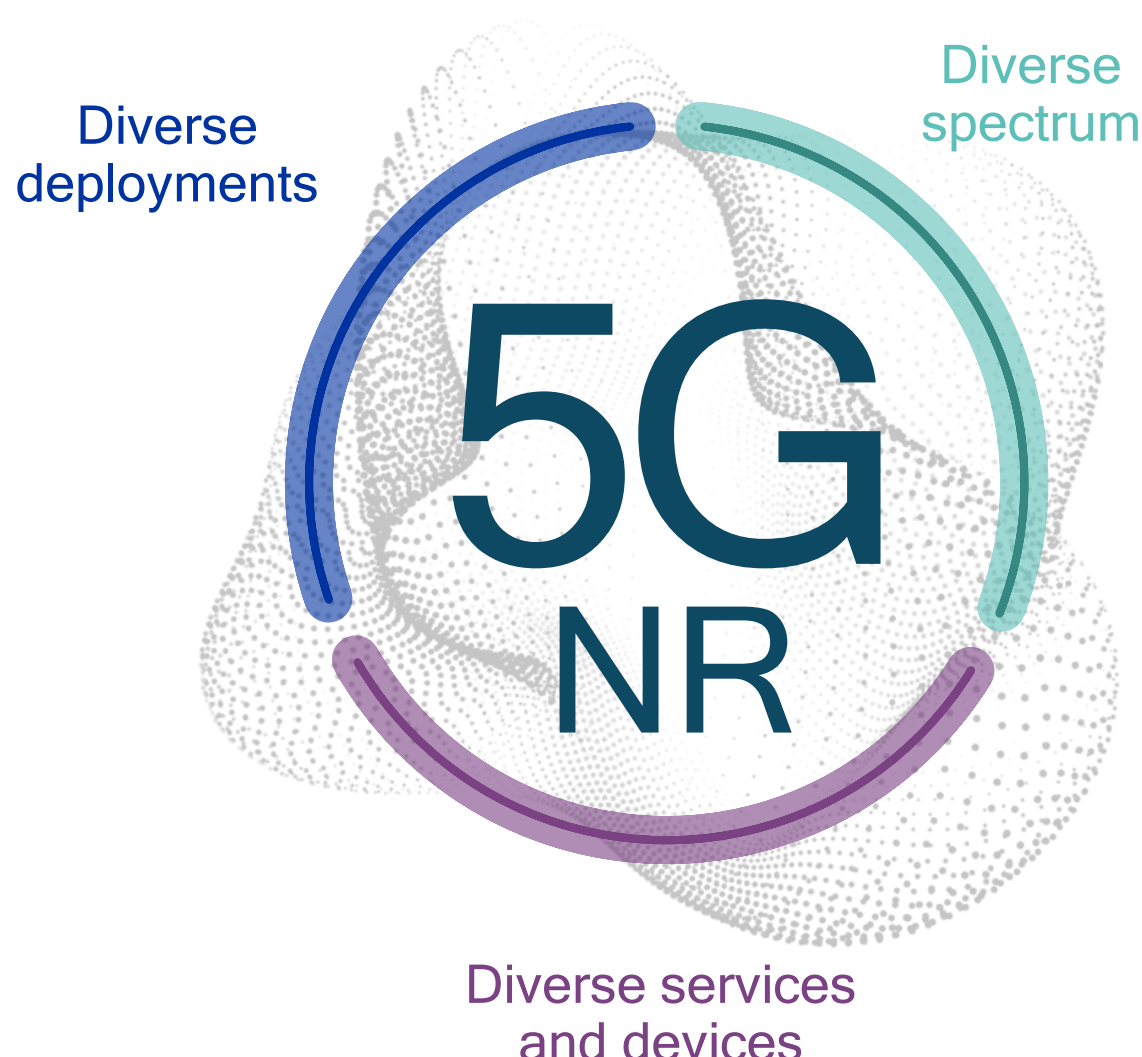


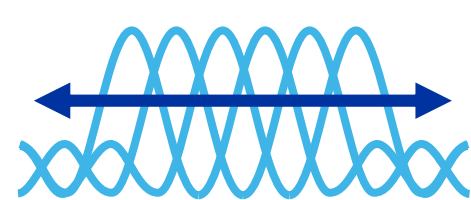
The vision for 5G

5G takes on a much larger role than previous cellular generations – connecting new industries, enabling new services, and empowering new user experiences. At the foundation of this next generation network is 5G New Radio (NR), the global 5G standard for a new OFDM-based air interface designed to support the wide variation of 5G device-types, services, deployments and spectrum.



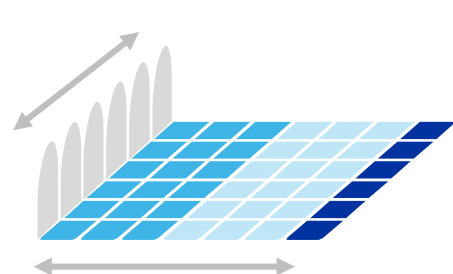
Qualcomm inventions form the core foundation of 5G

A signature of 5G is the massive expansion of addressable spectrum, and its potential is realized through new massive MIMO and mobile millimeter wave innovations. 5G brings extremely high data rates – to do this efficiently requires new advanced channel coding techniques. To achieve a much broader range of use cases in 5G, a scalable air interface is a core foundation. Finally, a cornerstone of 5G is forward compatibility to future services, and this is enabled through a new, flexible slot-based framework.



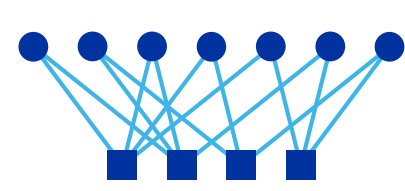
Scalable OFDM-based air interface

OFDM-based waveforms with scalable numerology dynamically and efficiently span the diverse spectrum, deployments, and services that define the vision for 5G.



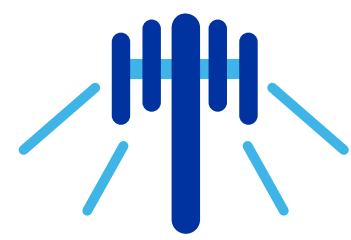
Flexible slot-based framework

A new self-contained slot structure is a key enabler to ultra-reliable low-latency communications and forward compatibility – laying the foundation for new services, such as autonomous driving and industrial automation.



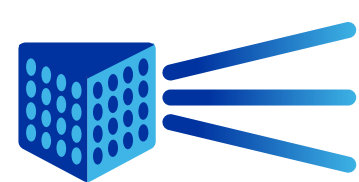
Advanced channel coding

State-of-the-art LDPC codes, newly designed for cellular, efficiently support large data blocks – scaling to support multi-Gbps speeds with improved energy efficiency and lower complexity. CA-Polar codes ensure a reliable control channel.



Massive MIMO

Reciprocity-based massive MIMO efficiently uses a large number of antennas for higher data rates, while providing efficient use of mid-band spectrum and effective coverage at higher bands.

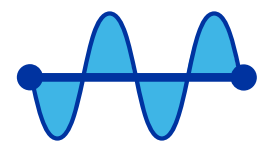


Mobile millimeter wave

Advanced beam tracking, switching, and steering techniques open up wide bandwidths of high-band spectrum for extreme speeds and capacity, fundamentally enabling mmWave for mobile devices, including in non-line-of-sight environments.

Built upon Qualcomm's 4G leadership

Qualcomm has pioneered the core innovations in LTE right from its inception – introducing OFDMA and SC-FDMA, Broadcast (eMBMS), Carrier Aggregation (FDD/TDD), Advanced MIMO technologies, and HetNets with Small Cells and Interference Management. Later, Qualcomm led LTE's expansion into unlicensed spectrum with LAA, eLAA, and into new verticals with LTE IoT (eMTC, NB-IoT), Cellular V2X, EnTV and Ultra-Low Latency. 5G NR builds upon these strong foundations laid in 4G LTE.



OFDMA, SC-FDMA



Broadcast (eMBMS, EnTV)



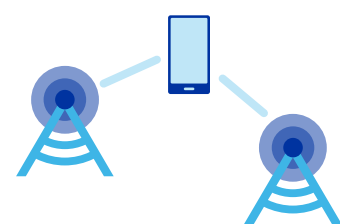
Carrier aggregation (FDD, TDD, FDD+TDD)



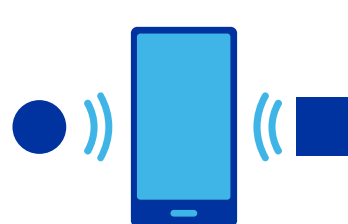
Advanced MIMO technologies



Security



CoMP



Dual-connectivity



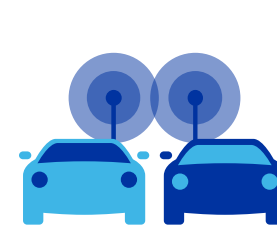
VoLTE



HetNets with Small Cells and Interference Management



LTE in Unlicensed (LAA/eLAA)



Ultra-Low Latency for C-V2X



Fast link adaptation



Hybrid ARQ



Positioning



eMTC and NB-IoT

To learn more visit qualcomm.com/5G