IS THE INDUSTRY—AND THE WORLD—
READY FOR 5G ADVANCED?

HOW 5G ADVANCED WILL IMPACT NETWORKS, DEVICES, LOCATION TECHNOLOGIES, ENTERPRISE, AND CONSUMER USE CASES

ABIresearch
THE TECH INTELLIGENCE EXPERTS℠

READY FOR 5G ADVANCED?

TABLE OF CONTENTS

By 2030, 75% of 5G base stations will be upgraded to 5G Advanced, accounting for 76 million radios, 23 million macro basebands, and 13 million small cells – all in the consumer market. Adoption in the enterprise will be slower, with half (14 million) small cells upgraded to 5G Advanced by 2030.

This dynamic is illustrative of both 5G's impressive evolution—and frustrating shortcomings—thus far. While 5G is already the fastest growing cellular generation ever, spurred by unprecedented improvements in speed and capacity, nearly all of this growth is concentrated in the consumer market. The enterprise remains woefully underserviced—and hard to penetrate—with 5G's current value proposition.

Now, three years after the initial deployment of 5G, the technology—and the industry—is at a crossroads. In order to fully realize the transformative potential of 5G, operators must look beyond selling data plans and SIM cards and instead get serious about enabling new use cases and empowering the enterprise. If they don't, they risk squandering the full benefits of 5G not just for potential customers, but also for their bottom lines. To that end, while there have been some mild successes for enterprises thus far, such as private cellular, the revenue generated to this point remains miniscule.

5G Advanced—the next evolution of 5G—can be the key to unlocking these new capabilities and revenue streams. It offers features and tools that are ripe for enterprise deployment and innovation, including high-precision 5G positioning, advanced Sidelink device-to-device (D2D) communication, affordable and flexible Reduced Capability (RedCap) New Radio, and support for a host of augmented, virtual, and extended reality use cases.

However, it remains to be seen whether operators are poised to take advantage. 5G standalone (5G SA), a precursor to 5G Advanced that introduced Service Based Architecture (SBA), where the core network deployment process is based on microservices, APIs and functionality exposure to third parties, has barely broken through. Only a handful of operators have launched nationwide deployments, and most SA launches are focusing on network efficiency rather than innovative use cases.

This report explores the evolution of 5G thus far and provides a detailed analysis of 5G Advanced. It covers:

- Why 5G technology is falling short of its promise to create new business opportunities in both the consumer and enterprise markets
- The evolution to 5G advanced, including key milestones and time-to-market
- Key features of 5G advanced and exciting use cases
- How, without 5G Advanced, 5G is doomed to fail and the industry will be forced to wait for 6G
- ABI Research's strategic recommendations for telcos and select verticals

THE 5G FOUNDATION IS SET, BUT TRANSFORMATION IS YET TO COME

The superiority of 5G manifests itself by the adoption speed of this technology throughout the last 3 years, making it the fastest growing cellular generation ever.

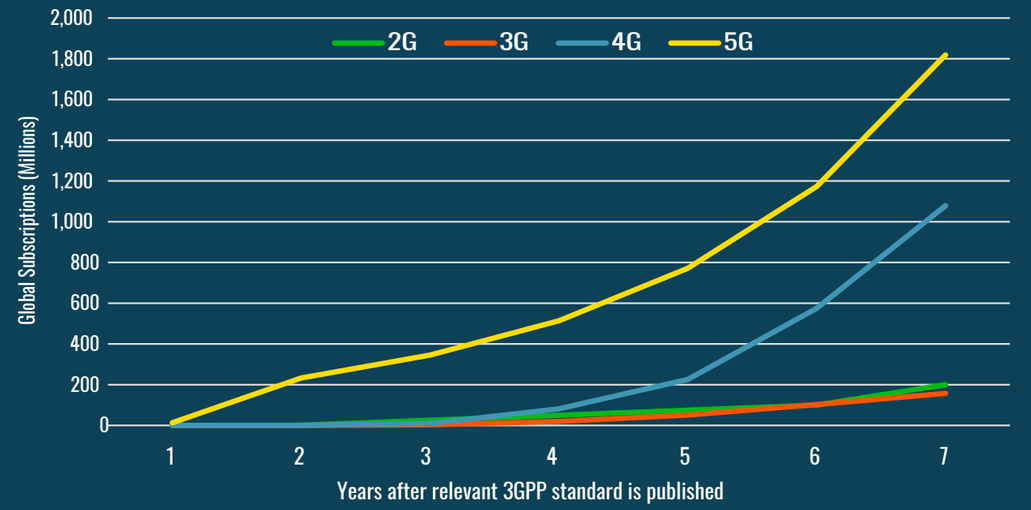
Over their 10 years of development time, cellular networks, including 2G, 3G, 4G, and 5G, traditionally evolved through two major phases in their development: the foundation phase and the transformational phase. The foundation phase is often designed to set the groundwork for any new generation, enabling it to be backward compatible with existing infrastructure, while focusing on fixing challenges left behind by the previous generation and improving the overall network performance in terms of network capacity, speed, or latency.

However, it is the transformational phase that really determines the success of each network generation. It is throughout that second phase when the industry pushes for new features and capabilities likely to address new use cases and enable new business models not possible with the previous generations.

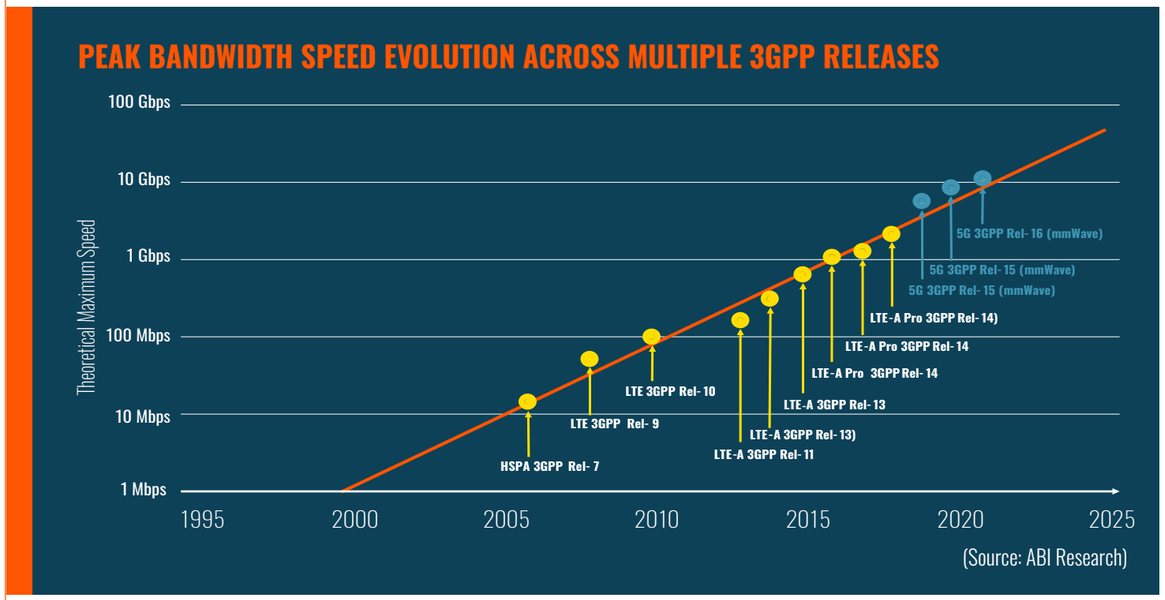
5G MILESTONES, 3 YEARS AFTER INITIAL LAUNCH

Current 5G networks provide astonishing data rates and capacity, something that could not have been expected a few years ago. For example, a Massive Multiple Input, Multiple Output (mMIMO) cell site (3 sectors, 100 Megahertz (MHz) bandwidth) can transfer 240 Terabytes (TB) of data during a single day, which is the equivalent of millions of digital photos. Although the transport network and other parts of the network would be challenged, the radio network is more than capable of providing high-quality connections for many years to come. Mobile operators have become experts in deploying high-speed networks, which will continue to evolve with additional upgrades. mmWave is also introduced in The 3rd Generation Partnership Project (3GPP) 5G specifications for the first time, which enables the technology to support an unprecedented theoretical speed of up to 10 Gigabits per Second (Gbps) in the Downlink (DL) and up to 4 Gbps in the Uplink (UL) as attained under Release 16 specifications.

SUBSCRIBER GROWTH ACROSS DIFFERENT CELLULAR GENERATIONS



(Source: ABI Research)



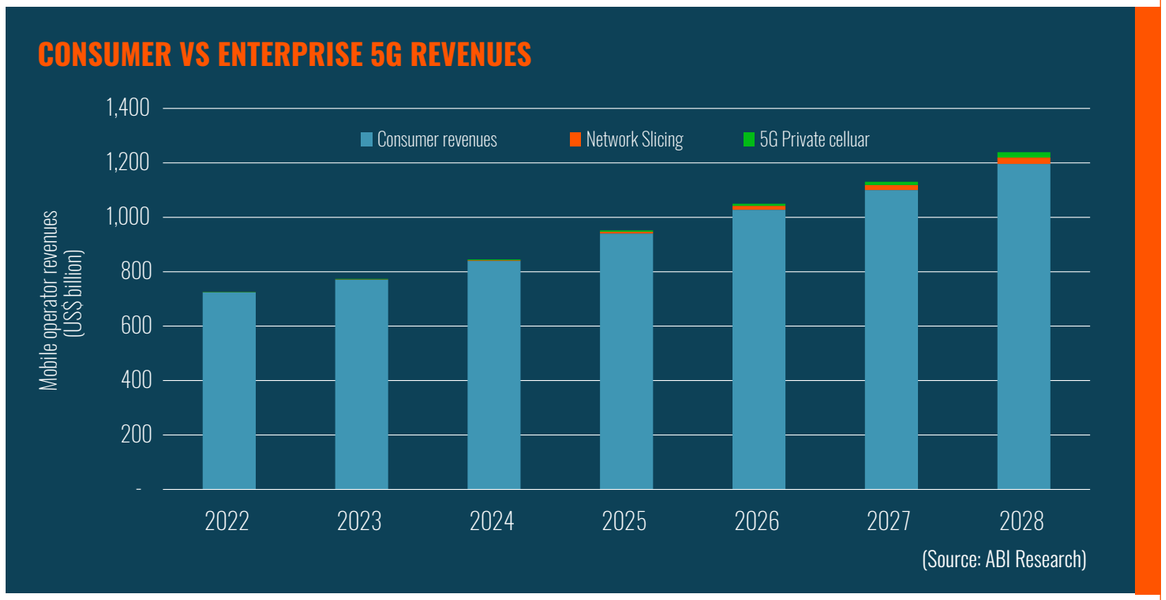
5G Standalone (SA) is another foundational milestone of 5G as this implementation enables the new generation to separate itself from the Long Term Evolution (LTE) core and use the 5G Next Generation (NG) core. This development enables far better service experiences (faster response time, lower latency, enhanced spectral efficiency, defined Quality of Service (QoS), and higher reliability) through the efficient management of 5G radio resources. 5G SA also introduces a Service-Based Architecture (SBA), with the core network deployment process based on microservices, Application Programming Interfaces (APIs), and functionality exposure to third parties.

However, SA implementations are still in their early stage of deployments, as only handful of operators have launched nationwide deployments, while most SA launches are focusing on higher network efficiency, rather than new types of services and use cases.

TECHNOLOGY PROGRESS, BUT A LACK OF USE CASE INNOVATION

5G has introduced several improvements in the public network environment that will continue to improve the user experience. It is worth noting that 5G 3GPP specifications up to Release 17 continue to improve the performance of 5G air interface with emphasis on the technical aspect of networking.

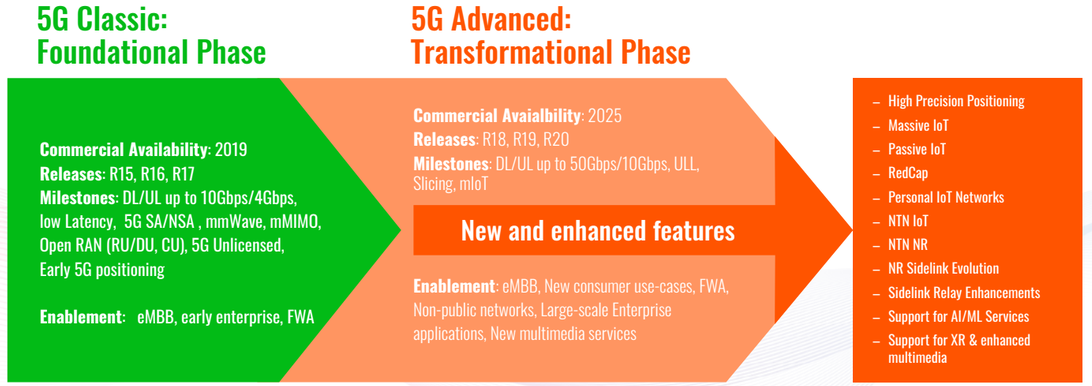
However, despite the milestones achieved by 5G, so far, the technology has failed to empower new use cases beyond eMBB. Indeed, 5G is currently used to fuel operators' strategies to migrate subscribers to premium data plans. While these strategies prove to be good enough to prevent the decline of the Average Revenue Per User (ARPU), operators have not been successful in creating new business opportunities either, launching new consumer use cases, or adequately addressing the enterprise opportunity.



For example, the most successful 5G enterprise application, so far, is private cellular, with small cells typically deployed in a factory floor, in a warehouse, or on other enterprise premises. Even if all private 5G cellular revenue is attributed to telco operators (which is arguably not the case, as they command a very small part of this opportunity) and these are added to 5G network slicing revenue, the comparison with consumer revenue is miniscule.

Nevertheless, the outcome of this progress is not surprising. The foundational phase of 5G has allowed mobile operators to familiarize themselves with the capabilities of 5G and what it can offer in the enterprise space. The next steps with 5G Advanced will build on this foundation and allow operators to monetize this knowledge and experience.

5G EVOLUTION ACROSS 3GPP RELEASES



(Source: ABI Research)

HIGH STAKES: WHY 5G ADVANCED DEFINES THE TRANSFORMATIONAL PHASE OF 5G

KEY MILESTONES EXPECTED WITH 5G ADVANCED

Future releases starting with Release 18, commonly referred to as 5G Advanced, will bring improvements in mMIMO, UL coverage, Dynamics Spectrum Sharing (DSS), and Integrated Access Backhaul (IAB). Most importantly, 5G Advanced will focus continuous enhancements on use case-based network support. Indeed, the new standards will be packed with a number of transformational features likely to enable the creation of new use cases and business opportunities not possible with existing 5G frameworks.

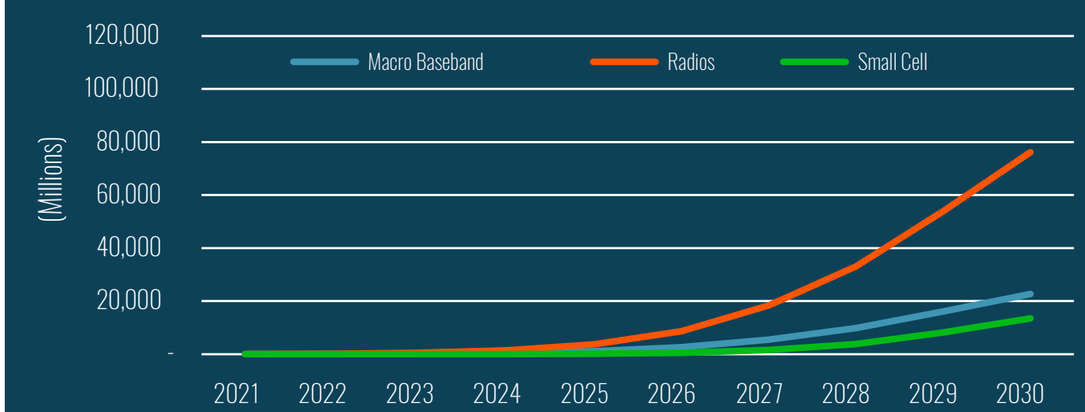
The new standard will enable the entire ecosystem, mobile operators in particular, to tap into new business opportunities, and will help them with the commercialization of brand new applications and services, including precision positioning in both indoors and outdoors, new public safety services, Extended Reality (XR), Device-to-Device (D2D) communications through sidelink enhancements, and sidelink relays. 5G Advanced will also extend 5G connectivity to a new category of User Equipment (UE) beyond smartphones to include wearables, drones/Uncrewed Aerial Vehicles (UAVs), surveillance and machine vision cameras, massive Internet of Things (IoT), and passive IoT devices. Now, it remains to be seen how long before all 5G Advanced features, as described above, will make it to the marketplace.

Meanwhile, 5G Advanced includes some topics to make progress close to the vision of the next generation, such as Artificial Intelligence (AI)/Machine learning (ML) for Radio Access Networks (RANs) and air interfaces as a starting point toward a full End-to-End (E2E) automation covering both networks and devices. 5G Advanced is introducing an essential framework in RANs for AI/ML applications, such as data collection enhancement and signaling support for energy savings, load balancing, and mobility optimization, as well as exploring AI/ML techniques to improve Channel State Information (CSI) feedback, beam management and positioning for the air interface.

Furthermore, with eyes on the long-term sustainable future, an evaluation methodology will be defined in 5G Advanced to make system-level network energy saving comparable and measurable across different deployment scenarios. At the same time, energy saving techniques for major network scenarios, such as Urban Micro in mid-band (Frequency Range 1 (FR1), and Millimeter Wave (mmWave) (FR2) spectrum deployments for beam-based scenarios with mMIMO, Macro in FR1 with/without DSS and E-UTRAN New Radio - Dual Connectivity (EN-DC)/New Radio-Dual Connectivity (NR-DC) macro with Frequency Division Duplex (FDD) Primary Cell (PCell) and Time Division Duplex (TDD)/mMIMO on a higher frequency. With the increasing demand for data traffic and number of UE connected, Communication Service Providers (CSPs) need to control power consumption as part of Operating Expenditure (OPEX), along with deploying 5G infrastructure.

5G ADVANCED: BUSINESS OPPORTUNITIES AND TIME TO MARKET

5G ADVANCED PUBLIC NETWORK INSTALLED BASE BY INFRASTRUCTURE TYPE, WORLD MARKETS: 2021 TO 2030



(Source: ABI Research)

ABI Research expects 5G Advanced will be commercially launched in 2025, two years after the planned freeze date of Rel-18. By 2030, 75% of 5G base stations are expected to upgrade to 5G Advanced, which accounts for approximately 76 million radios, 23 million macro basebands, and 13 million small cells globally in the consumer market. While in the enterprise market, slower adoption is expected with half of small cells upgraded to 5G Advanced, accounting for 14 million in 2030.

KEY FEATURES OF 5G ADVANCED

5G Advanced will indeed introduce several organic improvements to the cellular standard, but it will also introduce new radical features that aim to introduce significant value for enterprise applications. These include positioning improvements that aim to ultimately reach <1 Centimeter (cm) accuracy in the future, enable sidelink relays for a much more flexible deployment approach for on-premises deployments, and extend the network coverage through D2D communications. 5G Advanced will also support further sidelink enhancements beyond Vehicle-to-Everything (V2X). Reduced Capability (RedCap) is another key feature for 5G Advanced, which will extend 5G capabilities to a number of power-constrained devices, including smartwatches and other wearables, smart accessories, surveillance and machine vision cameras, Augmented Reality (AR)/Virtual Reality (VR) devices, and massive and passive IoT devices, to support asset tracking across both the enterprise and consumer markets.

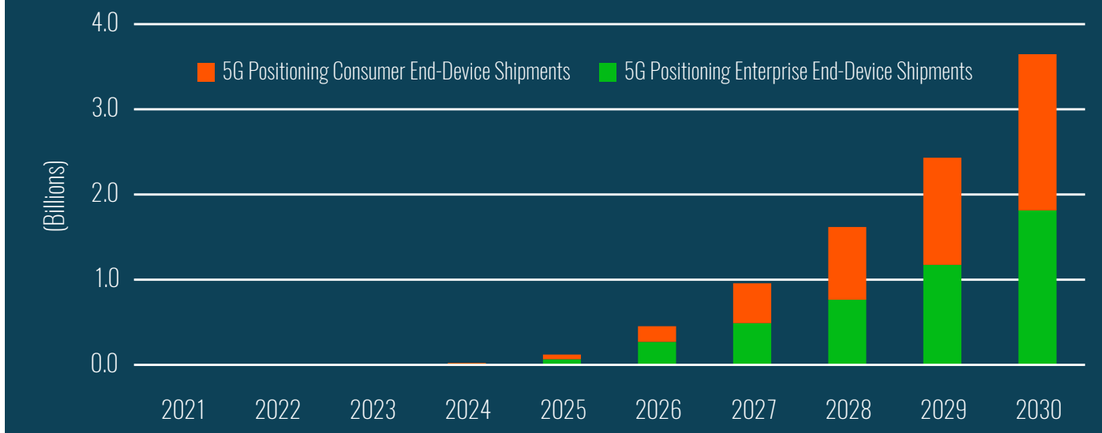
HIGH-PRECISION 5G POSITIONING

In a recent survey ABI Research conducted, 56% of respondents said 5G positioning is the right technology to support their Real-Time Location Services (RTLS) across multiple use cases.

5G positioning is emerging to make location-based services more accurate, precise, reliable, and seamless across both indoor and outdoor environments. The standards-based approach of the technology will allow it to benefit from the global and large-scale deployment of 5G, which could heighten the competitive barriers to alternative technologies in terms of cost and performance.

5G Advanced both introduces and iterates on features of 5G crucial to 5G positioning, enhancing the performance and reliability of the technology. This will include cm-level precision, further reductions in latency and power consumption, improvements to RedCap positioning for low-power applications, validation techniques, enhancements via Machine Learning (ML) and sensor fusion, efficiency improvements, and cooperative localization using sidelink relays.

5G POSITIONING ENTERPRISE VERSUS CONSUMER SHIPMENTS, WORLD MARKETS: 2021 TO 2030



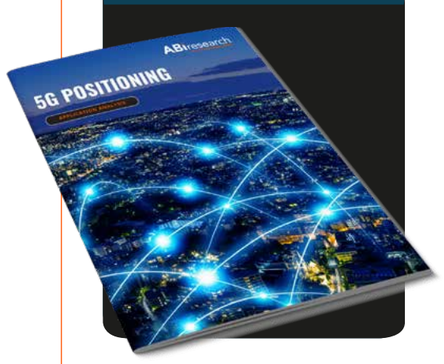
(Source: ABI Research)

Precise positioning can also benefit from communication between devices, as opposed to UL or DL connections that are limited to communication between base station and device.

With 5G Advanced, cellular positioning will be a breakthrough in the enterprise market and will represent a strong value proposition of enterprise private networks. In a recent survey ABI Research conducted with 213 C-level decision markers within the enterprise sector, 56% of respondents said 5G positioning is the right technology to support their Real-Time Location Services (RTLS) across multiple use cases. However, 5G positioning adoption in the enterprise sector will evolve in stages from Release 16, but large-scale adoption will not happen before the maturity of 5G Advanced adoption, which is expected after 2025. The commercial availability of 5G Advanced networks will mark a key milestone for the scalability and the democratization of 5G positioning across multiple industries and use cases from mission-critical and massive and passive IoT to support tracking using battery-less tags. By that time, 5G positioning will bring even greater positioning performance and accuracy without compromising power consumption or terminal cost, which will make it far from the most attractive and cost-effective technology out there.

In the consumer market, typical use cases would bring positioning services to challenging environments for Global Navigation Satellite Systems (GNSSs), such as urban canyons and tunnels. This includes indoor navigation and wayfinding in public venues, such as shopping centers, airports, hospitals, and sporting and entertainment arenas, which cover a number of use cases, such as accurate emergency response using both horizontal and vertical positioning information, geofencing for tracking children, vulnerable people, and pets when they leave safe areas like schools or home perimeters, enhanced AR/VR experiences through providing accurate positioning information on moving obstacles, and consumer goods tracking using much cheaper and more efficient solutions than existing technologies, such as Apple AirTags.

For more details on 5G positioning, see ABI Research's strategic report, 5G Positioning: Market Opportunities and Challenges (AN-5365).



Initial use of 5G positioning will be limited and sporadic, driven by enterprise use cases in IoT asset tracking and private 5G deployments. 5G Advanced positioning plays a crucial role in private deployments where multiple use cases, including positioning, can be compounded for effective Returns on Investment (ROIs). ABI Research expects much of the support for 5G positioning to be tied to overall private network rollouts, with adoption increasing rapidly around the 2025 to 2026 time frame. By 2026, there are expected to be 3,800 deployments, growing rapidly to more than 125,000 by 2030. This growth will be driven by the arrival of 5G Advanced around 2024 and the subsequent development and availability of hardware for these solutions. This will result in both many more private 5G deployments and a much higher proportion of them leveraging 5G positioning, particularly for the industrial sector in logistical use cases.

The remainder of enterprise device shipments can be attributed to asset tracking applications where 5G Advanced RedCap positioning will present major benefits for low-complexity designs and bring the performance of native 5G positioning in line with other Low-Power Wide Area Network (LP-WAN) solutions, such as LoRa, Sigfox, and 5G-compatible standards, such as LTE-M/Narrowband-IoT (NB-IoT). ABI Research expects shipments for 5G positioning asset tracking devices to accelerate significantly around the 2025 to 2026 time frame when 5G Advanced features will be introduced. By 2030, total 5G asset tracking positioning device shipments will reach more than 1.5 billion units.

In the consumer domain, ABI Research expects very little support for 5G positioning before 5G Advanced becomes a niche feature for select smartphones. With 5G RedCap as a viable solution for both connectivity and location for low-power device segments, such as wearables and consumer trackers (e.g., Apple AirTag, Tile tracker). By 2030, ABI Research expects more than 1 billion smartphone shipments worldwide to support 5G Advanced positioning alongside more than 90 million 5G Advanced RedCap wearables and AR/VR devices, and 595 million 5G Advanced personal trackers.

In summary, 5G positioning promises to address the majority of RTLS use cases by tapping into a pre-deployed 5G infrastructure used for communications, rather than deploying numerous RTLS solutions (e.g., Ultra-Wideband (UWB), Bluetooth Low Energy (BLE), Wi-Fi, etc.) that are often use case-specific and require heterogeneous equipment (e.g., tags, anchor points, and gateways). This can help drive down the cost and complexity of location services, enabling much more scalable deployments of positioning use cases over the next decade.

However, 5G positioning will not be positioned to systematically replace existing location-based technologies, but rather to augment their accuracy or extend the service coverage areas. 5G positioning technology will be able to replace some existing positioning technologies only when 5G becomes ubiquitous and reliable, and only when the ecosystem is mature enough to address all industry pain points without the need for redundant technologies.

Also, 5G could be cost-prohibitive for Small and Medium Enterprises (SMEs) that cannot afford to upgrade their infrastructure to wholly-digitized operation processes all at once. These players may instead choose to deploy more cost-efficient radio-in-the-box equipment tailored to their specific requirements, such as enabling 5G positioning provided by smaller system integrators that may be lacking expertise in radio systems. Any unspecified protocol stacks under 5G standards, such as low-power positioning, will be a challenge for them to integrate without compromising the terminal battery life, the system accuracy, or both. As the cost and complexity of alternative RTLS technologies falls, these smaller enterprises may also decide to leverage alternative technologies. In addition, competing technologies, such as Bluetooth and UWB, are likely to offer much lower tag costs than what 5G positioning will be able to achieve when it first arrives.

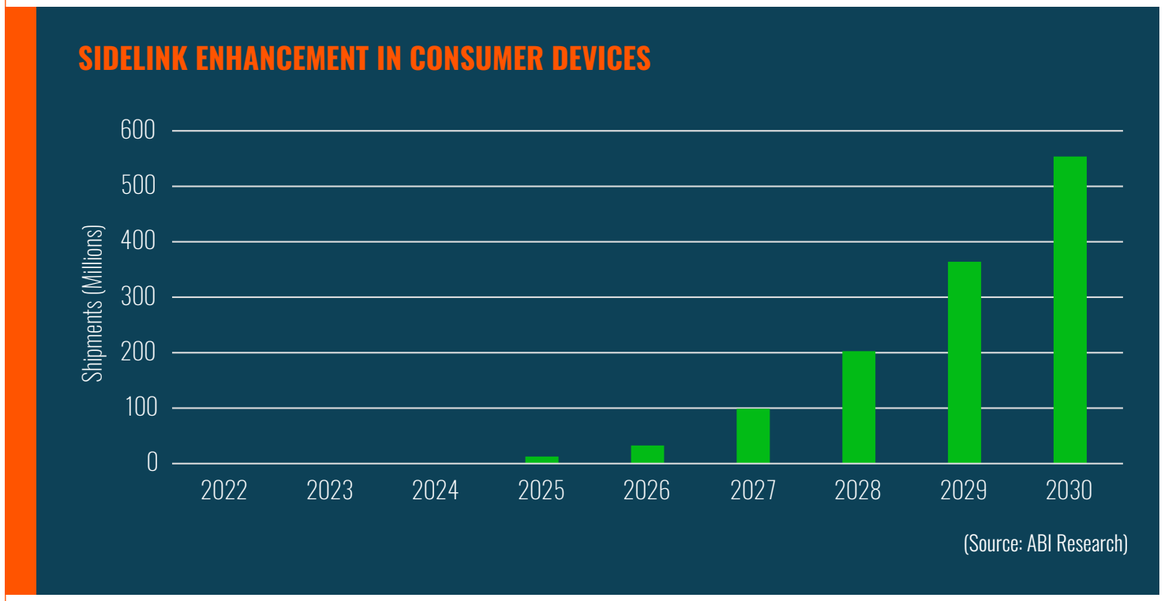
Perhaps most critically, adoption of 5G positioning technology requires timely support from 5G infrastructure suppliers and Mobile Network Operators (MNOs). While there are many opportunities for leveraging location-based services on 5G networks, the lack of market strategy, Proofs of Concept (PoCs), and pilot deployments from operators suggest that the availability of 5G Advanced positioning, commercial or otherwise, will require not only much more development, but also a shift in strategy from service providers. Barring a couple of PoCs from companies like Qualcomm and Huawei, incumbent 5G infrastructure suppliers are barely talking about 5G positioning capabilities, which is a stark contrast from how heavily 5G was promoted in its ability to target high-throughput low-latency enterprise applications several years ago. It is not clear whether operators are motivated enough to support these advanced positioning capabilities, and questions remain about the ability of these operators to monetize 5G positioning in the future. It is clear that more education, awareness, PoCs, and business monetization strategies need to be formed within the 5G positioning landscape, and all of these components need to fall into place swiftly or operators will risk this falling out of their hands.

Furthermore, effective 5G positioning deployments on public networks will require collaboration between multiple networks for coverage and reliability, carriers must be willing to coordinate on these issues, which would include sharing time and position data.

SIDELINK ENHANCEMENTS

D2D is a concept promoting direct communication between devices in proximity. The idea here is to offload local signaling and, eventually, traffic from the network, while enhancing the quality and the reliability of communication between devices interacting in the same local area. The first generation of D2D communication, commonly called sidelink, was introduced for the first time under 3GPP LTE Release 12 mainly to service vehicular communications (V2X).

Under 5G Advanced (3GPP Release 18) and beyond, further sidelink enhancements are expected , which will enable smartphones, wearables, and other mobile and portable devices to communicate with vehicles, enhancing the public's and pedestrians' safety. These enhancements include relative and collaborative positioning for improved accuracy, power efficiency, and integrity of positioning measurement used for Simultaneous Location and Mapping (SLAM) applications. In the longer term, sidelink enhancements will enable proximity services to be offered with premium quality in line with the expected ultra-reliability and low-latency requirements.



SIDELINK RELAYS

5G sidelink relay is a form of D2D communications allowing UE to act as a proxy gateway between a set of end terminals and the 5G network. The 5G NR sidelink relay will be first specified under 3GPP Release 17 and the evolution of the specification will continue throughout 5G Advanced releases. The technology targets a number of consumer and enterprise use cases likely to extend the market potential for 5G deployment and unlock new business opportunities for the 5G ecosystem. Key use cases that will likely benefit from the technology include:

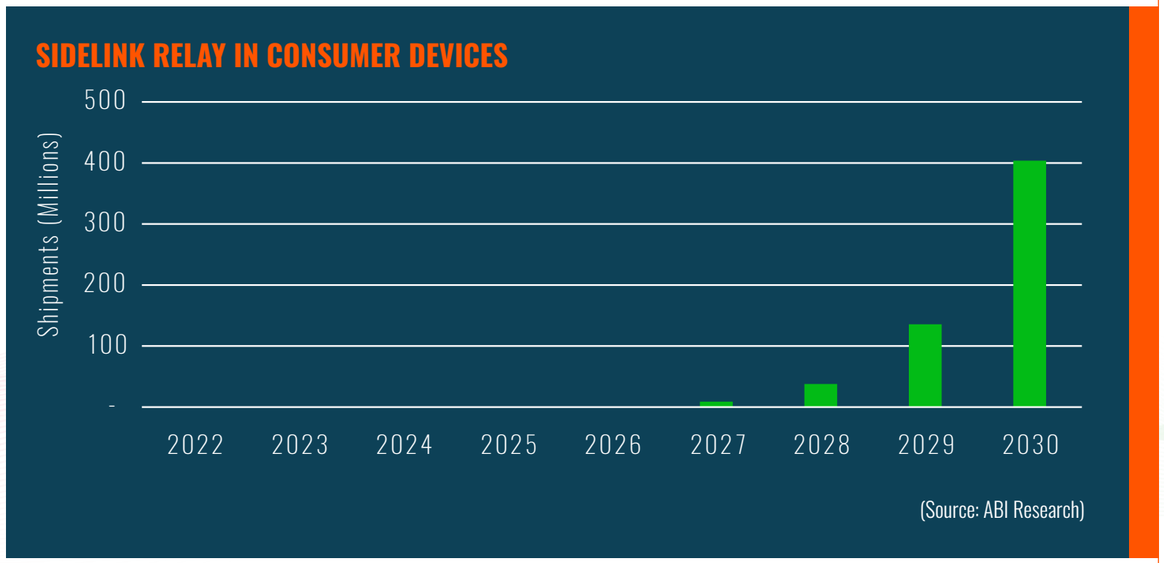
- **Extended Coverage**: This reaches beyond areas directly covered by the network. Using a single-hop NW-UE1-UE2 link, a sidelink relay relies on devices in the coverage area of the network to relay the transmission to other remote devices outside of the network coverage.
- **UE Acting as Network Proxy Gateway**: Another configuration of sidelink relay could be to enable UE to act as proxy to a registered number of other UE, using the NW-UE1-UEx paradigm. Under this configuration, the relaying UE acts as a network gateway that could connect other dependent devices to the 5G network. For example, the relaying gateway could be a smartphone providing 5G connectivity to other dependent devices and accessories, including wearables and smart accessories, such as earbuds, smart glasses, smartwatches, etc. The relaying gateway could also be an IoT access point deployed in a smart city, enabling the connectivity of many registered IoT devices, such as light bulbs, air-quality sensors, presence tags in car parks, or any other connected sensors.

5G Advanced (starting with Release 18) will address many issues related to sidelink relay, including UE discovery and communication initiation, QoS requirements, service continuity, and security of relayed connection.

Based on extensive discussions with key players within the supply chain, as well as with key technology implementers, early commercial deployments of sidelink relays will hit the enterprise market first, potentially for extending or improving coverage to remote devices receiving weak signals from the network. The enterprise will also deploy sidelink relays, where relevant, to connect a number of power- and cost-constrained IoT devices using 5G IoT gateways. Not only could this scenario improve the coverage area of 5G in areas with difficult access, but this approach could also lower the overall infrastructure cost and power consumption for end users.

The consumer market will be late in adopting sidelink relay due to the implementation complexity of the technology within public networks, but most importantly because of the uncertainty about how this feature will be monetized in the consumer market.

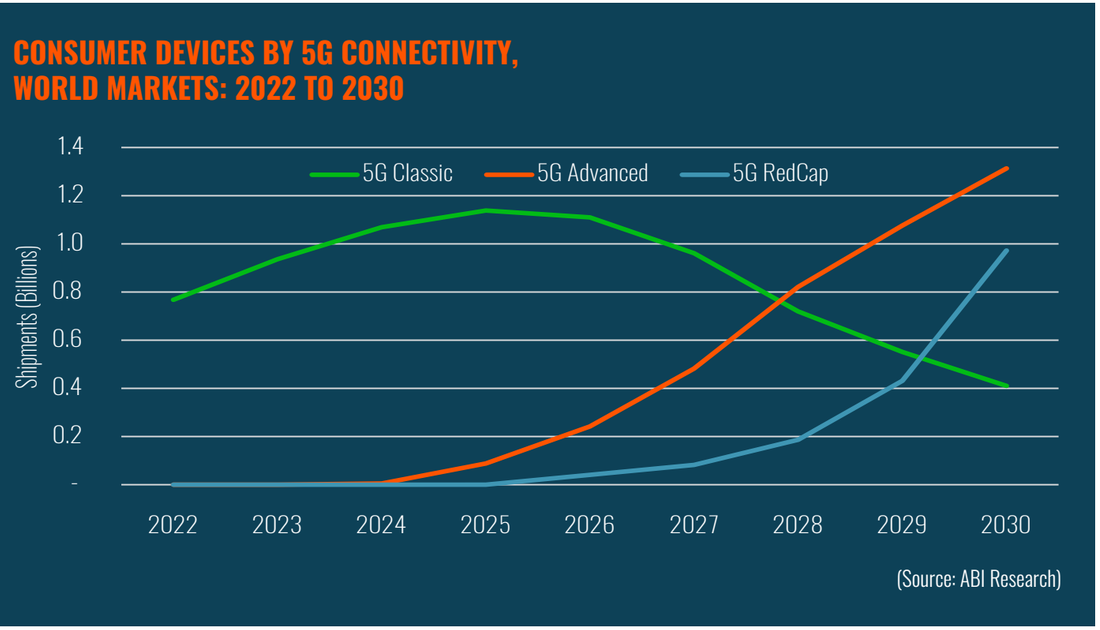
For these reasons, sidelink relay is not expected to be used in consumer devices until 2027, and shipments with the feature will only start to ramp up from 2029. Again, smartphones are likely to account for the vast majority of implementations due to their practical use as a proxy gateway. While the feature will lag behind its sidelink cousin in the consumer space, shipments are expected to grow quickly to reach more than 400 million units by 2030, which will see more than a doubling in market size from the previous year.



REDCAP

An expansion in 5G Advanced use cases will lead to the development of greater numbers of device form factors and market segments, taking growth way beyond mobile phones. One notable 5G enhanced feature set to expand the numbers of connected mobile products is RedCap.

Indeed, RedCap, including passive and massive IoT devices, will be key for addressing scalable use cases targeting smaller, lower-cost, and power-constrained systems within wearables, hearables, and asset tracking applications. Compared to devices with a full 5G modem, RedCap devices support a lower device bandwidth (5 MHz or below with Release 18), significantly reducing the cost and complexity of these devices.



Furthermore, the use cases for RedCap are in line with how LTE systems are currently deployed, such as in asset tracking, surveillance cameras, and low-power industrial sensors with newer applications on the horizon like location for XR. Moving forward, we can expect the migration of many of these devices from LTE to 5G NR RedCap, as the LTE spectrum is reallocated to 5G NR, private networks consolidate their connectivity, and other compelling 5G Advanced features are introduced.

RedCap products will be less complex, reduce costs, have good battery life, and require less bandwidth than current 5G products. Key device types expected to fall under RedCap are consumer or medical wearables, security and machine vision cameras, IIoT sensors and industrial modules, passive tags for tracking both consumer goods and assets within the enterprise, mobile accessories, and AR/VR headsets. Due to the innate nature of RedCap, it is expected to exclude more prominent consumer products, such as smartphones, tablets, and notebooks.

Incrementally to 5G Advanced, RedCap devices in the consumer segment are set to become commercially available from 2025 and the segment is forecast to grow from around 41 million in 2026 to 972 million by 2030. Personal trackers and wireless headsets are set to hold the lead in RedCap market shares across the forecast period. In addition, accurate positioning will be a popular feature in 5G devices, particularly for use cases like remote-control applications, and it is expected to account for 1.8 billion shipments in 2030, led by smartphones.

The creation of these 5G Advanced devices and experiences is central to the creation of mobile services with the user positioned firmly in the middle surrounded by multiple devices that act as enablers, whether that device is a smartphone, tablet, automotive equipment, set of wireless earbuds, or a smartwatch. An experience-centric design moves devices to function as hubs that can support multiple devices, so a system-level design needs to support and expand beyond just the main hubs to address all device types. It is important that the industry focus on the enablement of these 5G Advanced use cases and experiences to embrace the wider implications of moving the market from a device-centric to an experience-centric ecosystem.

AUGMENTED, VIRTUAL, AND EXTENDED REALITY USE CASES

5G Advanced promises increased understanding of applications and content. This would allow networks to identify XR applications and that application's specific latency and bandwidth needs (as there is no constant need, even in XR). Low-latency applications like multi-user instances or edge compute and streaming scenarios can be catered to separately from other applications, even XR applications that do not require low latency. Real-time adjustments, such as resolution and frame rate of content, can be made more quickly and accurately to ensure QoS.

CONSUMER DEVICES BY 5G CONNECTIVITY, WORLD MARKETS: 2022 TO 2030

	2022	2023	2024	2025	2026	2027	2028	2029	2030
AR Smart Glasses	0	0	0	36,401	229,324	902,962	2,136,151	4,290,158	5,958,202
VR Headsets	0	0	0	368,131	5,429,474	13,097,416	20,539,129	28,882,580	35,814,399

(Source: ABI Research)

Other elements of 5G Advanced also support AR and VR applications intrinsically, even if not specifically tasked to do so. Enhancements for edge compute, AI/ML, slicing, proximity-based services, security, real-time communications, and automation, among many others, all can play a role in XR connectivity and usage. AI/ML will be used to optimize networks in terms of load balancing and energy efficiency, and can expand into beam management and positioning—something beneficial to XR mobility use cases.

Some 5G Advanced usage will happen with natural market maturation for both 5G and XR. XR follows the smartphone market closely thanks to similar processing/connectivity architecture and even smartphone reliance in the case of tethered devices. As smartphones naturally have moved to 5G with XR following, the same will be true of 5G Advanced. The enhancements specifically for XR will mostly happen in the background, and users may not even be cognizant of the capabilities and improvements—QoS should only be noticeable to users if it falters.

There is the opportunity for telcos to use 5G Advanced as another value add for customers, just as 5G was. When it comes to XR-specific go-to-markets, by the time 5G Advanced is marketable, users will be more receptive to that potential value add. It will take the consumer market to push demand as the enterprise sector may recognize 5G Advanced benefits more easily, but the revenue and user base is always in the consumer sector. This is especially true with XR; the expected launch of prominent AR and VR hardware from tech incumbents will align with both mature XR software and service efforts, as well as the 5G Advanced rollout, creating a compelling ecosystem for all parties.

COMMERCIALIZATION OF 5G ADVANCED AND THE ROAD TO 6G

5G Advanced is an important milestone to prepare the industry for 6G, which will focus on distributed intelligence, blending the physical and virtual worlds, and the full use of AI/ML throughout the network. Several technologies are being discussed now for 6G, including full duplex transmission, doubling the capacity of each link when frequency is reused for both UL and DL. Rel-18 in 5G Advanced will explore the practical implementation to realize the full duplex transmission. Nevertheless, discussions about 6G are expected to begin in 2025, when the industry will discuss 6G requirements and the standard will likely be frozen a few years after. The following chart illustrates the likely development and deployment plan for future 3GPP releases.

	5G	6G
First Standard	R15 Early Drop: June 2018	2028
First Network	South Korea: April 2019	2029
100 Million Subs	June 2020	2031
1 Billion Subs	End 2023	2033

WHAT COMES NEXT?

5G Advanced is the foundation for the next generation of Mobile Broadband (MBB) and will set the scene for 6G. As discussed in this whitepaper, many new technologies and features are being developed, which will create new types of use cases, applications, and value to enterprises. Sidelink enhancements, sidelink relays, precision positioning, RedCap, intrinsic support of XR and advanced multimedia applications, and the use of AI/ML in the mobile network are slowly transitioning the functionality of cellular networks from consumer to enterprise. The first use of these technologies will likely expose functionality we cannot yet predict, and will likely create the foundation for network effects in the enterprise domain, much like 4G stimulated the creation of app stores, social networks, and the collaborative economy.

Now is the time to act and take advantage of all these new features 5G Advanced will enable. Mobile operators are looking for new partners that will help them crack the enterprise market and 5G Advanced will likely be the foundation that kick-starts this transition. 5G Advanced will likely become the mobile network powerhouse for many years to come, until 6G takes over and builds on the foundation of 5G Advanced and 5G. Some of the improvements it will introduce are in new directions, particularly in the enterprise domain, meaning that the companies that will benefit the most from the new generation may not be from the established value chain. 5G positioning, RedCap and sidelink are presenting new ways of connecting devices and using the network, which may lead to new use cases and applications, likely creating new ecosystems.

However, it is not obvious what role mobile operators will play in bringing these innovative 5G Advanced features and use cases to the marketplace and what business models they will deploy to monetize them. This is even more the case for the enterprise market with numerous new entrants promising to disrupt the market and create new implementation paradigms that could lower the barrier to adoption of 5G and 5G Advanced in the enterprise market. Open RAN is likely to open the doors for new implementations of 5G in the enterprise market, which could enable specialized system integrators or even chipset suppliers to become key players in the infrastructure supply in the enterprise space. The emergence of Radio Intelligence Control (RIC) and Service Management Orchestration (SMO) could open new business opportunities for third-party application developers and specialized vendors to plug their applications and services to 5G networks. This development will accelerate the time to market for 5G Advanced features, including 5G positioning, RedCap, XR applications, sidelink enhancements, sidelink relay applications, and many other use cases.

THE ROAD AHEAD

Let ABI Research help you navigate the road to 5G Advanced and beyond. Along with exclusive research and extensive market data, we also provide expert guidance to our clients, helping them identify their challenges, understand their markets, and optimize technology investments and strategies.

To learn more about any of our 5G services, or to discuss your specific needs and challenges with our experts, contact us today.

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