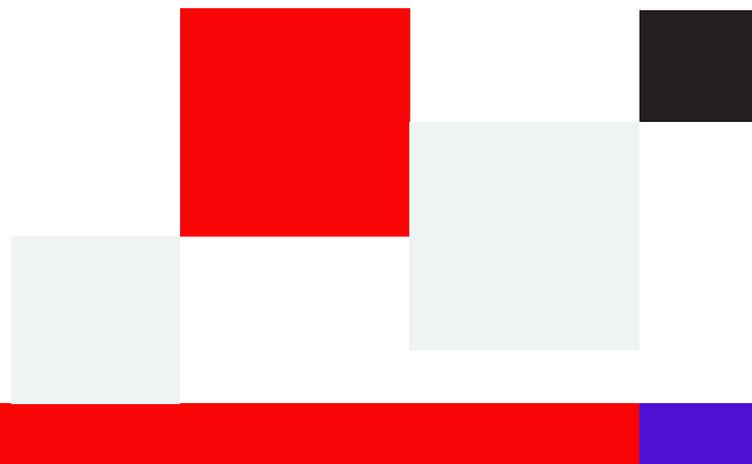


Whitepaper

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



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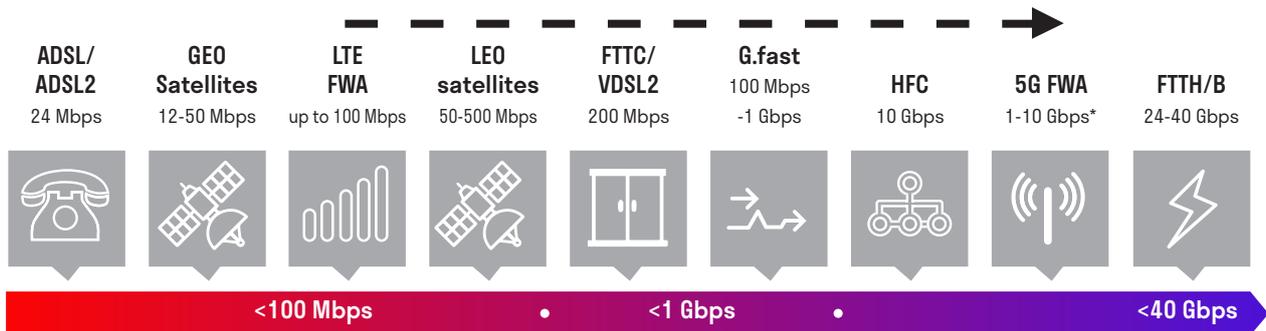


Introduction

Fixed wireless access (FWA) is not a new concept; solutions have been around for more than two decades but have only had limited applications because performance has been too limited to support mainstream consumer applications, such as home broadband. Before the arrival of 4G, FWA was confined to specific applications, connecting small numbers of devices such as meters and sensors. However, the arrival of 4G and in particular higher performance variants such as LTE-Advanced (LTE-A) has made the technology viable and 5G, where available, takes FWA to a new level.

The Global mobile Suppliers Association (GSA) reports that LTE FWA offers a mean peak download speed of 98.4Mbps while 5G FWA offers a mean peak download speed of 587.6Mbps. These are not maximum theoretical figures but actual speeds gathered from 292 LTE operators and 33 5G operators by the GSA. It's clear that, while operators don't often talk about FWA in terms of speed promises, 5G offers a vastly superior level of performance and can provide a real alternative to fiber connectivity for home internet. In trials in the UK, for example, a 5G FWA millimeter-wave service has been shown to deliver download speeds of around 1Gb per second.

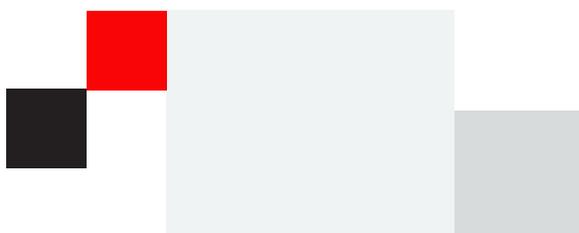
Figure 1: Fixed broadband technologies and average and average download speeds



*Depends on spectrum band used and cell-site density

Source: GSMA Intelligence

To compete in the fixed broadband market against DSL, cable and fiber, wireless services must provide performance that is sufficient to support appetites for streaming video and social networking and gaming. 5G can easily accommodate this and therefore is an attractive alternative, especially in areas where fiber or other connectivity is unavailable. 5G FWA services could serve 8.4 million rural households – nearly half the rural homes in the US — with a future-proof, rapid to deploy and cost-effective high-speed broadband option, according to an Accenture study commissioned by CTIA, the wireless industry association and published in November 2021.

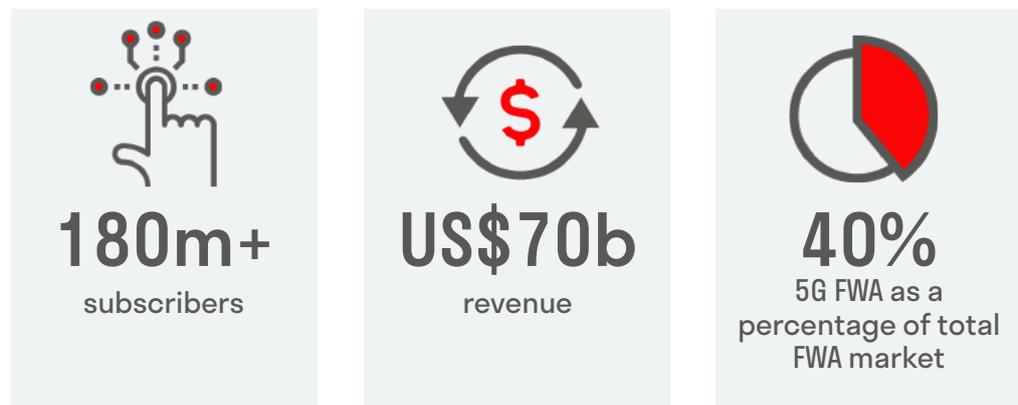


Who needs FWA?

The market that FWA addresses broadly divides into users, both business and consumer, and suppliers, the mobile network operators (MNOs). The users, those that do not have or cannot get a fiber connection, want cost-effective, broadband access to the internet. For MNOs this is a significant opportunity. 5G FWA offers a relatively easy way to generate new revenue streams by enabling internet access in rural areas, remote locations and developing nations if the economics of 5G coverage can be made to stack up against the typically less dense rural population. FWA has the potential to help address social and economic inequalities and to breach the digital divide but there are still costs to consider and 5G coverage still remains years away in many markets.

5G FWA will help accelerate the entire FWA market according to ABI Research which forecasts that in 2026, the FWA market will exceed 180 million subscriptions and generate US\$70 billion in revenue. The 5G FWA market will account for 40% of the total FWA market by then. Rapid 5G rollouts in North America and Western Europe are expected to drive the 5G FWA market as operators target areas where fiber-to-the-home (FTTH) is not available. Considering the size of the DSL user base in North America and the low FTTH penetration in Western Europe, the opportunity for 5G FWA service is significant. However, in spite of limited fixed broadband penetration in emerging markets, potentially delayed 5G deployments will result in LTE being the dominant FWA service in the forecast period. In 2026, North America and Europe combined will represent nearly 60% of global 5G FWA subscriptions.

ABI Research Forecasts



A huge opportunity

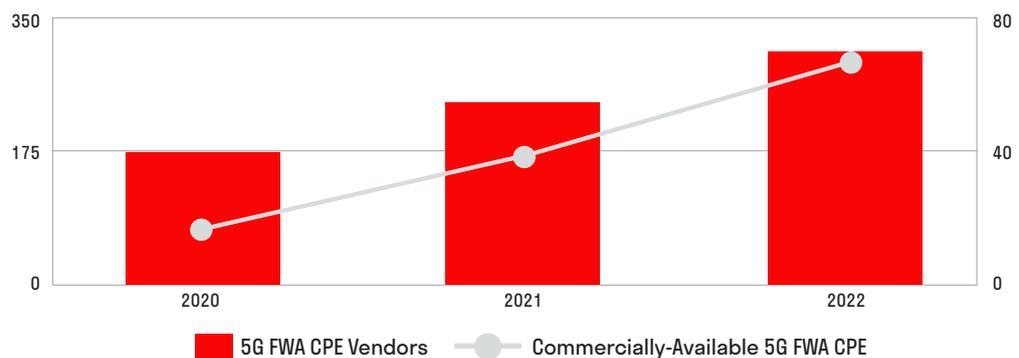
The ITU-T estimates that less than 50% of the more than two billion homes on the planet are served by fixed broadband access technologies and therefore FWA addresses a very large market. 5G will enable FWA to target a very broad audience in the wealthier markets that are not served by FTTH. Opportunities exist not only in the consumer and domestic market but also to serve SMEs. Emerging markets, which will be addressed by 4G first before eventually evolving to 5G, will also present a large opportunity bringing connectivity to households for the first time.

FWA hardware matures

The availability of 5G customer premise equipment (CPE) – typically routers and gateways – is growing and prices are declining. There are more than 56 5G CPE models available in the market as of 2021 from over 30 different vendors. These devices can be installed both indoors and outdoors and the service can be onboarded by customers. That is a big convenience feature for the customers and a big cost saving for the MNOs.

According to the GSA, there are currently more than 130 FWA CPE devices – both indoor and outdoor – that have been announced by a growing list of vendors, which now numbers more than 50. Over 50 of these dedicated CPE are now commercially available, which is up from 15 commercially-available units just one year ago. By the end of 2021, Dell’Oro Group expected that the number of commercially-available devices would exceed 100 and will double in 2022. The number of vendors producing or planning to produce 5G FWA CPE already exceeds the number of suppliers of 4G FWA CPE.

Figure 2: 5G FWA Vendors and CPE Units



Sources: GSMA and Dell’Oro Group Estimates



Fiber-like speeds

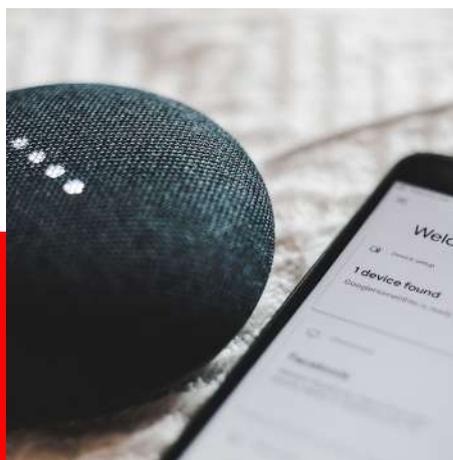
Dell'Oro Group estimates that the total number of 5G FWA devices shipped to operators in 2021 will easily exceed three million units and could approach four million units. The vast majority of these units will be to support sub-6Ghz service offerings, though we also expect to see millimeter wave units, as some operators use a combination of those technologies to provide both extensive coverage and fiber-like speeds in areas where the competition from fixed broadband providers is more intense.

The firm projects that costs of 5G FWA CPE will decline throughout 2021 and 2022, providing a catalyst for much larger, global deployments of the service in 2022 and beyond. It believes that the average cost for an indoor 5G FWA CPE will decline from around US\$475 in 2020 to around US\$180 by the end of 2023.

Other sources corroborate that 5G FWA deployment is gaining traction. As of January 2021, GSMA reported that about 40% of the 135 5G commercial launches worldwide contained an FWA offering – a relatively high proportion at this early point in the generational cycle. One real change factor compared to the LTE era is an expected increase in availability of lower cost routers with enhanced performance capabilities. Market Insights Reports estimates that 5G FWA will reduce the initial cost of establishing last-mile connectivity by as much as 40% compared to physical fiber.

This is the catalyst for accelerated FWA uptake. GSMA has gathered a range of industry estimates which indicate a projected cumulative sale of 250–350 million CPE units over the next five years – the majority of which will be 5G.

“Market Insights Reports estimates that 5G FWA will reduce the initial cost of establishing last-mile connectivity by as much as 40% compared to physical fiber”



How Quectel helps

Quectel's comprehensive portfolio of modules facilitates the design and production of FWA CPE products such as routers, gateways, and fixed 4G/5G wireless repeaters that can be installed indoor or outdoor by operators, companies or end users. They are used to amplify 4G and 5G signals and boost mmWave penetration and thereby avoid reflection and structural shadowing signal losses.

Figure 3. Quectel provides 360-degree support for its products. It starts with system evaluation and ends with mass production.



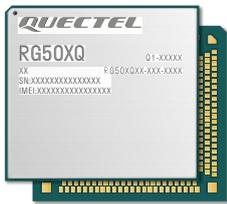
Support services can be employed throughout the planning phase and rollout of your solution. For example, the company's testing service can assist if debugging is needed, perform audio and power consumption tests, and make environmental reliability checks. In addition, the company provides a GUI tool, QNavigator, that helps customers quickly test the functionality of a Quectel module. Please visit our **Product Selector** to find the right module for your solution and feel free to **contact us** if assistance is needed.

5G Module Advantages:

Quectel is well-placed to support the growth of the FWA by providing a vast range of durable, compliant, multi-functional modules to support a new era of connectivity, including:

- Socket Secure Layer to meet strict security and privacy requirements in data transmission.
- Sub-6GHz and mmWave.
- Support both standalone (SA) and non-standalone (NSA) modes.
- MIMO technology, which greatly reduces errors and boosts data speeds.
- LTE fallback to enable extending coverage.
- Wide temperature ranges to ensure durability in harsh environments.




RG50xQ-EU

Quectel provides a range of modules and antennas to support FWA applications, which includes the **RG5xx** LGA modules and **RM5xx** M.2 modules for FWA applications. Among these, the LGA form factor **RG50xQ-EU** series modules can cover the EMEA, Oceania and Brazil regions and are in mass production now.

The Quectel **RG50xQ** is a series of sub-6GHz LGA 5G IoT modules measuring 41.0mm × 44.0mm × 2.75mm which meet the 3GPP Release 15 specification and are optimized for industrial and commercial IoT applications. The series supports both standalone (SA) and non-standalone (NSA) modes, as well as Option 3x, 3a and Option 2 network architecture. In addition, the modules are backward-compatible with 4G and 3G networks including LTE Cat 20 and deliver maximum downlink rates of 2.5Gbps and maximum uplink rates of 900Mbps. The series consists of four variants to meet different geographical requirements.


RM50xQ-EU

The Quectel **RM5xx** is a series of 5G sub-6GHz M.2 modules measuring 52.0mm × 30.0mm × 2.3mm which meet the 3GPP Release 15 specification and are optimized for industrial and commercial IoT and extended mobile broadband (eMBB) applications. The series supports both standalone (SA) and non-standalone (NSA) modes and delivers maximum downlink rates of 2.5Gbps and maximum uplink rates of 900Mbps. The series is compatible with Quectel's LTE-A category 6 module, the **EM06**, category 12 modules, the **EM12** and **EM120R-GL**, and the category 16 module, **EM160R-GL**, enabling customers to migrate from LTE-A to 5G. The series consists of five variants to meet varied geographical requirements.

Both the **RG50xQ** and the **RM5xx** series can operate in an extended temperature range of -40°C to +85°C and the integrated GNSS receiver greatly simplifies product design and makes positioning capabilities quicker and more accurate. A rich set of internet protocols, industry-standard interfaces and abundant functionalities allow the **RG50xQ** series to serve a wide range of IoT applications including business routers, home gateways, set top boxes, industrial laptops, consumer laptops, industrial PDAs, rugged tablet PCs and digital signage.



Key features

- **Frequency band:** 600–6000MHz
- Worldwide 5G/LTE band coverage
- **Dimensions:** 221mm × 26.95mm × 13.5mm
- **Efficiency:** up to 76%
- RoHS and REACH compliant

Quectel's extensive antenna range includes the **YE0001BA** 5G Terminal Mount Antenna. This ultra-wide-band 5G/4G terminal dipole antenna provides broad coverage from 600-6000MHz whilst backward-compatible to support 3G/2G networks as well as Cat M and NB-IoT. The antenna is designed to work with various ground plane sizes or in free space for ease of integration with a hinged SMA male connector to achieve the optimum position. This omnidirectional antenna is ideally suited for access points, terminals, industrial products and routers, offering great performance with its high gain and efficiency.



YE0001BA

Key features

- **Frequency band:** 600–6000MHz
- **Dimensions:** 49mm × 15mm × 0.95mm
- **Cable length:** 184mm
- RoHS and REACH compliant

The Quectel **YF0020AA** 5G Ultra-Wide-Band FPC antenna provides broad coverage from 600-6000MHz whilst being backward-compatible to support 3G/2G networks as well as Cat M and NB-IoT. Ground plane independent, it is designed for flexible mounting on the underside of any non-metallic housing with a cable and connector for easy installation.



YF0020AA

Key features

- **Frequency band:** 699–5000MHz
- **Dimensions:** 221mm × Ø61mm
- **Cable length:** 3000mm (RG58) with SMA male
- Dipole (ground plane independent)
- SMA male connector
- Magnetic mounting
- **IP rating:** IP55

The Quectel **YE0027AA** External Magnetic Mount antenna is an ultra-wide-band 5G/4G magnetic mount dipole antenna, and is backward-compatible to support 3G/2G networks. With its magnetic mount base it is easy to secure and install on metal surfaces, making it a perfect choice for vehicles, digital signage, CCTV and many more applications.



YE0027AA

In addition to these antennas, Quectel has a large portfolio of other options and provides comprehensive antenna design support such as simulation, testing and manufacturing for custom antenna solutions to meet specific application needs. The company also offers its **RMU500Q** Evaluation Board which is significant because it demonstrates a 4x4 MIMO 5G solution on a very small, compact, low profile board measuring just 100x60mm – most competitors show evaluation board lengths of 120-140mm. The isolation achieved between the antennas is 10-12 dB in the low bands and 15-20 dB in the mid/high bands – all very acceptable levels. Quectel offers four antennas for use on this evaluation board, the **YF0002AA**, **YF0002BA**, **YF0002CA** and **YF0002DA**.

**RMU500 EVB kit**

Conclusion

With FWA data traffic already representing around 15% of global mobile network data traffic at the end of 2020, according to Ericsson, the market is already substantial. However, this is only really the beginning with FWA traffic projected to grow seven times by 2026, when it will represent more than 20% of total mobile network data traffic worldwide.

FWA will also become a competitive force against slower and more expensive wireline alternatives in developed countries where fixed broadband is not prevalent. There is no need for roads to be dug up so that new cables can be laid. In addition, the performance of routers, a key CPE component, has been enhanced and shipments are set to expand. The vast majority will be 5G, driven by falling costs. A second important change is the significant advances in CPE functionality that simplify onboarding. A single, plug-and-play router installed indoors can enable access to the Net. A third is the financial backing of governments who are fueling broadband connectivity through programs and subsidies. FWA is considered to be vital for digitalization efforts and economic growth.

[For more information on Quectel's extensive module and antenna range click here](#)

