

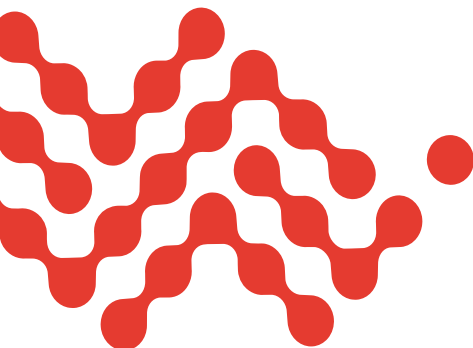


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5G RedCap (Reduced Capacity) – Delivering Right-Sized Performance for Mid-Tier IoT

Simplified 5G devices will support a broad range of lower cost connectivity applications currently running on 4G LTE.





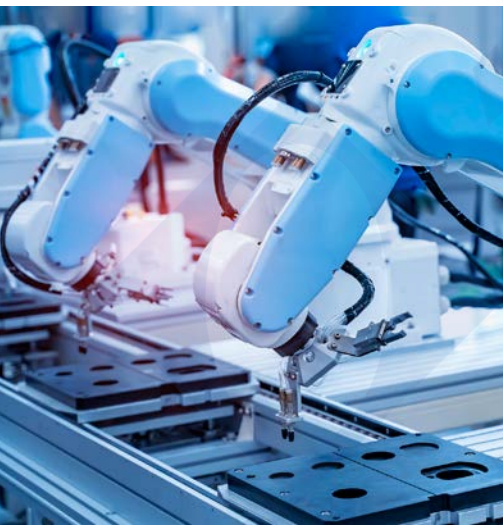
Introduction – The Continued Growth of 5G

5G market growth is being driven by new mobile device subscriptions and increased support for a diversified set of 5G IoT use cases. According to Allied Market Research, “the global 5G technology market was valued at \$5.13 billion in 2020, and is projected to reach \$797.80 billion by 2030, growing at a CAGR of 65.8% from 2021 to 2030.”¹ Faster network speeds and increased capacity have improved the performance of applications that used to run on 4G, and at the same time helped pave the way for new application and technology advancements.

The 5G commercial rollout to date has focused on delivering Enhanced Mobile Broadband (eMBB) supporting smart phones and high-performance modules and routers. eMBB supports a combination of voice, video and high-speed internet access for a broad range of mobile devices.

A second targeted 5G use case is Massive Machine Type Communications (mMTC) also called LPWA (low power wide area) which connects large numbers of devices with low data volume requirements and minimal network activity. The massive capacity will support billions of smart sensors and edge devices that will be added to the Internet of Things. 5G mMTC is supported by 3GPP 5G Release 15 NB-IoT and LTE-M devices. While 3GPP 4G Release 14 NB-IoT and LTE-M devices are broadly available at the publication time of this white paper, 3GPP 5G Release 15 NB-IoT and LTE-M devices have not yet been commercialized. *(Note: The 3GPP or 3rd Generation Partnership Project develops technical specifications for the third generation and beyond of mobile and cellular telecommunications.)*

A third targeted 5G use case, URLLC (Ultra Reliable Low Latency Communications) requires ultra-low latency (<1 ms), and high reliability (>99.99%) for critical communications. Use cases include Industry 4.0 which includes advanced industrial automation and remote health care including remote surgery. The rollout for URLLC is pending business validation.



Introducing RedCap

Not all IoT use cases need high-performance, high cost 5G eMBB hardware. However, many do require higher speeds and lower latency than mMTC or LPWA solutions provide, such as midrange IoT applications that currently run on 4G LTE using CAT 1 to CAT 4 devices.

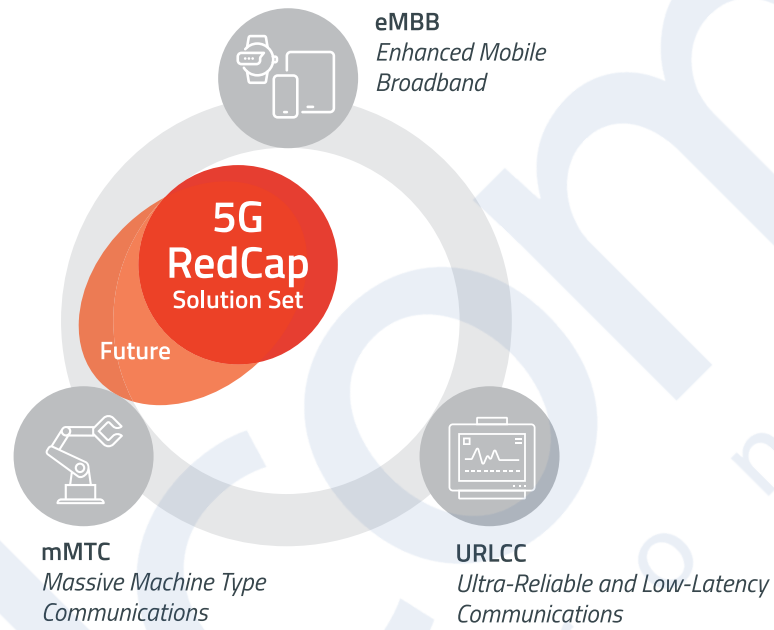


Figure 1 – 5G Reduced Capacity Application Subset

RedCap delivers just the right level of performance for Mid-Tier IoT applications. RedCap devices are smaller, less complex, less expensive and use less power than more expensive, higher power 5G eMBB modules, but are more expensive and use more power than 5G mMTC. 3GPP specified the new RedCap device type within Release 17 which was completed in 2021.

RedCap is a 5G-native New Radio (NR) solution that will help 4G LTE (Cat-1 and Cat-4) equipment users migrate to 5G without the size and cost burden of 5G NR eMBB hardware. (RedCap is also referred to as NR-Light.) And while the end of 4G is still many years away (i.e., 2030+), it enables companies to future-proof their current investments.

To reduce costs and power consumption compared to normal 5G NR devices, 5G RedCap NR devices will have less processing power (i.e., slower data rates), fewer antennas, less RF bandwidth and no carrier aggregation.

Unlike LTE categories in 4G, which strictly defines the peak rate of a device category, 5G NR specifies the lowest or minimum peak rate required. For RedCap, the minimum peak rate is specified at 64Mbps, but device vendors are free to commercialize RedCap devices with higher data rate (e.g., 100Mbps).

5G RedCap devices also have the option to support half-duplex FDD (HD-FDD) versus full-duplex FDD (FD-FDD). Since HD-FDD is not an option for LTE Cat-1 devices, 5G RedCap devices which support HD-FDD have the potential to be less complex and less



costly compared to LTE Cat-1bis devices. To further reduce power consumption, 3GPP specified optional power saving features normally used in mMTC devices including enhanced discontinuous reception mode (eDRX) and relaxed radio resource management (RRM) for stationary devices.

Since 5G RedCap NR devices are native to NR, they are designed to run on the same 5G networks as 5G NR eMBB devices. RedCap devices cannot support non-standalone (NSA) mode and thus require the network to deploy the 5G core network (5GCN) to operate in 5G standalone (SA) mode.

RedCap Use Cases

INDUSTRIAL IOT

Industrial IoT includes sensors and actuators in factories, machinery, pipelines and the power grid. Many of these sensors have midrange bandwidth requirements and may connect infrequently. Some remote applications require low power as they run on solar or battery power.

SURVEILLANCE

Video surveillance cameras require an estimated 4Mbps for low resolution and an estimated 25Mbps for higher resolution video. These systems typically use line power versus battery operation and require high reliability.

WEARABLES

Wearable devices include smartwatches, fitness trackers, location tracking, smart clothing, health sensors and AR/VR headsets. These are battery operated devices that are periodically recharged so battery life is often a key driver. Many devices use very little bandwidth while more complex devices like AR/VR headsets and body cameras require higher data rates.

RedCap will help bring 5G to many additional markets including agriculture, construction, mining, healthcare, manufacturing, retail and smart cities. It will also drive intelligent edge connectivity helping to increase reliability, reduce latency and increase network efficiency. Ruggedized routers will be designed and built around RedCap 5G modules as solutions for industrial and outdoor applications.



Evolution of RedCap

RedCap devices will require an upgraded network (i.e., 5G Core Network) to be deployed. Early adopters will want to choose RedCap modules with LTE fallback support. When LTE fallback is no longer needed, HD-FDD RedCap devices will be more practical, smaller and less expensive than FD-HDD devices. Additional network upgrades will be required to support HD-FDD RedCap devices.

3GPP is currently specifying an evolved RedCap device (eRedCap) in Release 18 to further reduce cost and size by lowering the minimum peak data rate to 10Mbps. This targets LTE CAT-1bis device replacement and is scheduled to be completed by mid-2024 with commercialization typically two years later.

Sierra Wireless RedCap Timeline

Sierra Wireless has been an active participant in the 3GPP RedCap specification and closely follows 3GPP specification development. Projected commercial availability of Release 17 RedCap products is 2024. This timing may depend on network support for 5G RedCap and may be regionally dependent.



How to Prepare for RedCap Availability

- Create an overall 4G to 5G migration plan for your entire organization.
- Identify the LTE devices (Cat 1 to Cat 4) that you will be migrating to 5G RedCap and establish the performance requirements you will want to achieve. Collaborate with Sierra Wireless engineers to develop a migration plan.
- Keep in touch with Sierra Wireless to get the latest insight on RedCap release timing and other new 5G devices. Participate in RedCap beta trials when available.

Start with Sierra

Developing an overall 5G transition plan is a daunting task. Partnering with a cellular expert like Sierra Wireless, with a 25+ year track record of successfully certifying products through major carriers, means you get the benefit of all that expertise. Sierra Wireless helps you keep design and development timelines on track without burning budgets on issues relating to system design and carrier compatibility.

At Sierra Wireless, our design teams are committed to the success of 5G RedCap. We're already drawing lessons from the first and second generation of 5G products and will continue to learn as 5G matures overall. Our approach to 5G builds on decades of leadership in cellular deployments of all kinds, and we're fully equipped to anticipate roadblocks and resolve issues as they arise. Working closely with our OEM and enterprise customers, our 5G specialists focus on quick and secure deployments that meet your needs.

TO LEARN MORE

To learn more about our unique dedication to success in 5G, visit us at www.sierrawireless.com.

GLOSSARY

3GPP – Third Generation Partnership Program specification and governing body

5GCN – 5G Core Network

5G mm Wave – Frequency spectrum from 24GHz to 40GHz – High capacity, short range

5G NR – 5G New Radio

5G SA – 5G standalone network that runs on dedicated 5G network components

C-Band - Frequency spectrum from 3.7GHz to 4GHz – Good 5G capacity, medium range

eMBB - Enhanced Mobile Broadband

mMTC - Massive Machine Type Communications

RedCap – Reduced Capacity also referred to as NR Light

RRM - Relaxed radio resource management

URLCC - Ultra-Reliable and Low-Latency Communications

REFERENCES

1. <https://www.alliedmarketresearch.com/5g-technology-market>

About Sierra Wireless

Sierra Wireless (a subsidiary of Semtech Corporation) is a world leading IoT solutions provider that combines devices, network services, and software to unlock value in the connected economy. Companies globally are adopting 4G, 5G, and LPWA solutions to improve operational efficiency, create better customer experiences, improve their business models, and create new revenue streams. Sierra Wireless works with its customers to develop the right industry-specific solution for their IoT deployments, whether this is an integrated solution to help connect edge devices to the cloud, a software/API service to manage processes with billions of connected assets, or a platform to extract real-time data to improve business decisions. With more than 25 years of cellular IoT experience, Sierra Wireless is the global partner customers trust to deliver them their next IoT solution.

For more information, visit www.sierrawireless.com.

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