



October 2018

5G Fixed Wireless: Is It Really a Solution to Help Bridge the Digital Divide?

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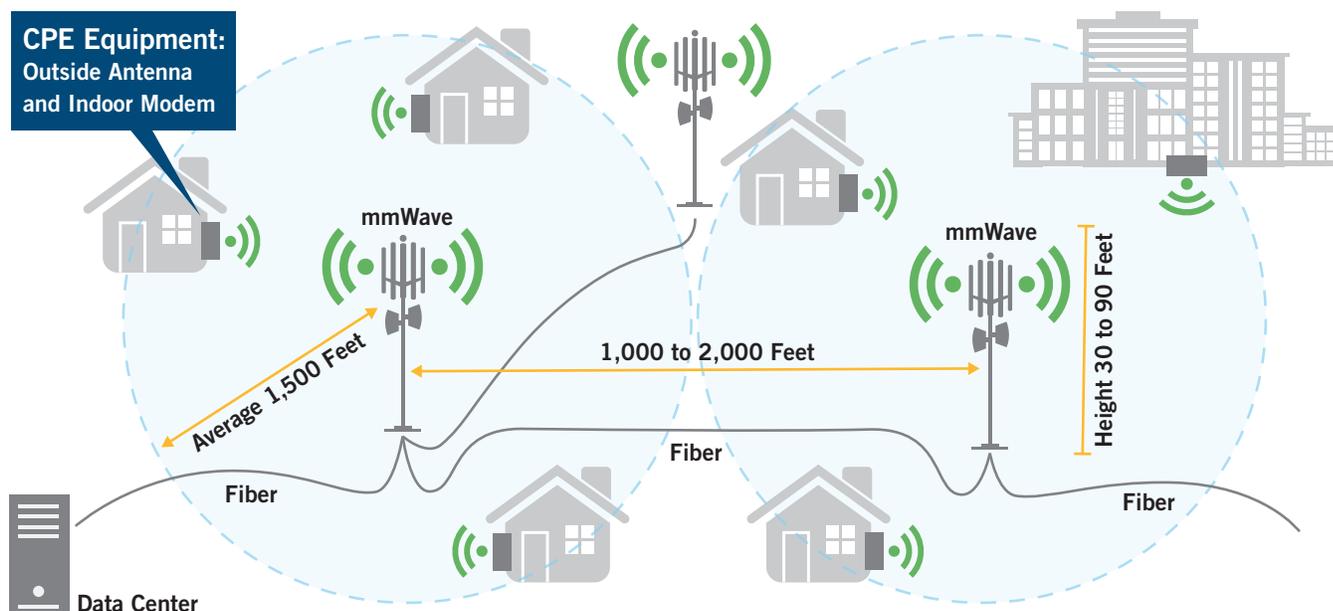
Key Points:

- As Verizon begins deploying its 5G fixed wireless networks (5G FWA) in urban and suburban markets, we've grown skeptical about how successful they will be in taking share from the incumbent broadband providers. This could be problematic for rural operators as they look to 5G FWA to bridge the digital divide.
- We see issues related to site acquisition, high CPE/installation costs, spectrum propagation, competition, and the capital required to build the networks as significant headwinds for 5G FWA.
- The 5G FWA ecosystem depends on investments made by tier-one carriers and if their commitment wanes, it could leave WISPs and cable operators that are looking to deploy the technology with fewer options and higher costs.
- Conversely, if 5G FWA fails to live up to the hype, it could be viewed as a positive for some rural cable operators and RLECs as it would increase the entry barriers for new market entrants.
- We see these issues, and the uncertainty around new low-band spectrum, as impediments to widespread 5G FWA adoption in rural America, but acknowledge the technology is in its infancy, and many unknowns exist.

Introduction

As rural telecom operators look for cost-effective ways to bridge the digital divide, 5G FWA has been identified as a potential solution. The issues deploying widespread fiber networks in rural markets are numerous and well documented, which has led to an estimated 25 million consumers without broadband access. 5G FWA is in its infancy, and there are diverging opinions regarding how successful it will ultimately be. In this report, we look at the challenges facing 5G FWA and to what extent it will help bridge the digital divide.

EXHIBIT 1: 5G Fixed Wireless with mmWave Spectrum



Source: CoBank

5G: What is it and why should people care?

5G networks can be broken down into two categories: 5G FWA and mobile 5G. From a consumer perspective, it will be several years before the mobile 5G value proposition is realized. Consumers may experience a bump in speeds, but the real benefits of mobile 5G in the near-term go to the carriers in the form of network efficiencies (e.g. enhanced spectral efficiencies, cheaper radio equipment, etc.).

5G FWA is being positioned as an alternative to wired broadband, and it promises to deliver speeds in the 300Mbps to 1G range. In its simplest form, 5G FWA consists of an access point(s) that is mounted, typically on poles, within 1,000-2,000 feet from the service area. The access points are connected via fiber back to the network core and transmit a wireless signal to an antenna mounted on the outside of a house/building. These outside antennas are connected to an indoor broadband modem.

Thus far, Verizon has been the biggest proponent of 5G FWA, as they see the urban and suburban fixed broadband market as one that is ripe for disruption. We view the market differently for a variety of reasons. We think Verizon's enthusiasm, in part, is related to AT&T and T-Mobile having more fallow spectrum to deploy while Verizon needs to densify its network via small cells, which opportunistically opens the door to deploy 5G FWA. We do, however, think that 5G FWA could be a potential upgrade path for existing LTE fixed networks in rural America, and as a complement to existing wired broadband networks where it's not feasible to deploy fiber-to-the-home. However, despite the inherent benefits 5G FWA offers, it's not a silver bullet solution that will address the digital divide. And based on the conversations we've had with rural operators, many are taking a "wait-and-see" approach. Additionally, if Verizon struggles to scale its 5G FWA networks, the 5G FWA ecosystem and technology could suffer, which would negatively impact operators such as WISPs and rural cable companies looking to augment their fixed broadband networks with 5G FWA.



Challenges facing 5G FWA

Tier-one wireless operators are utilizing millimeter-wave spectrum in their 5G FWA networks. Unlike the spectrum used in traditional mobile networks, millimeter-wave provides significantly more capacity which is needed given the higher levels of data traffic in fixed versus mobile data networks. However, the propagation characteristics are poor, and the spectrum struggles to penetrate windows with UV protection, dense foliage, etc. Because of this, operators may need to mount access points above tree line which could involve erecting new poles, as most of the existing “street furniture” is not tall enough. We think the costs associated with new poles, higher than average CPE costs, installation costs, site acquisition issues (not-in-my-backyard protests about new towers in neighborhoods) and the up-front capital investments will, in many cases, challenge the viability of the business case in non-rural areas.

We also note that the incumbent fixed broadband providers have the financial flexibility to offer attractive broadband promotions to stave off the 5G FWA competitive threat. They are also deploying fiber deeper into their networks, and adopting technologies like remote

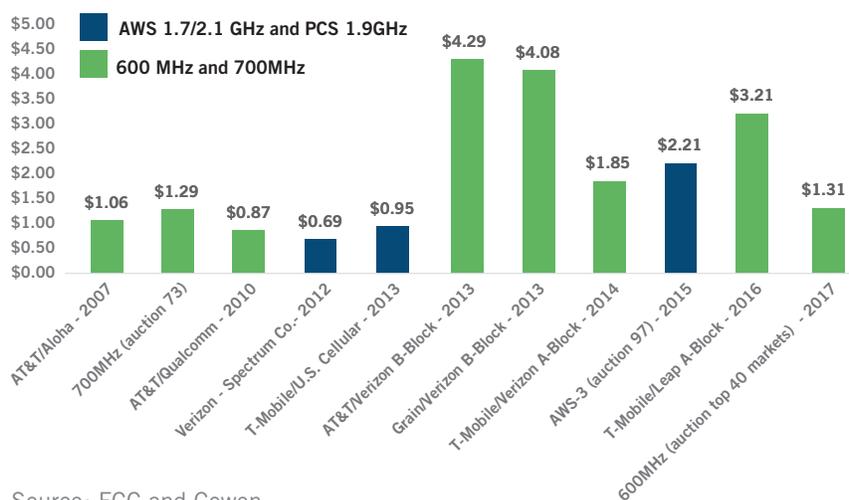
PHY. Remote PHY is an emerging set of products and specifications that takes certain modulation techniques out of the CMTS (cable modem termination system) and places them deeper in the network – typically at the node level. This enables the MSOs to efficiently scale their broadband networks, in addition to reducing operating expenses related to power and cooling at the headend.

Lastly, it's noteworthy that Charter, Comcast and Altice all decided to sit out the upcoming millimeter-wave auction. This suggests that cable is not worried about the 5G FWA competitive threat. If they were, they would want to keep additional millimeter-wave spectrum out of the hands of the wireless operators.

How does this affect rural operators?

Tier-one operators drive industry standards, technology innovation, and the overall communications ecosystem. We see potential headwinds for rural operators should tier-one carrier interest in 5G FWA begin to wane. For example, equipment manufacturers and chipset companies may start to deemphasize the technology which could result in higher prices, fewer choices, and a slowdown in the evolution of 5G FWA technologies. We note that signs from the vendor community are beginning to emerge that could be cause for concern. For example, Australia's NetComm Wireless noted that their revenue guidance was negatively impacted by a slower-than-expected rollout of AT&T's fixed wireless project (NetComm provides 5G FWA equipment to AT&T). And Dycom, Verizon's fiber construction provider, has seen its stock decimated this year due to delays in new projects. Perhaps these are just timing issues versus leading indicators, but with all the hurdles facing the technology, the path forward looks challenging.

EXHIBIT 2: Notable Spectrum Transactions (\$/MHz - POP)



Source: FCC and Cowen

Ecosystem headwinds are only part of the concern for rural operators

We've talked to a number of rural operators and in many cases, LTE fixed wireless networks and fixed wireless networks utilizing 5.1GHz and 5.8GHz Wi-Fi technologies have already been built where it has made sense to do so. So the question becomes, where is the incentive for rural operators to upgrade their existing networks, or build new ones? In the case of certain CAF II winners, there are network buildout requirements that must be met. And there are instances where fiber-based operators will look to deploy 5G FWA as a compliment to their fiber network. However, for many other operators it's less clear. Building these networks comes with significant execution risk and leverage demands that could be problematic given the current EBITDA levels for many WISPs. Rural customers tend to be more price sensitive than typical urban or suburban customers. This is a major consideration for operators when evaluating new capital expenditures because if there isn't a willingness to pay for a faster data connection, or a path to increased subscriber growth, then justifying the capital spend becomes difficult.

For these reasons we expect many rural operators to take a wait and see approach before they adopt 5G FWA. They will want to assess Verizon's experience before deploying their own new capital.

Mid-band spectrum will help address the propagation issue, but uncertainty exists

There are new developments that should alleviate some of the aforementioned technological challenges that bear watching. Specifically, the availability of additional mid-band spectrum – CBRS, to be exact – will help address the millimeter-wave propagation issue as mid-band signals travel much farther and can penetrate buildings.

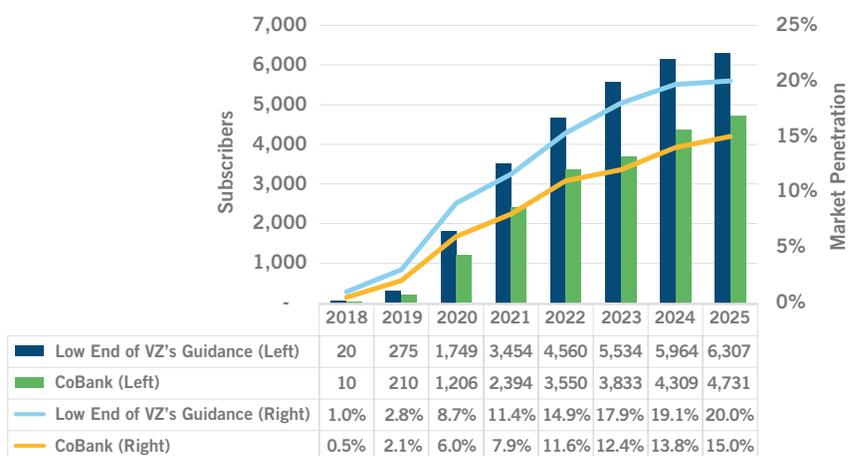
This would help support the market if mid-band spectrum is proven to be an economical solution to the millimeter-wave propagation issue.

The key here is economics.

The CBRS band is bifurcated into licensed and unlicensed spectrum. Typically, unlicensed spectrum (which is free) is used for best-effort applications, which may not live up to the quality of service expectations for consumers. If RF interference in the unlicensed portion of the band significantly degrades throughput speeds, there could be economic issues in justifying the use of licensed, mid-band spectrum for 5G FWA. For example, the implied valuation of Verizon's millimeter-wave spectrum is \$.01 per MHz-POP, which is significantly cheaper than some of the recent valuations for mid and low-band spectrum. And while we don't yet know the valuation for licensed CBRS spectrum, one thing is for certain – it will be many multiples higher than \$.01 per MHz-POP.

We also note that for rural operators with fixed wireless Wi-Fi networks, utilizing CBRS means they need to deploy LTE networks, which by itself introduces new challenges. User authentication on multiple access points and infrastructure costs have been identified as two of the major issues with CBRS.

EXHIBIT 3: CoBank's 5G FWA Forecast vs. Verizon's Guidance



Source: CoBank estimates and Verizon

NOTE: Verizon's guidance was limited to a target penetration range of 20%-30%. The timeframe and subscriber additions are CoBank estimates.

5G FWA market penetration and revenue forecasts seem overly optimistic

This is Verizon's third attempt to disrupt the wired broadband market with fixed wireless. The company believes it can garner 20-30 percent share of the broadband market outside its Fios markets, and ABI Research thinks the 5G FWA market will grow at a 26

percent CAGR with worldwide service revenues reaching \$45.2B by 2022. To us, these market penetration and revenue forecasts seem optimistic. Admittedly, it is difficult to forecast the number of homes Verizon will be penetrating the market. However, we've taken a more bearish view and believe that Verizon will ultimately fall short of their desired penetration goals given the challenges we've outlined.

Conclusion

We think it's too early to predict how much of an impact 5G FWA will have in bridging the digital divide.

The technology is in its infancy and several unknowns exist. But if we look at the technological challenges and competitive headwinds facing 5G FWA, it would be prudent to have tempered expectations over the next 3-5 years. As the technology matures, we do see some operators taking a rifle shot approach in deploying the technology. However, we're not optimistic about there being widespread adoption. ■

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