

5G and AI Transforming the Next Generation of Robotics

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Technology fueling tomorrow's robotic innovations







Heterogeneous computing

A computing approach that intelligently uses fundamentally different types of processing engines

Specialization is key for robotics

Each processing engine has its own strengths





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5G is far more than just mobile

To meet an extreme variation of 5G NR requirements



Mission-critical services

Cellular Vehicle-to-Everything (C-V2X) Drone communications | Private Networks Ultra Reliable Low Latency Comms (URLLC)





embed

Summit

Enhanced Mobile Broadband

Spectrum sharing | Flexible slot-based framework Scalable OFDM | Massive MIMO | Mobile mmWave Dual Connectivity | Advanced channel coding | VR/XR

Massive Internet of Things

Enhanced power save modes Deeper Coverage | Grant-free UL Narrow bandwidth | Efficient signaling

5G NR URLLC for new mission-critical services





A platform for tomorrow's more autonomous world

Ultra-low 1 ms e2e latency

Faster, more flexible frame structure; also new nonorthogonal uplink access

High reliability targeting 10⁻⁵ BLER¹

Ultra reliable transmissions that can be time multiplexed with nominal traffic through puncturing

High availability

Simultaneous links to both 5G and LTE for failure tolerance and extreme mobility

¹Block Error Rate





Ultra reliable time sensitive networking





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Ultra reliable time sensitive networking





5G positioning supports a wide rage of IoT use cases



Release 16

Meeting initial accuracy requirements of 3m (indoor) to 10m (outdoors) for 80% of time



1 5G positioning requirements defined in TS 22.261; 2 Such as GNSS, beacons, sensors, Wi-Fi/Bluetooth



scenarios Supporting new

channel models for industrial IoT environment

\$ 9

Release 17

Enhancing capability and performance

for a wide range of use cases

Lower latency Reducing positioning latency to as low as 10 ms

Meeting absolute accuracy requirements¹ of down to 0.2m

Centimeter level accuracy

Higher capacity Scaling to millions of simultaneous devices (e.g., IoT, automotive)

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For indoor and outdoor applications

Targets various accuracy and latency requirements

Complements existing positioning technologies²

Indoor Precise Positioning







Efficiently expanding the IoT requires a new distributed intelligence paradigm

embedded VISI N Summit



Enriched user experiences, new use cases, new verticals





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World's first 5G and Al-enabled robotics platform



Qualcomm robotics RB5 platform

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Qualcomm Robotics RB5 Platform



Vision Mezzanine

12MP Main camera, IMX577 Tracking camera, OV9282 Depth camera, Intel RealSense D435i Time-of-Flight (TOF) camera, Panasonic V4T GMSL2 camera, LI-AR0231

Sensor Mezzanine

Single and Dual IMU Compass/Magnetometer Pressure sensor Temperature sensor Chirp ultrasonic sensor Digital PDM mic DC/BLDC Motor drivers Dynamixel smart motor control

Industrial Mezzanine

EtherCAT EtherNet/IP Modbus-TCP PROFINET



Purpose built robotics development kit

Motor Control Mezzanine

Brushed DC motor control Brushless DC motor control Dynamixel smart motor control Stepper motor control Servo motor control I/O expansion

Communication Mezzanine 5G, LTE, CBRS

Sub6, Quectel RM500Q-GL Sub6 + mmWave, Quectel RM510Q-GL

Flexible commercialization choices

System-on-Module, chip-on-board, POP/non-POP packages



Building Better Robots, **Drones &** Intelligent Machines



Purpose built silicon roadmap for Robotics





Qualcomm[®] Neural **Processing Engine** for AI/ML

OpenCL and Qualcomm Computer Vision SDK OpenCV and Open GL

Machine Vison SDK

AWS RoboMaker

Linux

ROS 2



Prototype and commercialize robots quickly with fewer resource restraints

Qualcomm **Robotics RB5** Platform

Qualcomm[®] **Robotics RB3** Platform

Qualcomm Flight[™] Pro



Collaboration with multiple ODM/CM, technology, and platform companies

Altek

ModalAl

TDK Invensense

Thundercomm

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Robotics

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https://www.qualcomm.com/products/industrial-commercial/robotics

Qualcomm Robotics RB5 Platform Video

Resources

https://www.youtube.com/watch?v=RArzm3h_0vg

Developer Support

https://developer.qualcomm.com/solutions/robotics



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Thank you

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