DECT-2020 NR:
The new standard for IMT-2020 (5G)

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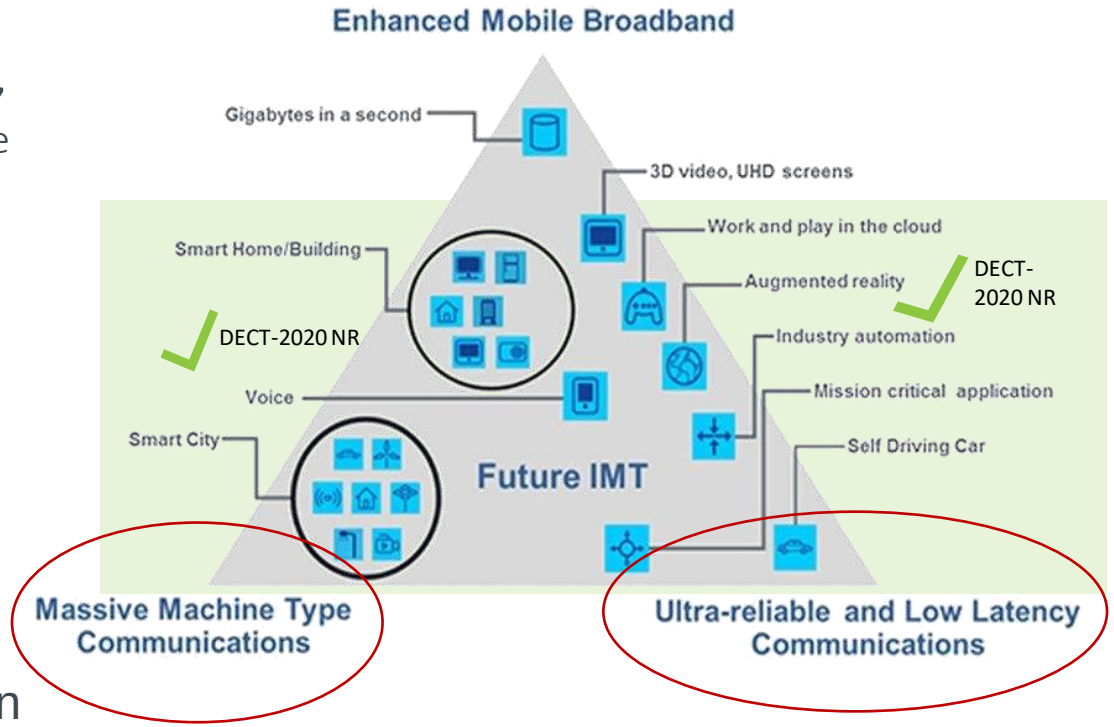
DECT-2020 NR introduction

- DECT-2020 NR design objective has been to create a wireless communication technology which can **be deployed by anyone, be operated by anybody and used anywhere**. Its operation must **be simple, autonomous** and able to co-exist with other local networks in the same area **sharing spectrum**. Technology is easy to introduce into new frequency bands.
- It should be **application-agnostic** enabling rapid adoption of different use cases fostering digitalization. It should focus on **ultra-reliable low latency communication** and **massive scale machine communication** networks **exploiting mesh** communication.



ITU-R adopted DECT-2020 NR as part of the IMT-2020 family, also known as 5G. ITU-R technology recommendation [M.2510-1]

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ETSI TC DECT activity

Standards and publications

- ETSI TS 103 636-1 V1.3.1 DECT-2020 New Radio (NR); Part 1: Overview; Release 1
- ETSI TS 103 636-2 V1.3.1 DECT-2020 New Radio (NR); Part 2: Radio reception and transmission requirements; Release 1
- ETSI TS 103 636-3 V1.3.1 DECT-2020 New Radio (NR); Part 3: Physical layer; Release 1
- ETSI TS 103 636-4 V1.3.1 DECT-2020 New Radio (NR); Part 4: MAC layer; Release 1
- ETSI TS 103 636-5 V1.3.1 DECT-2020 New Radio (NR); Part 5: DLC and Convergence layers; Release 1
- ETSI TR 103.810 V1.1.1 ETSI Evaluation Group; Final Evaluation Report on DECT-2020 NR

A harmonized standard (EN 103 406-2) for DECT-2020 NR under development

New work item approved on Application Profiles for DECT-2020 NR

- Smart meter profile is the first one to be defined (DLMS/COSEM application)
- Other use case profiles under development.

TC-DECT release 2 work has started to provide additions to this specification series in the following releases.

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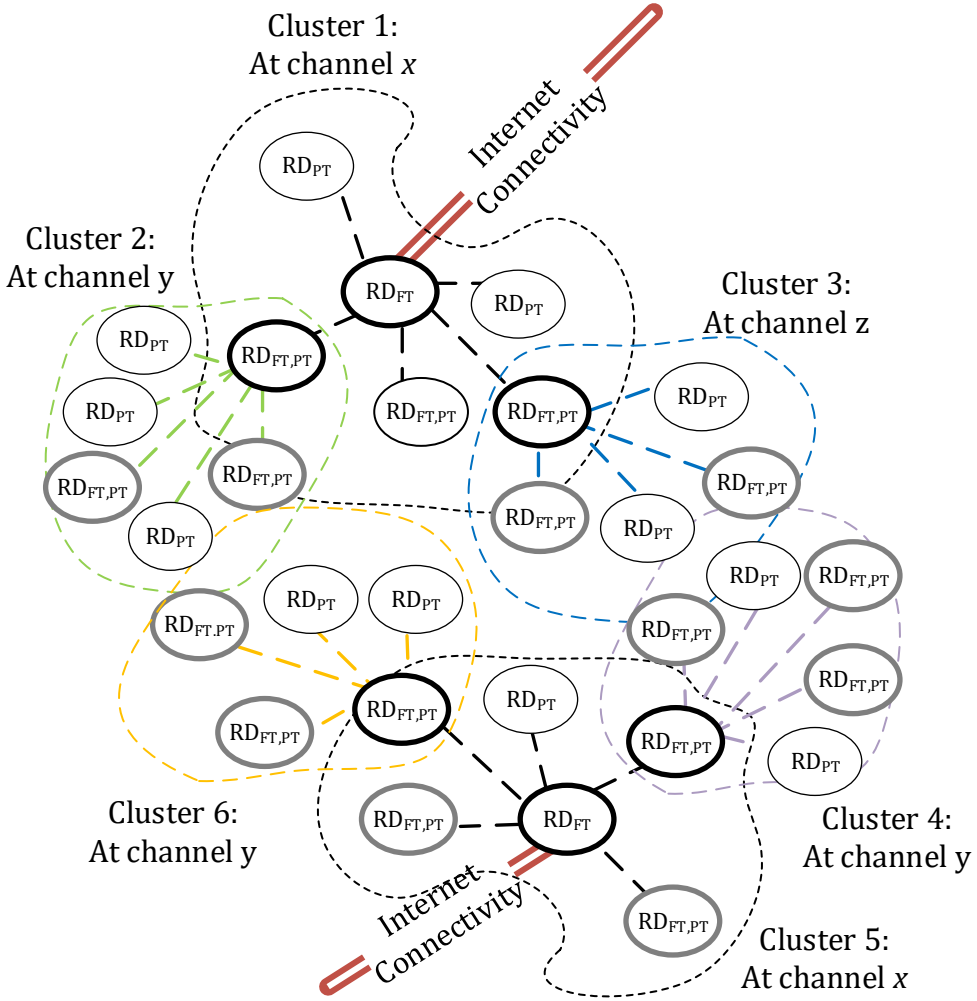
DECT-2020 NR System Architecture

DECT-2020 NR - System Architecture



Supports multiple deployment scenarios

- Mesh topology based on Radio Device (RD) to RD communication
- Local area network (Star Topology)
- Direct P2P and P2M connections

State of art co-existence capabilities to support multiple networks in the same area sharing spectrum

- Between other independent DECT-2020 NR networks.
- Between DECT-2020 NR networks and any other wireless systems.

Over the air synchronization locally between different DECT-2020 NR equipment.

Symmetric uplink (TX) and downlink (RX) radio access support cost-effective equipment designs.

Device-centric, decentralized decisions, enable autonomous operation fostering industry digitalization.

- Autonomous operation minimized network planning effort

Back-end connectivity to the internet can be any type of connectivity technology

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Decentralized and autonomous operation

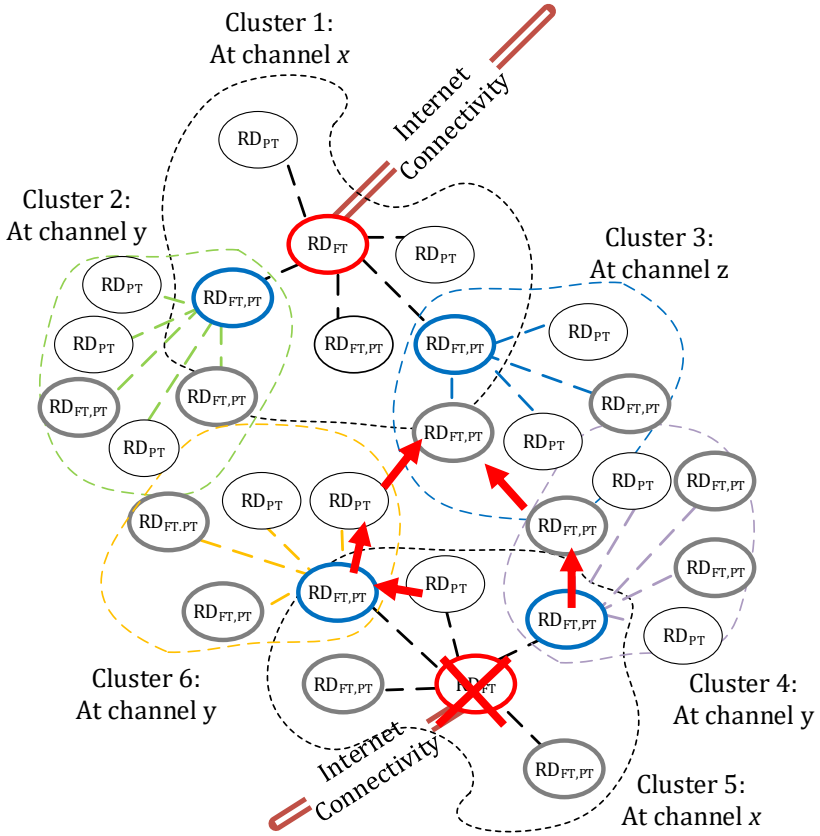
- Radio access and device autonomy
  - DECT-2020 NR supports **autonomous device operation**. Each device can choose its role in the communication network, whether they are routing data or not. A device may change its role autonomously when radio conditions or network deployment is changing or due to device failure.
  - **Each device does independent decisions on associations** with other devices related to local radio conditions and mobility.
  - **Device autonomy takes care of reliable radio communication and data routing** between devices as well as between devices and the back-end system.

System autonomy

- DECT-2020 NR supports **flat radio architecture** enabling connection to multiple types on back-end systems with varying deployment constraints (public or on-premise cloud).

Application autonomy

- DECT-2020 NR is **agnostic to application** data and can support e.g. non-IP and IP based applications



DECT-2020 NR
Key features

DECT-2020 NR Key features

- Flexible radio access technology with dynamic channel selection based on cognitive radio (spectrum sensing)
  - No frequency planning required, ideal for local network deployments
  - Compatible with legacy DECT technology including uncoordinated systems
  - Very advanced capabilities for multiple overlaying DECT-2020 NR networks in the same area
- Improved transmission quality, link budget and increased data rate compared to legacy DECT
  - Applies OFDM Physical layer combined with advanced channel coding and Hybrid ARQ providing state of art performance
- Support of
  - Mesh radio network topologies enabling large local area networks
  - low latency operation
  - scheduled and unscheduled services
  - ultra low power consumption devices
  - seamless handover
  - MIMO for exploiting multiple channels
- Up-to-date security based on AES and CCM

Spectrum sharing

Advanced radio

Adaptive for different use cases

Secure

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Technical Characteristics

- Dual mode MAC architecture supporting unscheduled and scheduled services
  - Listen before Talk (LBT) to protect other systems and other transmissions
  - Capability to schedule protected resources for high-quality services.
- Radio technology is OFDM similarly to all modern radios with MIMO support
  - 1.9 GHz range and in principle all IMT-bands below 6 GHz, depending on national regulation.
  - Improved link budget, approx. 6 dB better performance with a comparable bit rate in the legacy DECT with a single 1.728MHz channel.
- TDMA/FDMA based channel access
  - Basic frame is 10 ms, split into 24 slots and subslots.
  - Very short latency in communication as minimum transmission unit is a subslot, length is between 26 us – 208 us.
  - Single transmission can have a duration over multiple slots/subslots.

Future proof feature set

Frequency agile
Low latency links

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Technical Characteristics

- Basic channel width is 1.728 MHz, with scalable bandwidth support up to 221 MHz
  - Sub-carrier spacing (SCS) is 27 kHz with 2^{μ} scaling options up to 216 kHz
  - Symbol time is 41.67 µs. The cyclic prefix is 4.6 µs with 27 kHz SCS.
- Adaptive Modulation and Channel coding supporting :
  - BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM
  - All information coded with Turbo coding in Release 1.
- Data rates: 120 kbps to 1.1 Gbps with 27 kHz sub-carrier spacing;
  - up to 8.6 Gbps with 216 kHz sub-carrier spacing.
- Very low latency Hybrid ARQ support, latency after 1st retransmission can be less than 2.5 ms with 27 kHz SCS.

Future proof physical layer feature set serving applications

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DECT-2020 NR Spectrum Strategy

- 1.9 GHz range including:
  - 1880 MHz to 1900 MHz | DECT Core Band in Europe
  - 1900 MHz to 1920 MHz | potential DECT Extension Band in Europe
  - other regional 1.9 GHz variants.
- DECT-2020 NR supports coexistence with legacy DECT in the 1.9 GHz range.
- DECT-2020 NR can address all IMT-2020 TDD bands below 6 GHz, depending on national regulation.
- Supports Local Spectrum Access solutions, e.g. 3.7 GHz to 3.8 GHz (Germany) and 3.8 GHz to 4.2 GHz (UK), potentially with eLSA (ETSI TC RRS and WInnForum).

Unlicensed and licensed frequencies support

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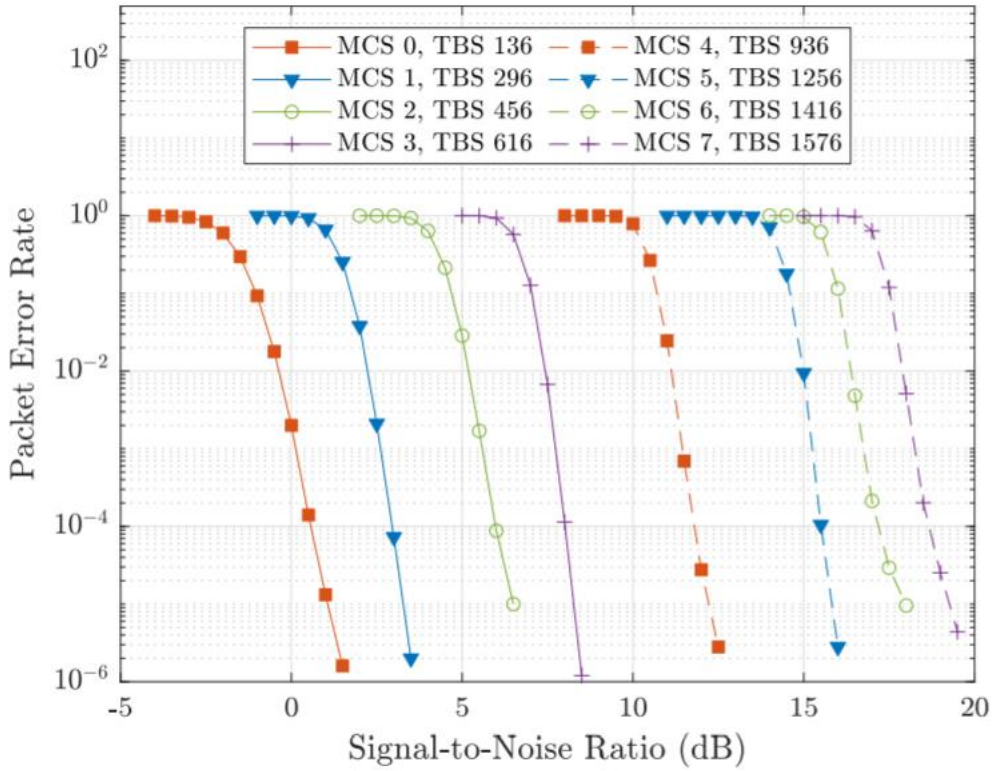
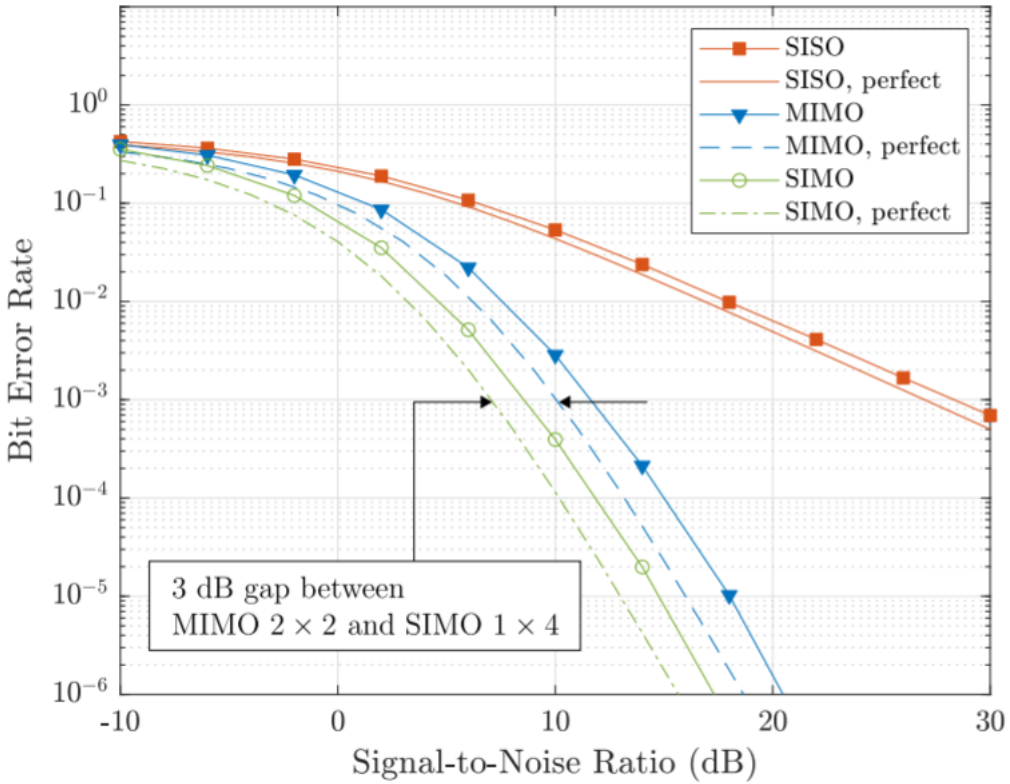
DECT-2020 NR performance

DECT-2020 Link performance



"TBS: Transport Block size in bits when TX duration is 0.416ms with 1.728 MHz."

Source: Maxim Penner, et al. [Link-Level Performance Evaluation of IMT-2020 Candidate Technology: DECT-2020 New Radio]



"Our experiments show that in all cases, receivers can be built that operate close to perfect channel knowledge. This confirms that for the models tested, DECT2020 NR is a well-designed OFDM system"

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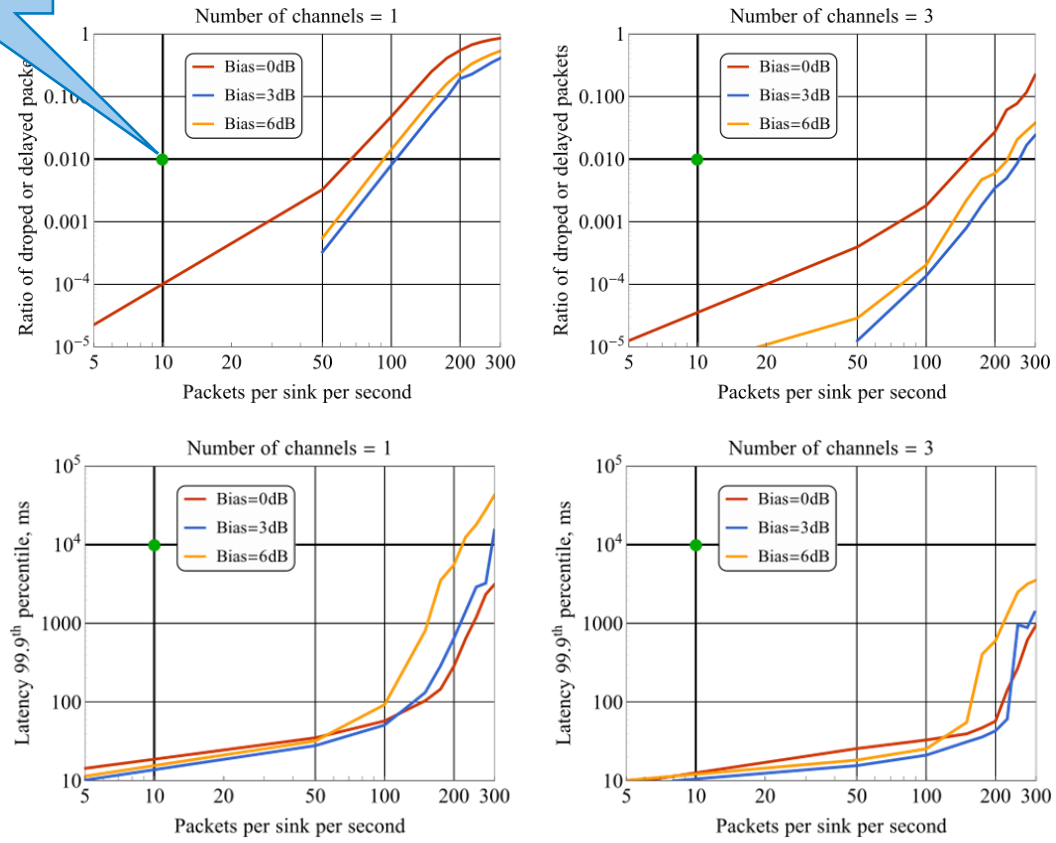
DECT-2020 performance in IMT-2020 mMTC scenario

Green mark = ITU mMTC requirement

e2e packet loss

e2e latency



Source: DECT(20)000191

	1 channel	3 channels
Bias = 0dB (Red)	67 pps or 1 message / 17.8 minutes/device	154 pps or 1 message / 7.8 minutes/device
Bias = 3dB (Blue)	105 pps or 1 message / 11.4 minutes/device	255 pps or 1 message / 4.7 minutes/device
Bias = 6dB (Yellow)	93 pps or 1 message / 12.8 minutes/device	226 pps or 1 message / 5.3 minutes/device

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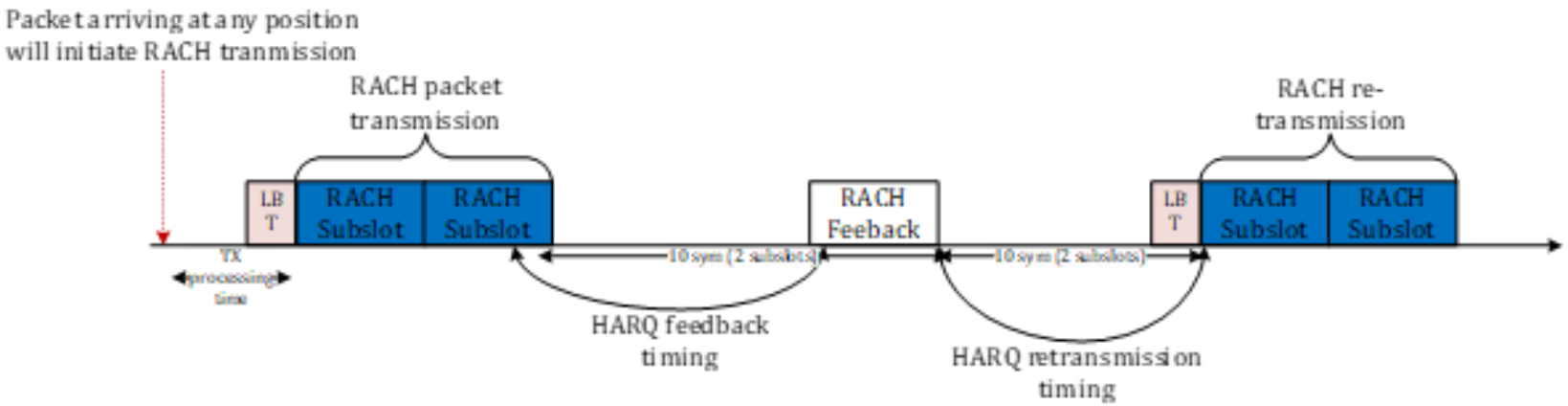
Latency performance for mMTC, for single link



PHY layer numerology	TX duration	Subslot duration	Transport block size	Frameless Transmission mode (RACH)	Latency per hop
1,728 MHz @ 27 kHz	416,667 µs	208,333 µs	296 bits	No HARQ transmission	0,9 ms
				With HARQ	2,44 ms
3,456 MHz @ 54 kHz	208,333 µs	104,166 µs	368 bits	No HARQ transmission	0,45 ms
				With HARQ	1,22 ms

Source: ETSI MSG(21)0004_ ETSI Evaluation group Final evaluation report.

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