

# 5G und 5G Advanced – das Beste kommt noch

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Mobilfunkkonferenz 5G.NRWeek Competence Center 5G.NRW

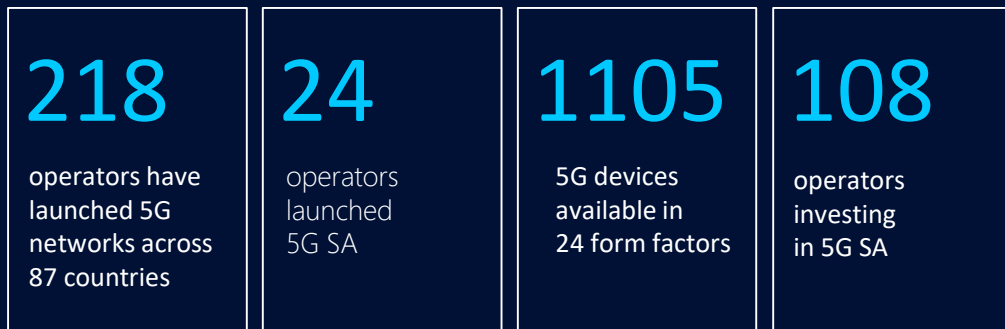
10. November 2022

# Drivers for the 6G future...



<sup>1</sup> Morris, Chris. "The Metaverse Could Be Worth \$13 Trillion, Host 5 Billion Users by 2030, Says Citi." Fortune, 1 Apr. 2022

# ... while 5G subscription growth continues

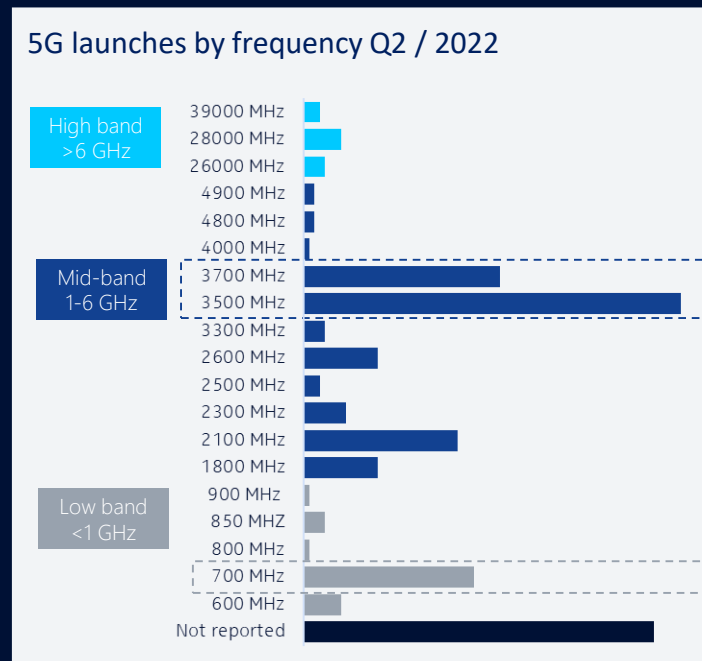


Source: GSA, July 2022



Source: Omdia, July 2022

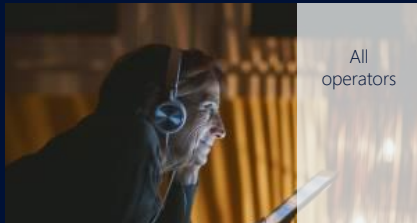
Source: GSMA, Mobile Economy 2021



Source: GSMA Intelligence August 2022

# 5G use cases in the spotlight

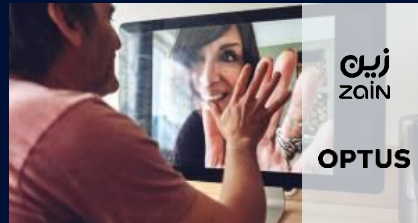
● Commercial  
● Trials



All operators

## Evolved Mobile broadband

Consistently great video streaming and social media experience

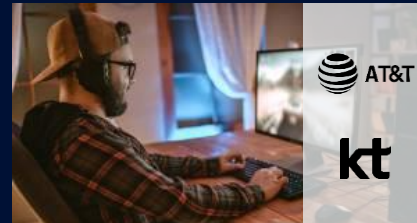


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## Fixed Wireless Access (FWA)

Gigabit broadband experience, rivalling FTTx



AT&T

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## Cloud gaming

Leveraging 5G's high data rates and low latency

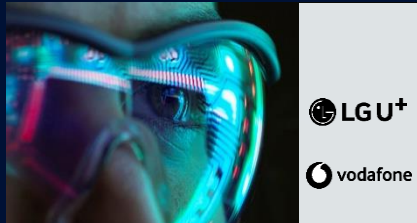


Bell

Bell

## Immersive events

Multi-camera event experience with AR and social extensions



LGU+

vodafone

## AR glasses

Opening up rich extended-reality consumer possibilities



SK telecom

vodafone

## AR/VR-enabled tourism

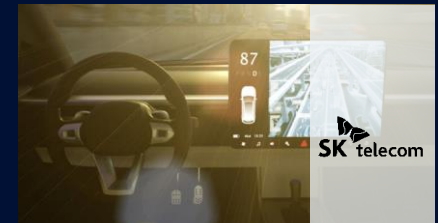
Enriching the tourist experience



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## Drone racing

High-speed sports action enabled by 5G's low latency



SK telecom

## 5G connected car

Enabling high-definition mapping and infotainment



CSP logos are examples, not an exhaustive list



Boosted 5G  
experience

## 5G-Advanced takes XR to the next level

Rel-18 technologies will be critical in shrinking the XR device down to the size of eyewear that will fit into a breast pocket.

<b>Application aware radio</b> Prioritize contextual information or view angle	<b>Power savings</b> Adaptive and dynamic discontinuous reception	<b>Device revolution</b>  Device revolution beyond smartphones
<b>Edge cloud usage</b> Processing moving from device to network	<b>Zero interrupt mobility</b> Mobility optimization solutions	

XR - Extended reality  
AR - Augmented reality  
VR - Virtual reality

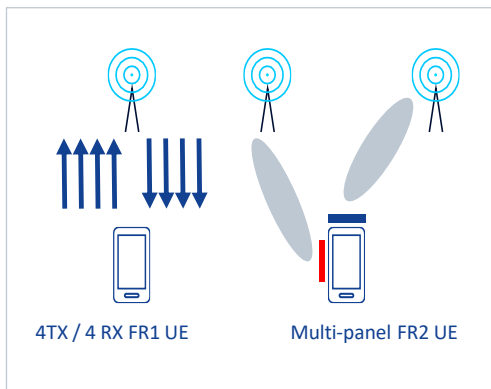
# 3GPP radio evolution in Rel-16, Rel-17 and Rel-18

URLLC	Ultra-reliable and low latency communication	URLLC was completed in Rel-17
Radio boosters	Extreme radio performance	Radio improvements continue in every release with focus moving to uplink in Rel-18
Automation and energy saving	Fast rollout and minimized energy usage	Self optimization (SON), relays, AI/ML usage, energy saving evaluations
New verticals	New use cases with 5G radio	Car-to-car, satellites, high altitude platforms, GSM-R, public safety, drones
IoT optimization	Low cost IoT connectivity	RedCap 100 Mbps and 10 Mbps capability with low cost IoT device
Position and time	Accurate position, accurate timing	Sub-10 cm position and timing service with Rel-18
XR/AR/VR	Extended reality power consumption, cost and performance enhancements	XR optimized radio interface

# Beamforming boost for uplink performance

Focus shifts towards uplink with 5G-Advanced

- Constant growth of UL oriented applications creates need to boost mobile UL traffic
- Enable UE to connect to multiple mobile station to get higher throughput



**Up to 500 Mbps user rates and multi-Gbps cell capacity with 100 MHz TDD**

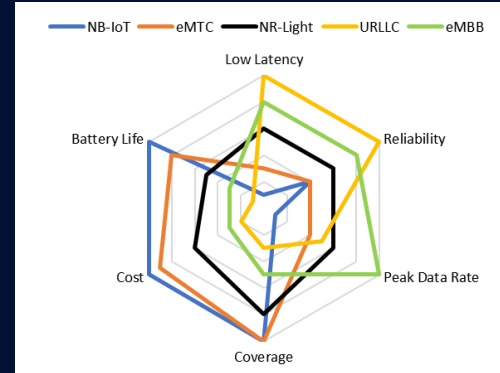
- Uplink user data rate boost from 2x2 to 4x4 MIMO.
- UE multi-panel simultaneous transmission control
- Multi TRP a.k.a. distributed mMIMO improvements.

Boosted 5G  
experience

# IoT optimization with RedCap in Release 18



	5G MBB	RedCap R17	RedCap R18
Bandwidth	100 MHz	20 MHz	5 MHz
Peak rate	2 Gbps	100 Mbps	10 Mbps
IoT modem cost*	Reference	-60%	-71%



Boosted 5G services usage

Substantially **lower device cost** especially in baseband with relaxed requirements

**Longer battery life** with narrowband operation and long DRX

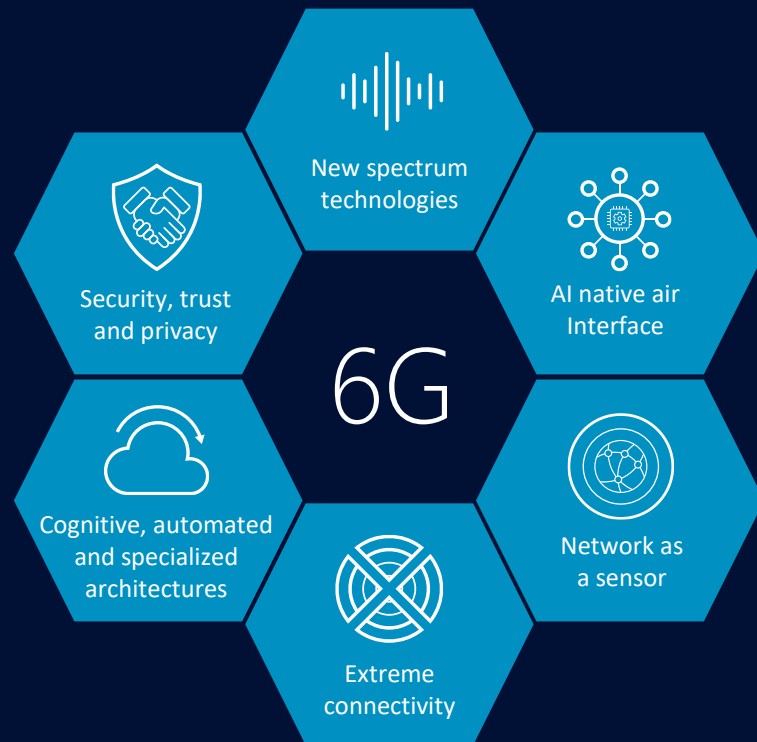
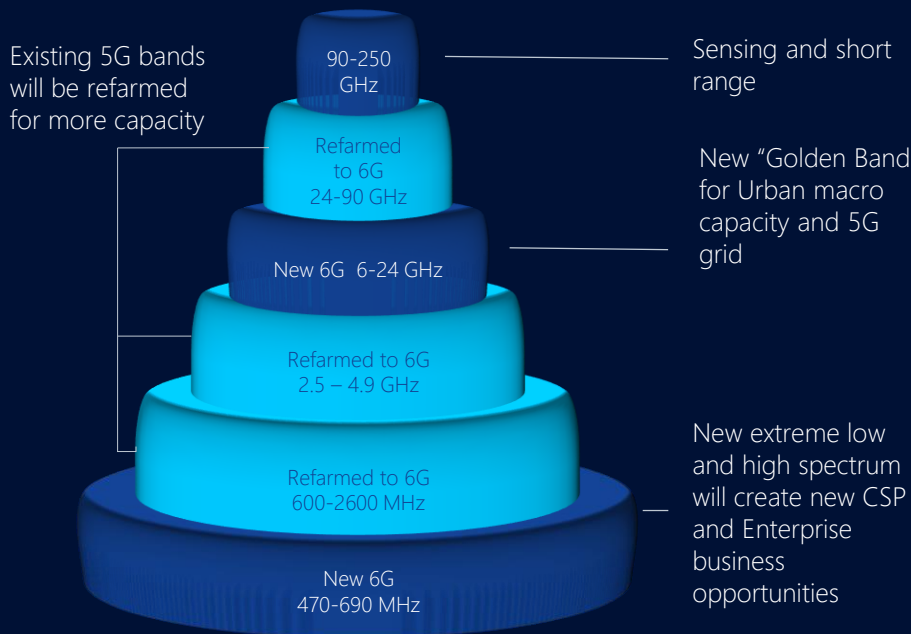
Minimize changes to 5G control design by keeping 5 MHz bandwidth

RedCap has a few **benefits compared to LTE NB-IoT and Cat-M**: substantially higher capabilities and minimal changes in the system design

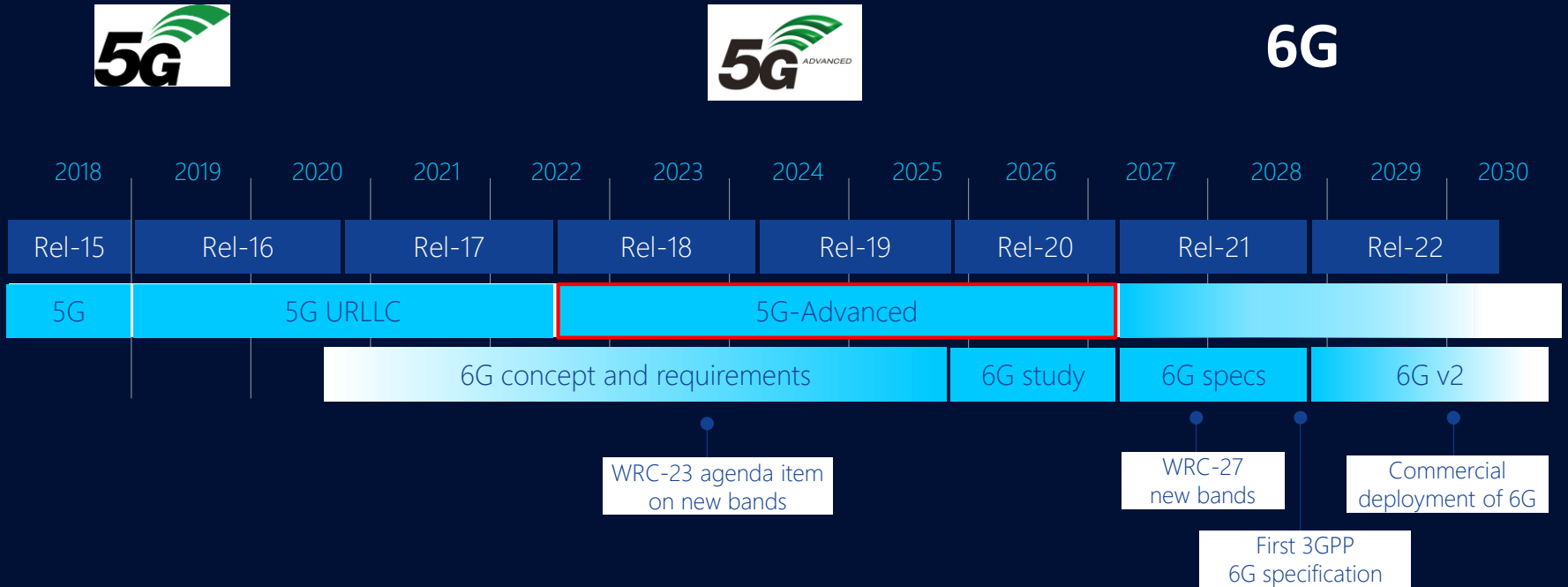


# Key elements in transition to 6G

## Expected characteristics of 6G



# 5G-Advanced as a stepping stone towards 6G



# We are leading the way to make 6G a reality

Collaboration is key



**NOKIA**