

Defiance ETFs: Investment Case for FIVG

5G describes the technological innovation and infrastructure that will likely support the next era of mobile connective technology. Its adoption should provide faster speeds, more functionality and lower latency (the delay between input into a system and the desired outcome, i.e. the time for data to travel between two points), facilitating substantial innovation in a much wider number of use cases than previous mobile technology. 5G applications do not focus purely on the consumer; they can also transform work practices and production in industry, healthcare, transportation and manufacturing, gaming, retail, business and education.



5G is the technology that will support smart cities, eSports and remote medicine

Major market actors, including telecommunications companies, governments, infrastructure providers and hardware firms, have been researching and developing 5G capacities for years and AT&T, T-Mobile, and Verizon have already launched their networks across thousands of US cities. Rising mobile data traffic and the increased adoption of virtual networking architecture in telecommunications continues to push the technology to fruition. The Global Mobile Suppliers Association (GSMA) notes that 113 mobile operators have launched a 5G network in 48 countries. It believes operators will spend \$890 billion on 5G networks over the next

five years and that consumer adoption of 5G will reach 20% of global mobile connections by 2025.¹ This will build on the LTE (4G) networks run by 791 operators in 228 countries worldwide, which provide mobile and/or Fixed Wireless Access (FWA) services, and which act as a foundation for future 5G network upgrades.²



5G International

The 5G rollout became a global phenomena in 2019, when South Korea was the first country to achieve a nationwide network. It saw 1 million subscribers within 69 days of launching³ and finished 2020 with nearly 12 million.⁴ International commitment to the 5G rollout has also been demonstrated recently: President Trump's statement in April 2019⁵ was reinforced by the October 2020 \$9bn 5G fund for rural America⁶ and the centrality

placed on 5G technology companies like Huawei in the trade war between China and the US.⁷ The European Commission had committed to 5G network launches across all member states by the end of 2020, and while it recently admitted a Covid-induced delay, it reiterated its commitment to achieve its target of uninterrupted 5G coverage in urban areas and along main transport paths by 2025.⁸ Many countries (Canada, Japan, Singapore, China, India and others) saw their 5G rollouts begin in 2020,⁹ and Ericsson have predicted that 5G subscriptions could reach 3.5 billion by 2026.¹⁰

1 "5G roll-outs to continue apace in 2021," Aaron Tan, December 21, 2020 www.computerweekly.com/news/252493941/5G-roll-outs-to-continue-apace-in-2021

2 "LTE - 5G Market Statistics," GSA.com, December 16, 2019. <http://www.gsacom.com>

3 "South Korea hits 1 million 5G subscribers in 69 days, beating 4G record," Jeremy Horowitz, June 12, 2019. <http://www.venturebeat.com/2019/06/12/south-korea-hits-1-million-5g-subscribers-in-69-days-beating-4g-record>

4 "South Korea ends 2020 with nearly 12 million 5G subscribers: report," February 3, 2021. <http://www.rcrwireless.com/20210203/5g/south-korea-ends-2020-nearly-12-million-5g-subscribers-report>

5 "Remarks by President Trump on United States 5G Deployment," April 19, 2019. <http://www.whitehouse.gov/briefings-statements/remarks-president-trump-united-states-5g-deployment>

6 "America's 5G Future," Federal Communications Commission. <http://www.fcc.gov/5G>

7 See "5G and The Trade Truce," Defiance ETFs, July 18, 2019 at <http://www.news.defianceetfs.com/investment-cases/5g-the-trade-truce>

8 "Commission concedes delay in 5G deployment across EU," Samuel Stolton, September 18, 2020. <http://www.euractiv.com/section/5g/news/commission-concedes-delay-in-5g-deployment-across-eu>

9 "5G Availability Around the World: Most countries already have limited access to 5G networks," Tim Fisher, February 03, 2021. <http://www.lifewire.com/5g-availability-world-4156244>

10 Ericsson Mobility Report, November 2020. www.ericsson.com/4adc87/assets/local/mobility-report/documents/2020/november-2020-ericsson-mobility-report.pdf

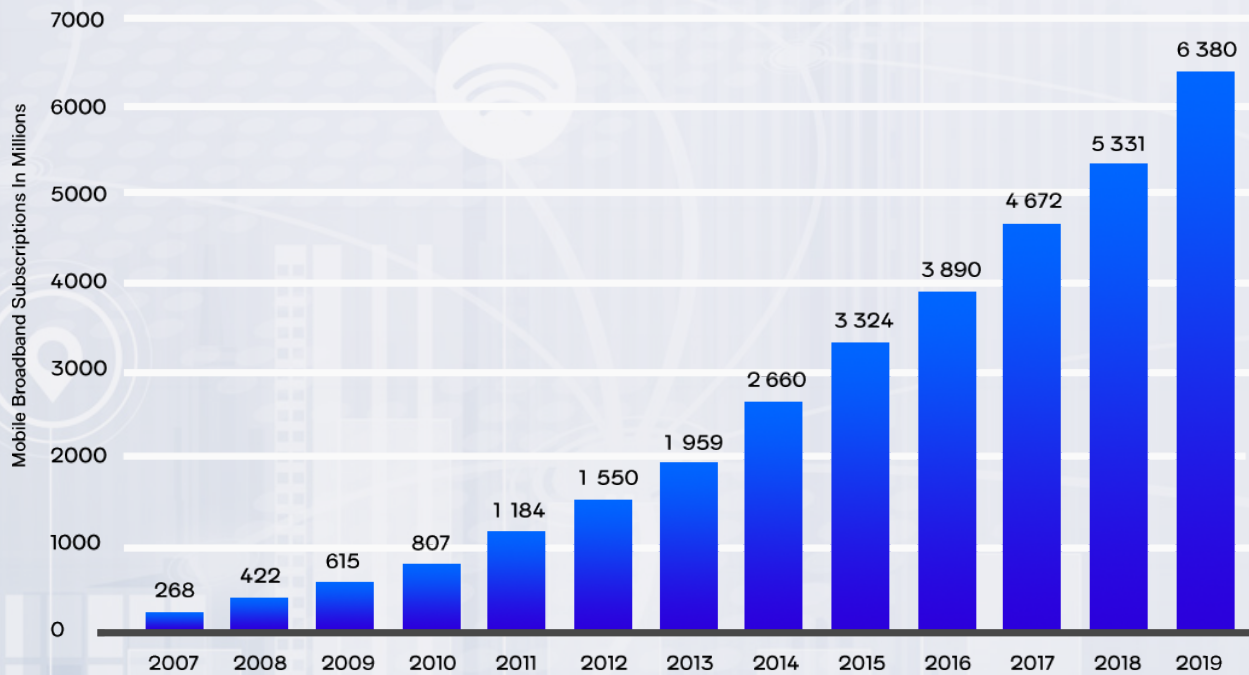


5G Potential

Expansion of 5G infrastructure has an impact potential far beyond the smartphone industry, promising to impact every aspect of society and drive new economic activity. One investment manager continues to describe 5G as an **“unstoppable trend”** which will increase productivity, enhance well-being, reduce pollution and waste and enable more satisfying leisure.¹¹ We believe that 5G will bring disruptive transformations in three key areas: Enhanced mobile broadband, the massive Internet of Things (IoT) and mission critical services. 5G could

also support institutional change that fosters the emergence of original business models, thereby advancing new ecosystems of technologies and industries that engage in its wide use-functions. For example, 5G supports Edge computing, which is when processing power and data storage are brought closer to data sources such as IoT devices or local edge servers. The Edge improves response times, saves bandwidth and will support more seamless automation and coordination among disparate systems. Verizon’s 5G tech, for example, is already supporting global pharma track-and-trace solutions, which improve inventory management, demand and use evaluation, patient safety and cost control.¹²

Number of active mobile broadband subscriptions worldwide from 2007 to 2019¹³ (in millions)



¹¹ “Outlook 2021 – Unstoppable trends 5G Hyper-Connectivity,” Citibank <https://www.privatebank.citibank.com/home/video-hub/outlook-unstoppable-trends-g-hyperconnectivity.html>

¹² Pharmaceutical supply chain, Verizon, <https://enterprise.verizon.com/solutions/customer-success-stories/use-case-mec-and-pharma-supply-chain>

¹³ Data Source: <https://www.statista.com/statistics/273016/number-of-mobile-broadband-subscriptions-worldwide-since-2007>



Elsewhere in the semiconductor industry, for which smartphones are the far largest consumer with \$87.7 billion in global revenue in 2019, 5G expansion could spur demand and boost the microchip business.¹⁴

Cooperation between the supply and demand sides of the market (telecom companies versus industry/energy/transport businesses and consumers) comprises a robust value and supply chain and

contributes to the expected success of the 5G market. The consistent and steep worldwide growth in broadband subscription reflects the strong underlying demand for ever-improving data access and processing. (see graph above) Covid has normalized the work from home paradigm with its dependence on smooth communication, data sharing and security and remote collaboration; all of which are facilitated and enhanced by 5G.

What is 5G?

If 1G describes the technology that enabled the first cellphones, 2G brought text messaging, 3G internet access to the cell phone and 4G higher speeds (albeit in an overloaded network); then 5G brings the industry the capacity for even lower latency, more sophisticated apps, instantaneous availability of information and more structured and relevant capabilities. But 5G is not just about cell phones. 5G is the bundle of technological advances that will likely enable autonomous driving, the internet of things (IoT), cloud computing, mass participation in eSports and significant developments in the use of virtual or augmented reality (VR/AR) products.



While the configuration and collaboration of technologies that comprise 5G is not yet final, the core features will include:

1. Leveraging of new bandwidths – The range of millimeter wave frequencies currently in use (usually up to 6Ghz) are becoming overcrowded, resulting in slower service and mixed connections. 5G will exploit a much greater spectrum (30–300 GHz) of shorter waves, greatly increasing network capacity. The European Commission for the EU, the Asia Pacific Telecommunity for the Asia Pacific (APAC) region, and the Federal Communication Commission (FCC) in the United States are already pursuing initiatives to open up other bandwidths to 5G.

2. Small Cell Antennae – The shorter millimeter waves don't travel well through buildings and are absorbed by rain and plants. They therefore require a network of thousands of small, low powered mini base stations to work in relay to pass data around obstacles and maintain service.

3. Massive MIMO – Multiple Input Multiple Output cellular antennae stations – MIMO stations would have around 100 ports (in contrast to 4G's 12) and could increase capacity of networks by a factor of 22 or more.

¹⁴ "5G's rise set to break the semiconductor market's fall in 2020," October 18, 2019. <https://technology.ihc.com/618002/5gs-rise-set-to-break-the-semiconductor-markets-fall-in-2020>



4. Beamforming – In contrast to 4G dispersed wave signals, MIMO stations strategize the best route for a focused stream of data from the base to a specific user. This increases efficiency and avoids interference, resulting in a coherent, personalized data stream. It also allows for network slicing, where certain network functions are reserved for certain users– these could be premium customers or mission critical services such as remote driving or medical procedures.

5. Full duplex – Radio waves are reciprocal – they travel forward and back on the same frequency, meaning that today’s antennas can only either send or receive data at any one time. To avoid this, researchers are formulating scalable orthogonal frequency–division multiplexing (OFDM): using silicon transistors to create high speed switches that momentarily hold back signals, so they can pass on the same frequency. This should bring lower latency and forward compatibility.¹⁵

2021 where do we stand?

As of January 2021, PwC reported that US mobile operators had collectively covered 75% of the country with 5G; expansion of 5% is expected by July.¹⁶ Until recently 5G networks were accessible only via a limited range of 5G-enabled Samsung, Verizon and Huawei smartphones. However, since Apple launched its first 5G compatible iPhone 12 in October 2020, and as the roll out has gained traction, it would now be unusual for a new handset to be released that did not support 5G connectivity. T-Mobile also released 15 new 5G phones in 2020 at varying price points,¹⁷ nodding to the competition in this sector. Companies such as Qualcomm and Intel are advancing 5G modems that will be compatible with network operators and serve smart-home and other devices whose design has not yet been finalized. 20 device manufacturers have already confirmed their use of Qualcomm’s 5G components in their tech.

On the infrastructure side, companies such as American Tower and Crown Castle continue to develop their large portfolios of strategic rooftop sites to streamline the connectivity that 5G expansion requires. American Tower for example, manages access to 5,500 rooftops; and CC’s over 40,000 towers, 70,000 on-air or under-contract small cell nodes, and more than 75,000 route miles of fiber connections are strategic elements in the 5G rollout.¹⁸ In early 2020 CC announced its backing of Vapour IO’s \$90m nationwide edge rollout,¹⁹ further demonstrating its commitment to digital transformation for the U.S.²⁰

15 The 5G Economy: How 5G Technology will Contribute to the Global Economy, IHS, January 2017, p.13. <https://www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study.pdf>

16 “Making 5G Real,” PwC, <https://www.pwc.com/us/5g>

17 “T-Mobile Just Turned on Its Nationwide 5G Network,” Kellen, December 2, 2019. <https://www.droid-life.com/2019/12/02/t-mobile-just-turned-on-its-nationwide-5g-network>

18 “Endless opportunity through a diverse network,” Crown Castle. <https://www.crown-castle.com/network-infrastructure/#2>. See also “Viewpoint: The case for better connectivity in D.C.,” John P. Drew, January 14, 2020. <https://www.crown-castle.com/news/viewpoint-the-case-for-better-connectivity-in-d-c>

19 “Crown Castle-backed Vapor IO raises \$90M for nationwide edge rollout,” Monica Allevan, January 22, 2020. <https://www.fiercewireless.com/wireless/crown-castle-backed-vapor-io-raises-90m-for-nationwide-edge-rollout>

20 “Crown Castle on Cutting Edge of 5G Innovation” Diane Rusignola, REIT magazine, November 15, 2020. <https://www.reit.com/news/reit-magazine/november-december-2019/crown-castle-cutting-edge-5g-innovation>

Five 5G Applications

1. Smart driving – A 2016 Huawei White Paper reported the estimation that if 90% of vehicles in the United States were automated, the number of traffic accidents would decrease by nearly 80% and the number of fatalities by about 60%. The same paper reported the US National Highway Traffic Safety Administration’s prediction that light and medium-sized vehicles with vehicle-to-vehicle communications (V2V) could avoid 80% of accidents, and large vehicles with V2V could avoid 71% of the accidents.²¹ Furthermore, Accenture have suggested that all new cars will be connected by 2025.²² Smart driving is a clear example of how strong consumer and industry interest and uptake of 5G technology could encourage telecom companies to invest in the necessary research and development (R&D) and infrastructure to partner with industry for market share.

Indeed Nokia was a founder of the “5G Automotive Association” (5GAA) established in 2016 with 120 plus members. This body aims to unite



automotive and telecommunications to accelerate the introduction of intelligent transport and communication solutions. 5GAA expects the earliest deployments of the most advanced 5G automotive technology, which could reduce accidents and allow vehicles to travel closer together and therefore save road space, to come in 2023.²³ In January 2020 Qualcomm announced its first “Car-to-Cloud Service” would be available in the second half of the year. This first taste of smart driving will support “actionable analytics and insights through data collection correlated from multiple sources at the edge,” secure communication between cars and a personalized user experience for passengers.²⁴



2. Smart Grids – Based on the principle that everything in the grid is connected, monitored and controllable, smart grids are now regarded as an indispensable component of national energy strategies in many markets, including China, Europe and the United States. They integrate information, telecommunication and automation into traditional power systems, revolutionizing the way energy is stored, delivered and sold. They require 5G’s intelligent, comprehensive and reliable network which would provide very low latency for immediate data sharing and wide coverage, high bandwidth and a massive web of connections to millions of smart meters. In return 5G could enable significant social and environmental benefits due to the reduced power usage and wastage.²⁵

²¹ 5G Opening Up New Business Opportunities, Huawei White Paper, December 2016, p.8.

²² “Accenture, Connected Vehicle,” April 2016. https://www.accenture.com/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_21/Accenture-digital-Connected-Vehicle.pdf

²³ “Building the 5G highway for connected cars,” Uwe Pützscher, Jan 23, 2020. <https://www.nokia.com/blog/building-5g-highway-connected-cars>

²⁴ “Qualcomm Introduces Car-to-Cloud Service for Over-the-Air Vehicle Updates and On-Demand Services & Features,” January 6, 2020. <https://www.qualcomm.com/news/releases/2020/01/06/qualcomm-introduces-car-cloud-service-over-air-vehicle-updates-and-demand>

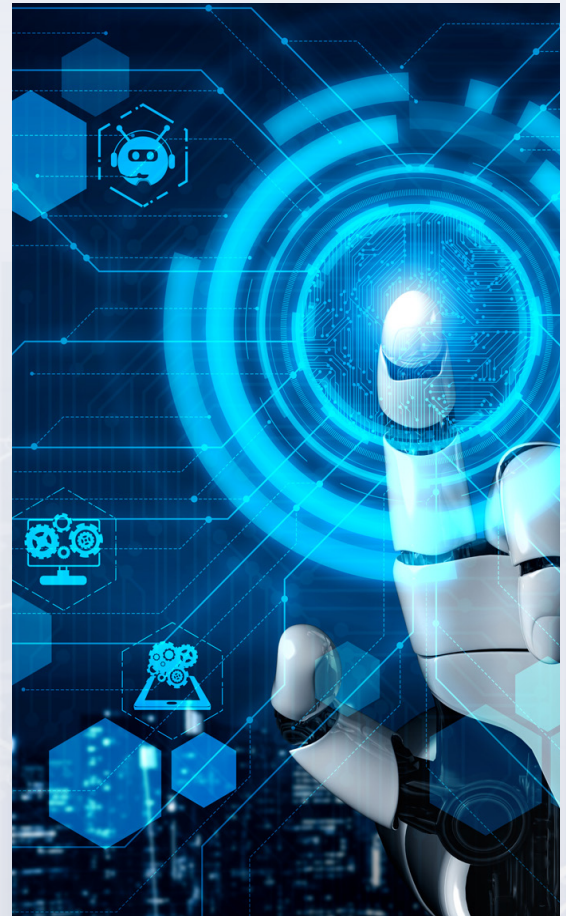
²⁵ 5G Opening Up New Business Opportunities, Huawei White Paper, December 2016, p.5.



3. Smart Healthcare – From remote controlled telemedicine to EMT's having immediate access to information on a patient, there is wide acknowledgment of the potential of eHealth to increase the availability and decrease the cost of medical services. Mobile devices are already being used as part of medical diagnosis or treatment all around the world, with 5G advances promoting market potential in telehealth services, personal health monitoring, remote surgery and commercial wearables.

4. AI-Assisted Living – 5G's hyper connectivity and network slicing could support mission critical services in real time. A digital assistant, worn by the user, could continually gather information about the environment, process it and feed back directions and information, with almost invisible delay. Artificial Intelligence augmentation in daily life could become the norm.

5. Drones – 5G supported drones (autonomous, unmanned, aircraft) are set to be one of the biggest new tech trends of 2021. Vodafone and Ericsson have already successfully tested sky corridors for 5G drones in Germany, and BT has launched the first commercial drone corridor in the UK. Imagine, a network of flying machines, independently surveilling, delivering, inspecting and transporting. 5G drones will empower a new digital airspace economy.



Catalysts for growth

Industry is already partnering with Telecom companies as the 'best enablers' for new applications, giving both partners the confidence to invest in R&D and infrastructure to make the move to 5G effective, sustainable, innovation-welcoming and profitable. For example, automotive manufacturers see the potential in 5G networks as a platform to open up new revenue streams and business models, including in-car entertainment or flexible rental charges based on the car/route used. Their industry-centered technological advancements could propel further investment by 5G providers.

Governments that support private investment in 5G through intellectual property protection, availability of risk capital, spectrum licensing and the facilitation of R&D position themselves to embrace the innovation and potential associated with 5G's ubiquity in the economy.

Consumer demand should grow with the understanding that people will benefit from wireless, untethered, immersive experiences that enable them to watch movies and live sports programs, play games, shop online and work remotely with convenience, freedom and efficiency. Such services could also enhance cooperation and interaction in fields like education, training, construction, city planning and oilfield exploration.



FIVG, the First 5G ETF:

- Is a diversified basket of stocks that can potentially benefit from the expansion of the 5G market. Rather than buy one or two individual equities focused on this sector, investors can invest in a way that provides diversification while maintaining a targeted view for their portfolio.
- Will have access to companies leading the 5G rollout, including Verizon, AT&T, Samsung, Nokia, Ericsson, Qualcomm, Skyworks Solutions, Cisco, Broadcom and Xilinx.
- Is a cost-effective way to access the 5G disruptors with an expense ratio of 0.30%.



Fund holdings and sector allocations are subject to change at any time and should not be considered recommendations to buy or sell any security.

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The possible applications of 5G technologies are only in the exploration stages, and the possibility of returns is uncertain and may not be realized in the near future.

Diversification does not assure a profit, nor does it protect against a loss in a declining market.

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