



Sivers Semiconductors

at the heart of innovation

Gigabit broadband connectivity to bustling city areas
and broadband-starved residents in rural regions

Sivers Insights

Fixed Wireless Access capable of
delivering Gigabit connectivity to
high-density urban and under-
served rural areas



The 5G Fixed Wireless Access opportunity

Multiple market research and analyst firms have highlighted that the Covid-19 pandemic has accelerated demand for high-speed broadband connectivity required for remote working, online learning, virtual healthcare, online gaming and video streaming. To fulfill this demand, broadband operators are investing heavily in expanding higher-capacity broadband networks.

Fixed Wireless Access (FWA) is nothing new. It's been used for decades with previous generations of telecom and cellular standards. FWA services are a cost-effective alternative when the deployment of a high-speed fixed broadband network is not economically feasible. Ongoing 5G network deployment coupled with 5G millimeter wave (mmWave) solutions will allow service providers to offer high-speed 5G FWA services in both urban and low-density areas. According to global tech market advisory firm ABI Research, 5G FWA will be the fastest-growing residential broadband segment to increase at a CAGR of 71%, exceeding 58 million subscribers in 2026.¹

According to the "5G Millimeter Wave 2021: Radio Architecture and Outlook Report" from Mobile Experts, the USA will have the strongest appetite for mmWave capacity for the next 3 years. Mobile Experts is forecasting a strong rise in the mmWave market in 2023-2025

¹ ABI Research; [Press release "5G FWA, the Fastest Growing Residential Broadband Service, to Exceed 58 Million Subscriptions in 2026"](#); Aug 11, 2021.

when China starts to invest in mmWave options. The below chart shows the forecasted 5G mmWave network and device shipments for licensed 5G through 2026 by Mobile Experts, using the number of Radio Units (RUs) deployed as the primary metric for tracking 5G mmWave network infrastructure deployment. Forecasted client device shipments include mmWave enabled smartphones, mobile hotspots, fixed Access Points (AP's) and Customer Premises Equipment (CPE's), of which Market Experts expect to see CPE devices for Fixed Wireless Access as well as indoor network deployments materially contributing to the device total from 2021 onwards.²

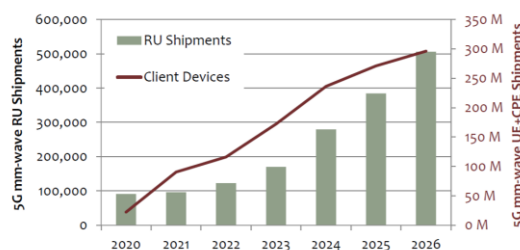


Figure 1 Global forecast of 5G mmWave network and user device shipments (licensed 5G bands only) through 2026. Client Devices include CPEs, handsets and APs. Source: Mobile Experts

Breaking it down to the 5G CPE and Repeater shipments specifically, Mobile Experts forecasts that the 5G mmWave CPE shipments for licensed 5G bands will be about 1.5 million next year (2022)

² Mobile Experts, Inc.; "5G Millimeter Wave 2021: Radio Architecture and Outlook Report", page 9; March 2021.

and ramp up to 16 million by 2026.³ There is currently no market forecast for unlicensed 5G CPE shipments, which represents an additional big opportunity.

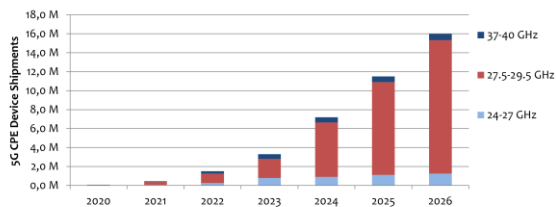


Figure 2: Global forecast of 5G mmWave CPE shipments (licensed 5G bands only) through 2026. Source: Mobile Experts

We believe there should be a significant opportunity for Sivers Semiconductors to capture a share of this market thanks to ecosystem collaboration and customer engagements across multiple regions.

Bringing broadband to the people

Today Sivers offers a compelling portfolio including RF chipsets and modules for both licensed (24-29.5 GHz) and unlicensed 5G (57-71 GHz) and there is work ongoing to address also the 37-43 GHz band. These products can be used as key components in the development and provisioning of FWA solutions to rapidly deliver Gigabit services to residential and enterprise customers – from bustling urban centers to remote rural small cities and villages. Our chipsets can be used both in small cells/ AP's, which are typically mounted on roof tops, radio masts or lamp posts, as well as in the CPE's

mounted on buildings, which simplifies system integration and roll-out.

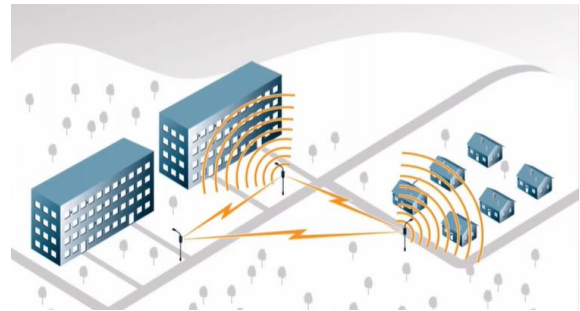


Illustration: Fixed Wireless Access in a residential area

Some of the main market challenges with wireless broadband connectivity today are typically:⁴

- Stable and reliable high-speed (gigabit)
- Robust outdoor operation (at wide temperature range and varied climate) with equal performance over the full bandwidth (all six channels)
- Reach as many customers as possible within a covered area
- Cost-effective deployment

Typical requirements from customers for FWA applications include:

- Multi-Gigabit speed distance: 200-500m (up to 1000m) depending on use case
- Outdoor operating temperature: -40° to +85°C
- Configuration flexibility
 - Point-to-Point, Point-to-Multipoint, Mesh, Mix
 - Minimum 20-30 CPEs per AP

³ Mobile Experts, Inc.; "5G Millimeter Wave 2021: Radio Architecture and Outlook Report", page 74; March 2021.

⁴ Sivers Semiconductors [BFM06009 Product Launch Webinar](https://www.sivers-semiconductors.com/webinars/); October 7, 2020; <https://www.sivers-semiconductors.com/webinars/>

- 2D electronic beamsteering (i.e. being able to steer the antenna beam in the FWA product in both horizontal and vertical level) with self-alignment for quick installation when connecting new customers
- Interference mitigation capabilities especially important when using unlicensed 5G frequencies
- For the unlicensed 57-71 GHz band there are specific limitations set by regulatory bodies, where you are only allowed to transmit a certain power (max 40 dBm) unless you have a specific antenna performance. It is key for service providers to be able to offer Gigabit services to as many customers as possible within a certain area to have a sound business case. Therefore, special considerations are needed with respect to the radiating power limitation.

Cost considerations

5G mmWave is a suitable solution for providing wireless gigabit speed broadband connectivity to homes and small and medium businesses, either as a complementary service or a competitive and cost-effective alternative last-mile connection to fiber.

The operator Three and global analyst company CCS Insight have calculated that FWA could be installed for half the cost of full-fiber and still provide a comparable level of connectivity, and are calling on the UK government to reconsider its reliance on fiber technology when executing its Gigabit 2025 plan.⁵ We see a similar trend

⁵ IT Pro; [Article "5G FWA could 'halve the cost' of rural full-fibre rollout"](#); July 26, 2021.

in other markets, where the US is currently our biggest market when it comes to FWA.

According to "The Economics of mmWave 5G" report by GSMA Intelligence, "Operators that underestimate the role of mmWave in the short term run the risk of finding themselves at a disadvantage to competitors when offering 5G services." The report gives an in-depth analysis around the economics of using mmWave in a 5G network, compared to using Sub-6 GHz technology only.⁶

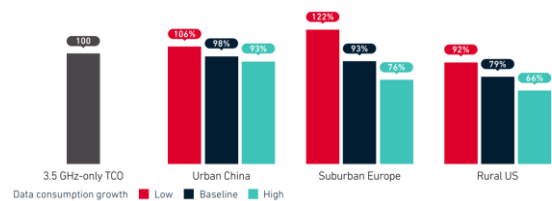


Figure 3. Net present value (NPV) of total cost of ownership (TCO) for a 5G mmWave FWA network compared to Sub-6 GHz only. Source: GSMA Intelligence

For the specific case of FWA, GSMAi's conclusion is that the cost saving could be between 15% and 27% when applying mmWave as a complement to Sub-6 GHz on a network level, and as high 35% when addressing high data demand with mmWave FWA only.

To summarize, the business case for operators and service providers can be improved significantly by considering the following aspects:

- When addressing high data demand from users by deploying broadband access, the wireless alternative to fiber can significantly

⁶ GSMA Intelligence; ["The Economics of mmWave 5G"](#); January, 2021.

improve profitability and competitiveness

- When deploying FWA, it will be more efficient to combine Sub-6 GHz and mmWave, than to deploy Sub-6 GHz only
- Both licensed and unlicensed 5G mmWave options are available and mature for commercial deployment
- Secure that the technical solution can reach and connect as many FWA customers as possible with a minimum of hardware and infrastructure installations

Market-leading in 60 GHz mmWave

Sivers Semiconductors was the first RFIC and RF Module vendor on the market to cover the whole 57-71 GHz frequency range for unlicensed 5G in one single hardware.

The Sivers TRX BF/01 chipset is the market-leading RFIC in terms of frequency range and proven performance. Our most recent RF module with integrated antenna (the BFM06009) is based on this mature RFIC and supports multi-gigabit broadband of up to 10 Gbit/s throughput.

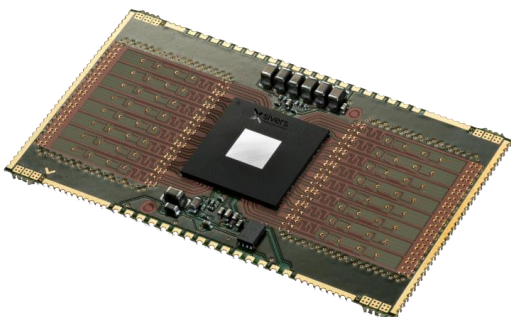


Image: Sivers RF Module BFM06009

The module has compelling 2D beam steering capabilities combined with high

output power and is optimized for true high-volume production. Furthermore, it is future-proof – it is pre-802.11ay compliant and prepared for 5G NR-Unlicensed (as part of the upcoming 3GPP Release 17).

One of the advantages of using Sivers' chipsets is that we use open interfaces to be able to combine our RFIC's with leading baseband modems on the market. One such is the RVM605x modem from our partner Renesas. The combination of the BFM06009 and the RVM6050 enables operators and service providers to serve more users (up to 60 CPEs per AP) for dense deployments of FWA, which is unique in the industry.

Compared with other commercially available FWA solutions for unlicensed 5G mmWave (from e.g. Qualcomm and Peraso), it is evident that Sivers has a competitive edge when it comes to the technical specifications. With superior output power, state-of-the-art phase noise, high level of autonomous operations and being designed for outdoor performance, it offers the flexibility and quality that comes from long experience within the field.

But good performance means more than just technical parameters. Understanding the greater context is key to build and deploy a full network. Higher output power means you reach farther; better phase noise means you can transmit more data over the air; and being able to utilize the full available spectrum (57-71 GHz) means you either get better frequency re-use or you reach farther and are able to cover more customers. The full effect depends on your specific network situation, but customer feedback indicates that these performance aspects bring much-valued

flexibility and competitive edge for the service provider.

You can easily ruin a business case by not paying attention to operational expenses like site rent cost, fees for power supply, cost for mechanical structures needed on site, etc. These are important cost adders that go beyond the actual FWA product cost. When summing up all costs (opex as well as capex), you can imagine the impact it would have on your business case if you would need only half the number of sites to cover your customer base.

Today, if you deploy an unlicensed 5G mmWave FWA network based on a non-Sivers alternative, you will end up needing 2-4 times more APs to reach your customers, compared to a solution based on Sivers' technology. That is how better performance can lower the total cost of ownership and make you more profitable.

Thanks to the capabilities and unique features of our chipsets, we see a growing interest from new customers to explore 5G mmWave for FWA.

Customer deployments

One of our customers is UK-headquartered Cambridge Communication Systems (CCS). The CCS Metnet 60G is an ultra-high capacity mmWave mesh system for unlicensed 5G, delivering an unrivalled hybrid backhaul and gigabit FWA solution based on Sivers Semiconductors' mmWave radio/antenna solution (BFM06010) for the 57-71 GHz frequency range.

The Metnet 60G reduces time to market for operators and service providers and helps them build hybrid fiber-wireless networks, delivering low overall network total cost of ownership. The solution has already been deployed by service providers in the UK (e.g. Ontix and Talk Straight) and Sweden (MikroNät). Thanks to a sales and manufacturing agreement with ADTRAN, it is possible to quickly scale up deployment to meet increasing market demand from service providers globally. Learn more: <https://www.sivers-semiconductors.com/ccs-customer-case-study/>

Our market leading 60 GHz technology is also the foundation for our agreement with Lithuanian high-tech company 8devices. In Q2 2021, our customer reached a key milestone in the development of a new 60 GHz FWA product and increased its estimated demand for equipment from us by 30–50% in 2021–2024.⁷

Other examples of customers that have developed products for the FWA market based on Sivers' chipsets are Cambium Networks (28 GHz product for global market) and Tachyon Networks (60 GHz product for the US market), both launching in 2H 2021.

Summary and take-aways

We believe that our market-leading chipsets and antenna modules will be a driver for the ramp up of volume deployments on the FWA market (both urban and rural settings), used in Mesh networks for Smart Cities, as well as for

⁷ [Sivers Semiconductors Interim Report Q2 2021](#).

delivering reliable Gigabit speed connectivity to high-speed vehicles in track-to-train solutions and the transportation sector.

Many of our customers are moving towards volume production and we foresee considerable potential to capitalize on the hard work we have put into the company when societies are able to reopen post-pandemic. Our competitive products and global network make us well equipped to capture market opportunities and we remain very optimistic about the future.

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