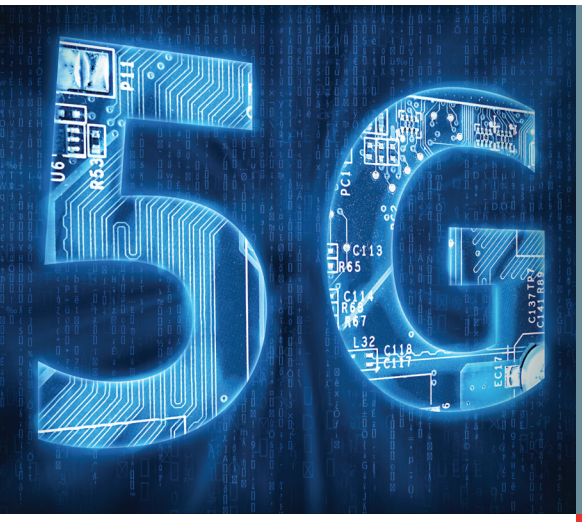
SIERRA WIRELESS

White Paper



Preparing for the **5G Future**

A SIERRA WIRELESS WHITE PAPER

Executive Summary

The buzz around 5G continues unabated, with some analysts projecting it will upend entire industries. Industry analyst ABI Research is forecasting that mobile broadband operators will generate $247 billion in 5G revenues in 2025. At the same time, there are many mixed messages surrounding 5G, and—as with any standard still under development—much that remains unknown. As Will Hahn, principal analyst at Gartner, stated, "While 5G is still in the early stages of development, we've never seen the emphasis on investing in the next generation of communications capabilities come so far in advance of settled standards."

To better understand where 5G is going, we need to understand the two distinct access technologies that operators will likely deploy to create 5G systems that meet all 5G requirements: 5G LTE and 5G New Radio (NR).

You likely have questions: Is it risky to invest in 4G LTE technology now? Should I wait for newer 5G technology to avoid deprecating LTE investments? Will 5G capabilities really live up to the hype? And when will my business actually be able to start taking advantage of them? The short answers to those questions are no, no, yes, and it depends. The long answer is detailed in the sections following. Here are the key points to understand:

- LTE will continue to play a major role in 5G systems in both the short and long term, so you don't have to worry about LTE investments getting deprecated.
- Some aspects of 5G truly are revolutionary—and we can expect to see major disruption in some industries, especially fixed broadband connectivity, over the next few years.
- Just how disruptive 5G will be—and how quickly organizations will be able to start taking advantage of 5G capabilities—depends on the application.

For some use cases (fixed wireless broadband access, wireless "hotspot" connectivity for high-volume/high-density locations), 5G, and specifically 5G NR, holds the potential to be truly disruptive. Operators are currently conducting technology trials using millimeter wave spectrum (mmWave), and showing multi-Gigabit speeds and massive capacity. However, mass commercialization of 5G NR in mmWave is still a few years away.

For many other wireless use cases, 5G represents more evolution than revolution. This is where 5G LTE fits in. For example, organizations launching applications that need broad nationwide coverage or Internet of Things (IoT) applications that need low cost, long battery life, and deep coverage, will benefit from this evolution to 5G LTE technology. In many cases, organizations will be able to incorporate new 5G LTE capabilities relatively painlessly, without having to re-architect their solutions.

No matter how your organization views the future of 5G, you can trust Sierra Wireless to help you navigate this transition. Sierra Wireless actively contributes to the industry groups defining the 5G standard, including the Third Generation Partnership Project (3GPP), and continues to be a key industry stakeholder helping to direct the evolution of next-generation wireless technologies. Sierra Wireless has been an industry pioneer since the early days of 2G. We are a global leader today in 4G LTE and will continue to be a leader in 5G—in both its evolutionary and revolutionary forms.

Read on for more insights on what the 5G NR revolution and 5G LTE evolution entails and what it's likely to mean for your business.

5G: A Wireless Story in Two Parts

Two different industry bodies are leading the charge to develop the 5G standard: the 3GPP and the International Telecommunication Union's (ITU) International Mobile Telecommunication system project (IMT-2020). It is Sierra Wireless' view that, in order to meet all the 5G requirements from both organizations, operators will most often deploy both 5G NR and 5G LTE. 5G LTE will allow the system to meet 5G Low-Power Wide-Area (LPWA) requirements, 5G automotive requirements, and 5G consistent user experience requirements via ubiquitous coverage. At the same time, operators will use 5G NR to meet the super-high speed, broad channel, and high spectrum (mmWave) requirements defined for 5G. Ultimately, both 5G LTE and 5G NR will be part of the operator's 5G system.

Some aspects of 5G truly are revolutionary—and we can expect to see major disruption in some industries, especially fixed broadband connectivity, over the next few years.

5G NR

As the name implies, 5G New Radio is a new wireless air interface—requiring an entirely new cellular module architecture, and the significant design and integration effort that entails. 5G NR will play a key role in fulfilling the promise of 5G transformation, enabling massive improvements in capacity, density, spectrum, and network efficiency. It will enable commercial cellular products to support mmWave for the first time, opening up massive amounts of new spectrum and offering unprecedented new capacity.

In the near term, however, 5G NR will be used in limited use cases—primarily for fixed wireless broadband and pay-TV services, as an alternative to fiber connectivity over "last-mile" networks. Trials for such services are already under way. In the longer term, 5G NR will expand to support similar use cases as 5G LTE supports and more.

5G LTE

5G LTE is the latest release of LTE Advanced Pro, Release 15. It will evolve many LTE Advanced Pro features, such as LTE-M, NB-IOT, V2X (automotive), LAA (unlicensed spectrum), positioning, and coordinated multi-point connectivity. It will also support higher speeds (multi-Gigabit), as well as provide new LTE features such as ultra-high reliability, ultra-and low latency.

5G LTE is guaranteed backwards compatible with 4G LTE, so there is no risk of deprecation as 4G LTE devices will continue to work on 5G LTE systems. For organizations weighing their wireless technology options today, it's important to note that 5G LTE is not a "transitional" technology; as mentioned, it's an essential part of a true 5G system.

LTE will continue to play a major role in 5G systems in both the short and long term, so you don't have to worry about LTE investments getting deprecated.

Inside 5G LTE

5G LTE is currently being standardized by 3GPP, with standardization scheduled to be complete in June 2018. It is an evolution of LTE Advanced Pro Release 14. So why then does this protocol fall under the category of "5G"?

5G LTE will be essential to meet some of the requirements defined for the final 5G standard in 2020 by 3GPP and IMT-2020—especially those around consistent user experience, seamless handoff (e.g., via dual connectivity), and the low-cost/high coverage/long battery life requirements of LPWA applications. For these reasons, the 3GPP has agreed to submit 5G LTE along with 5G NR as a 5G candidate to the ITU. Leaving no doubt, 3GPP will label all LTE release 15 specifications with the new "5G" logo.

WHAT DOES 5G LTE EVOLUTION COMMERCIAL DEPLOYMENT ENTAIL?

In most cases, existing wireless infrastructure will need only a software upgrade to support 5G LTE. As a result, you can expect broad (e.g., nationwide) coverage sooner than 5G NR. Additionally, for the non-standalone (NSA) version of 5G NR, dual connectively to 5G LTE is required, so 5G LTE coverage will be required anywhere that 5G NR NSA is deployed.

Since 5G LTE is an evolution of 4G LTE, organizations can smoothly transition their applications to the new standard whenever 5G LTE's enhancements make sense for that application or segment. The transition will be smooth because the software interfaces will be largely the same, and modules will be pinout-compatible.

5G LTE product transition will not be on the scale of disruption that organizations experienced moving products from 2G to 3G, or 3G to 4G. The transition will be more like moving from LTE to LTE Advanced—that is, simple, straightforward, and in many ways transparent. In terms of forward compatibility from 4G LTE to 5G LTE, for LPWA (e.g., LTE-M and NB-IOT) cellular modules, a firmware upgrade to 5G LTE will likely be possible. To achieve multi-Gigabit speeds, however, a hardware change will be required.

Inside 5G NR Disruption

Unlike 5G LTE, 5G NR represents a disruptive change for customers. The standard is still being defined; the non-standalone version, which, as mentioned, mandates that 5G LTE be deployed, is scheduled for completion in December 2017. The standalone version with ultra-reliable low latency communication (URLLC) support is scheduled for completion the same time as 5G LTE – June 2018. 5G NR will support revolutionary improvements in throughput, capacity, and efficiency, particularly at frequencies above 6 GHz, more commonly known as mmWave. At the same time, because the standard is still being developed, and because of the complexity of integrating a completely new technology and product architecture, we likely won't see mass-scale commercialization of 5G NR in the mmWave band until the 2019-2020 timeframe.

As mentioned, the release 15 version of 5G NR currently under standardization is not intended to support all the use cases targeted for 5G. Features for massive machine type communications (mMTC) or LPWA application support, automotive (V2X) and unlicensed spectrum, for example, won't be included in the release 15 version of NR. Like LTE, however, 5G NR is expected to continue to evolve, and eventually expand support to other use cases.

That doesn't mean 5G NR won't be transformational. The 5G NR millimeter wave technology opens up massive amounts of new spectrum, creating an entirely new category of wireless services. By eliminating the need for fiber connectivity over last-mile networks, even initial 5G NR deployments could profoundly disrupt the home broadband and pay-TV markets, as well as offering massive capacity boosts for locations such as stadiums and malls. For this reason, operators are already demoing 5G NR for these applications. More broad-based rollouts of 5G NR that provide ubiquitous coverage, including standalone 5G NR systems, will take longer, but initial 5G NR deployments will start ramping as early as 2019.

WHAT DOES 5G NR COMMERCIAL DEPLOYMENT ENTAIL?

On devices, mmWave support will require a new product architecture and significant technical design and integration effort and thus will be disruptive for customers. For example, modules will have to be co-located with antennae.

On the infrastructure side, given the short propagation distance of mmWave spectrum (a few hundred meters), 5G NR will also require new infrastructure and large numbers of new cell sites. As a result, large-scale (nationwide) deployments are likely to be slower than for 5G LTE.

Just how disruptive 5G will be—and how quickly organizations will be able to start taking advantage of 5G capabilities—depends on the application.

Looking Ahead

Recognizing the differences between 5G LTE and 5G NR is an important first step in determining how organizations should proceed with planned application launches. For organizations launching applications that call for the delivery of very large amounts of data over short distances, expect 5G NR to be a very big deal, especially in the fixed broadband and pay-TV marketplace, with initial deployments as early as 2019.

For applications that require broad (e.g., nationwide) coverage, LPWA support, V2X, broadcast, D2D, unlicensed spectrum, or other capabilities not included in initial versions of 5G NR, organizations should keep an eye on 5G NR, but it is unlikely to be significantly disruptive to their business anytime in the near- or mid-future. Instead, these organizations should look to 5G LTE in the near-term to provide the 5G experience via a straightforward upgrade. For this reason, continue to expect value from LTE investments through 2020 and well beyond.

Sierra Wireless: Your Partner in the 5G Evolution

Sierra Wireless is a global leader today in 4G LTE, and will continue to be a leader in 5G LTE, as well as 5G NR. We provide:

- **Proven Experience:** We have more than 20 years experience building, implementing and securely managing large-scale applications across technologies from 2G to 4G, winning the trust of the world's largest enterprises.
- **Product Innovation:** We have a long track record of pioneering wireless innovations, including being first to market with several 4G and LTE technologies. We are committed to developing new technology timed to coincide with network rollouts.
- **IoT Industry Leadership:** We play a leading role in the development of standards-based wireless technologies and are active participants in the GSMA Working Group, 3GPP standards bodies, and many other industry organizations.

Start with Sierra to learn more about how you can prepare to capitalize on 5G, visit: www.sierrawireless.com

About Sierra Wireless

Sierra Wireless (NASDAQ: SWIR) (TSX: SW) is building the Internet of Things with intelligent wireless solutions that empower organizations to innovate in the connected world. Customers Start with Sierra because we offer the industry's most comprehensive portfolio of 2G, 3G and 4G embedded modules and gateways, seamlessly integrated with our secure cloud and connectivity services. OEMs and enterprises worldwide trust our innovative solutions to get their connected products and services to market faster. Sierra Wireless has more than 1,100 employees globally and operates R&D centers in North America, Europe and Asia.

For more information, visit www.sierrawireless.com.