technologies that are very similar to 5G, such as OFDMA (Orthogonal Frequency-Division Multiple Access) which allows for simultaneous transmissions to and from multiple clients.

We are also looking at some new technologies for some market requirements. As a pioneer of the 5G area we see the 3TX (3 transmit antennas) and AI features coming up now. These will considerably enhance user experience especially at the network edge where signal coverage is not so good. In addition, in the future there will be more Carrier Aggregation and also more higher power transmission. We are also looking at the business case across borders – in particular satellite connection upgrades so that the user working in remote areas such as a boat on the sea can also get 5G, with satellite as a backup. We think this is a case where better communication everywhere is good for the world.

The satellite connectivity with 5G is covered in a major way in Release 17 as part of NTN – Non-Terrestrial Networks, which is coming up soon.

RDW: For OEMs and your customers, what other support do you provide them with in their design of new products?

ST: In addition to the support already mentioned, we aim to ensure that our different platforms can inter-operate. Our main chipset vendors – Qualcomm, Mediatek– each with its own software environment. We build a middle tier scenario to make sure our customers can switch for example between Mediatek and Qualcomm solutions when they need that flexibility. That can significantly speed up their development process.

Summary of Fibocom 5G FWA activities

The 5G FWA market is now set for substantial growth over the next 5 years and Fibocom is setting out a comprehensive range of unique module offerings to lead in this market. In summary, Fibocom is bringing together the following key capabilities:

- Reliable network quality for home and business with 5G network slicing
- Material protection in the device to make it more robust, including heat, power consumption, humidity and other parameters
- Close liaison with chipset makers Qualcomm and Mediatek, supporting Carrier Aggregation for higher data throughput
- Network safety
- Software design
- 3Tx (3 Transmit antennas) to enhance the speed
- Merging together and easing the R&D process

Fibcom Core-Competitiveness in FWA Industry

Global Certification Service

Understanding FWA Industry & Operator Requirements

Comprehensive Product Matrix & Reliable Product Quality

7x24 Local Support & Service through Product Life Cycle