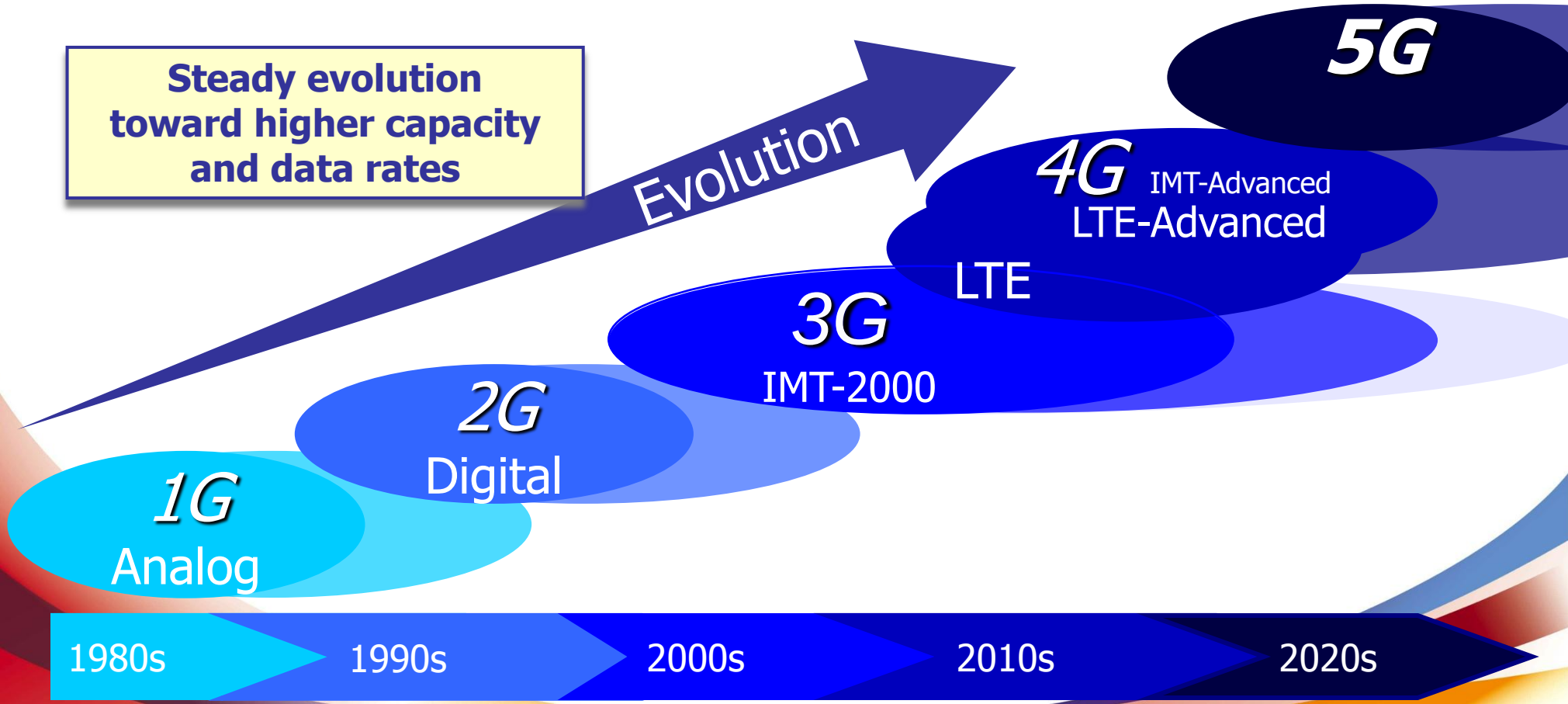
Next-generation Mobile Communications System
- 5G -
NTT DOCOMO

Evolution of mobile technology

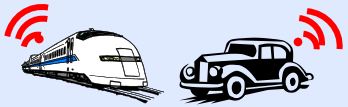


Communications in 2020 and beyond

Everything connected by wireless

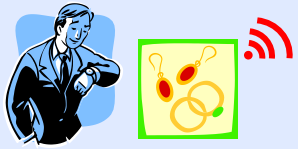
Multiple personal devices

Transportation (Car/Bus/Train)



Consumer electronics

Watch/jewelry/cloths



House

Sensors

Cloud computing

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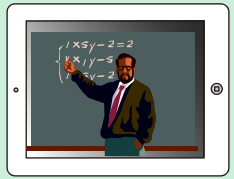
Extended and enriched wireless services

Video streaming

New types of terminal/HI

Healthcare

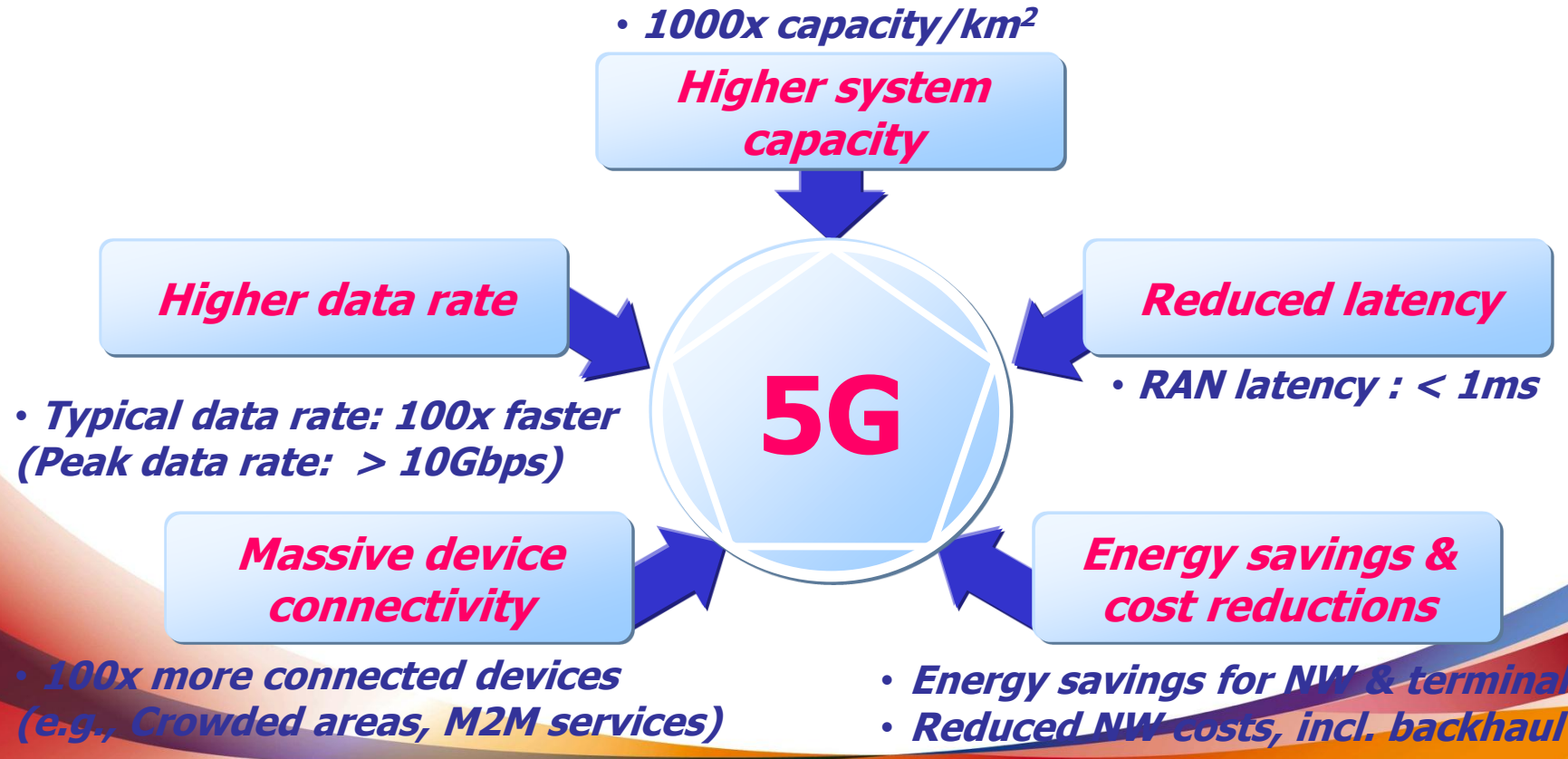
Education



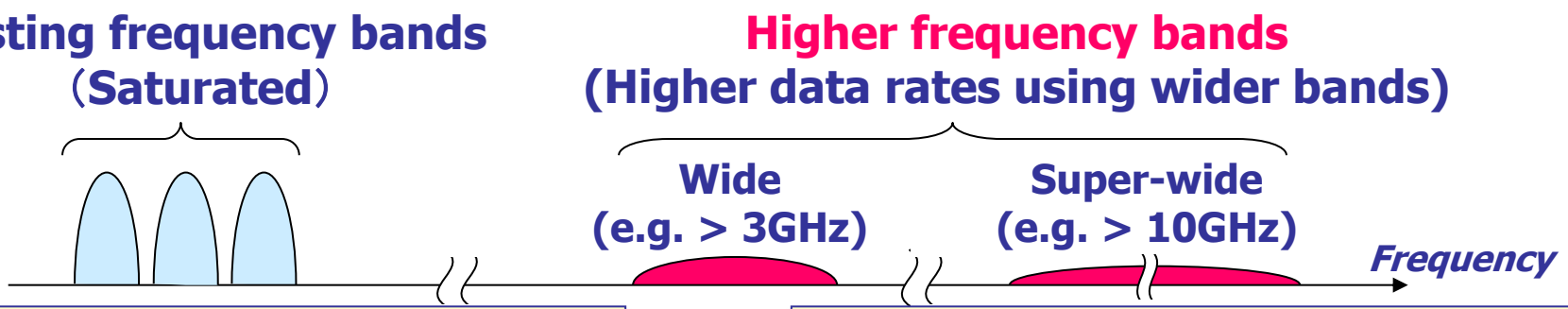
Safety and lifeline system

5G target performance

5G radio access will provide a total solution for a *wider range of requirements* in 2020 and beyond



DOCOMO's 5G technical concept



Connectivity and mobility maintained using lower frequency bands

+

Efficient high data rates transmission using higher/wider frequency bands

Further cellular enhancements

Non-orthogonal multiple access (NOMA), etc.

Exploitation of higher frequency bands

Small cells, Massive MIMO, New RAT, etc.

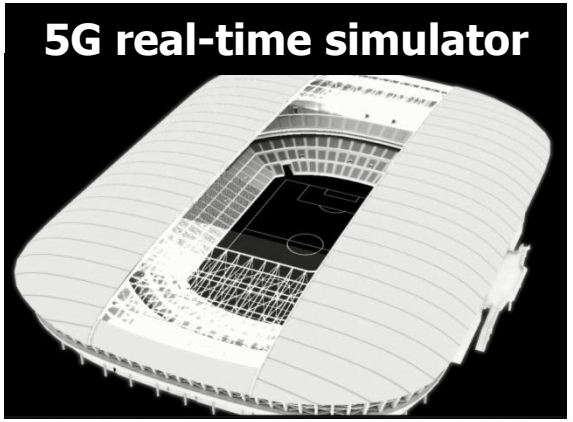
Frequency agnostic enhancements

Phantom cell concept

Radio frame design for reduced latency & M2M, etc.

5G real-time simulator

- Real-time evaluation of 5G system performance and demonstration at ultra-dense environment (e.g., stadium)



- Demonstrations
  - ➢ BW extension x NW densification
    - ✓ NW densification using small cells
    - ✓ BW extension at higher frequency bands
  - ➢ Technologies for higher frequency bands
    - ✓ Massive MIMO @ Small cells: 128 antenna elements
  - ➢ Download & play of high resolution movie (4K)

5G trials with Eight leading mobile technology vendors

Existing bands

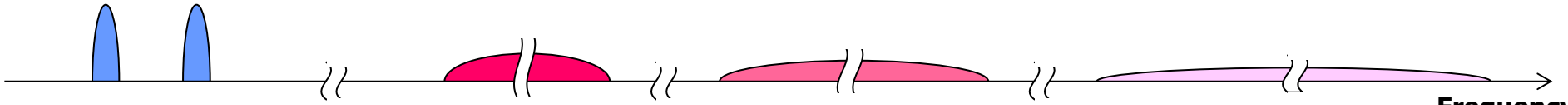
UHF bands
Ex. 800MHz, 2GHz

Exploitation of higher frequency bands

Low SHF bands
3-6GHz

High SHF bands
6-30GHz

EHF bands
> 30GHz



Alcatel·Lucent HUAWEI FUJITSU NEC ERICSSON SAMSUNG MITSUBISHI ELECTRIC NOKIA

NTT docomo × Alcatel·Lucent

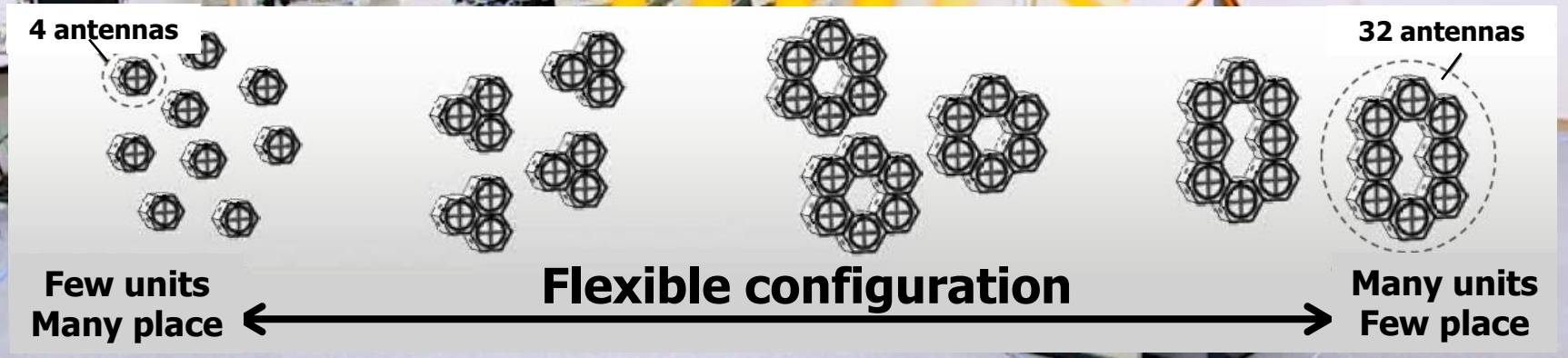
New 5G waveform

- For IoT, M2M
- Robustness for high mobility
- MIMO multiplexing for MBB

NTT docomo × FUJITSU

Dynamic virtual cell

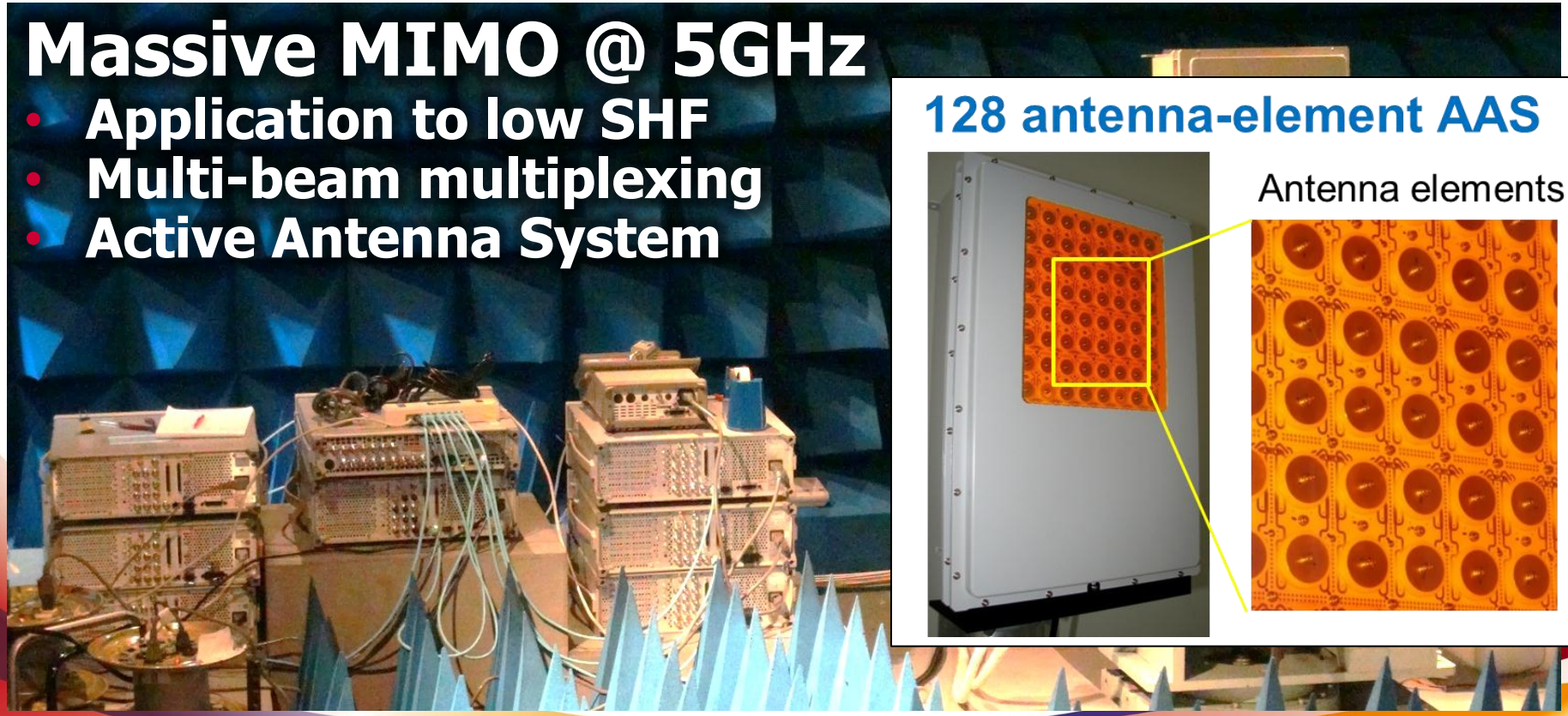
- Super high-dense deployments
- Flexible cell/antenna configurations
- Coordinated scheduling



NTT docomo × NEC

Massive MIMO @ 5GHz

- Application to low SHF
- Multi-beam multiplexing
- Active Antenna System



128 antenna-element AAS

NTT docomo × ERICSSON

New radio interface concept

- New numerology for wider band and low latency
- Ultra high data rate
- Beamforming with massive antenna

Achieved over
5Gbps in indoor trial

Achieved over
4.5Gbps in outdoor trial

NTT docomo × SAMSUNG

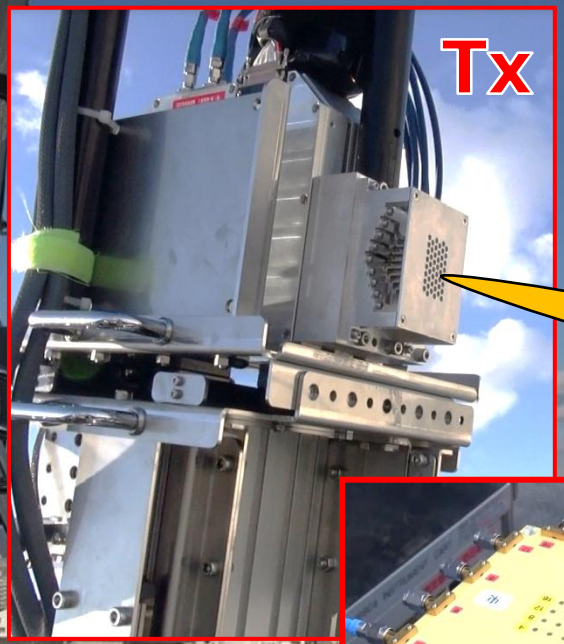
Massive MIMO @ 28GHz

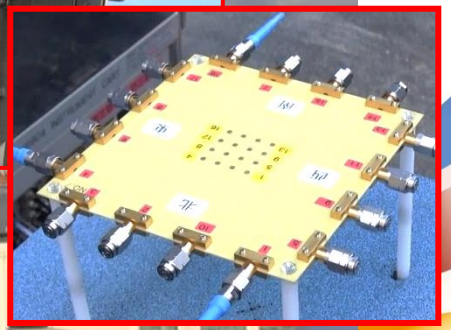
- Ultra wideband
- Beam-tracking at base station and user device

NTT docomo × MITSUBISHI ELECTRIC

Multi-beam multiplexing

- Beamforming @ 44 GHz
- Virtual Massive MIMO for super high bit rate





NTT docomo × NOKIA

mmW radio access @ 70GHz

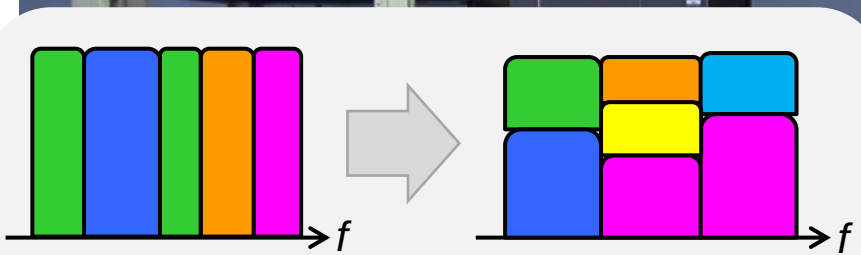
- For dense small cells and indoor/hotspot
- Beam tracking for mobility
- Ultra-wideband (1GHz)

Achieved over
2Gbps in indoor trial

Non-Orthogonal Multiple Access (NOMA)

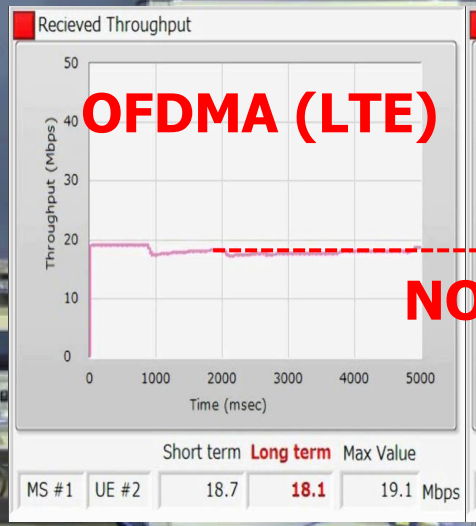
Advanced multiple access

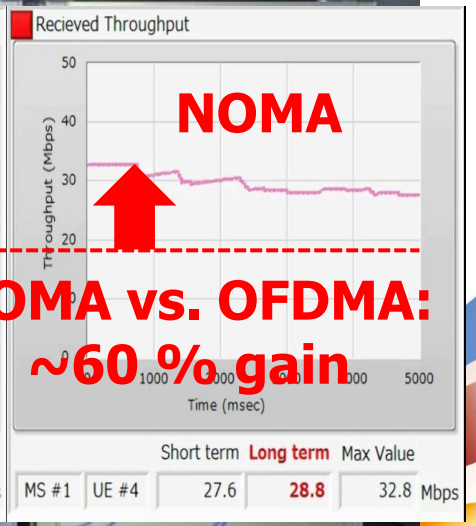
- For further cellular enhancements
- Power-domain user multiplexing
- Advanced receiver (SIC)



OFDMA(LTE) NOMA

Intentional Non-Orthogonality



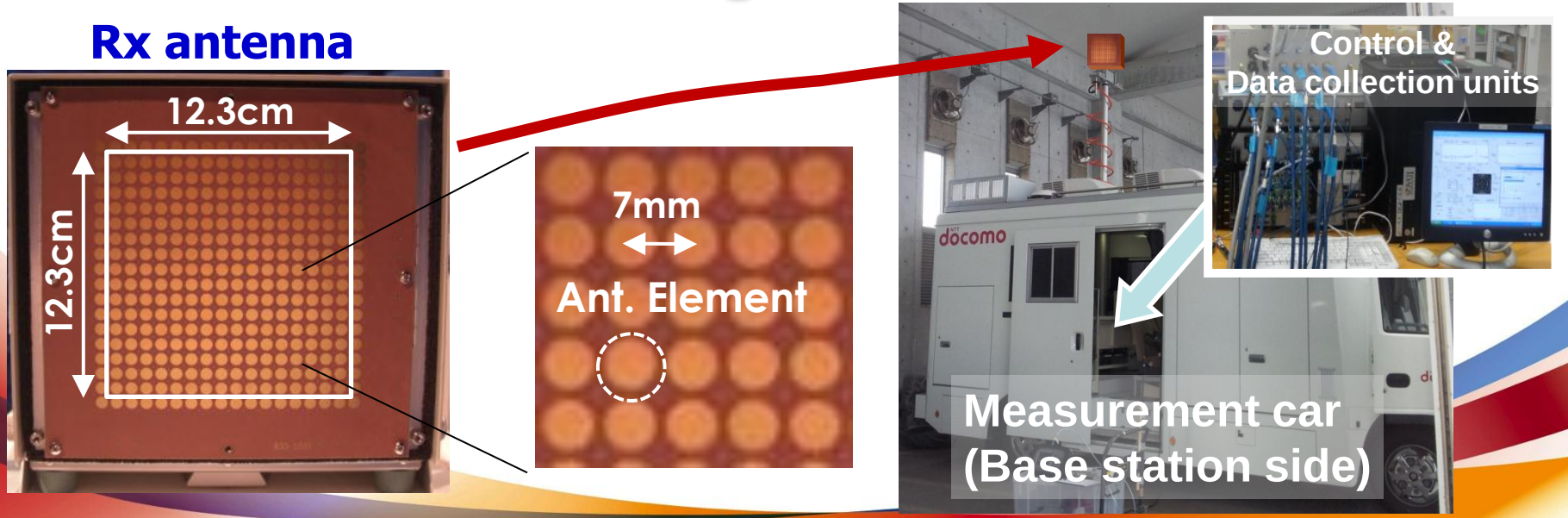


NOMA vs. OFDMA: ~60 % gain

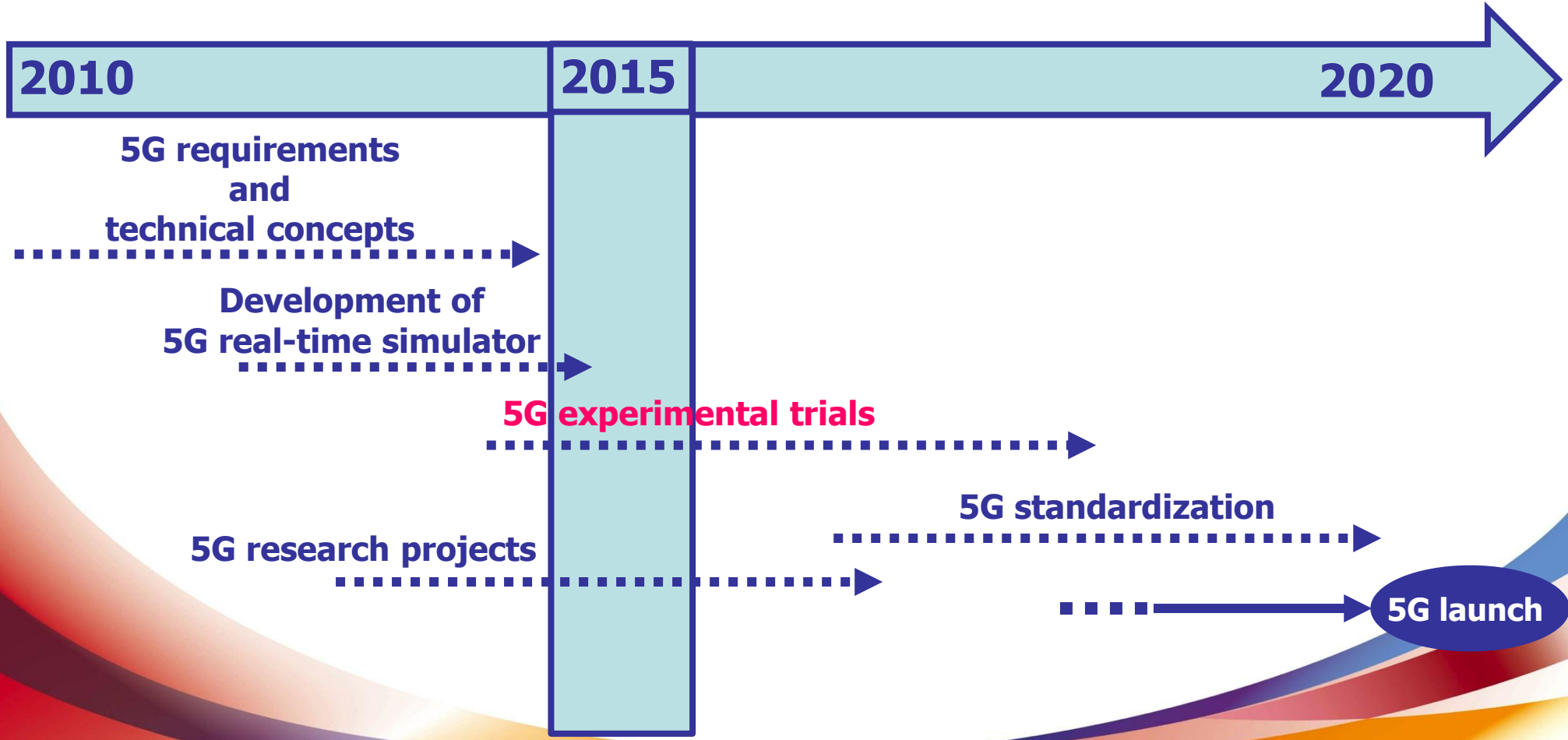
Channel Sounding at 20 GHz Band

Features of channel sounder

- Mu MIMO measurement
- Tx signal: OFDM signal with 50 MHz band width
- # of Tx antennas (or UEs): 2
- Rx antenna: Massive array antenna with 256 elements



Approach for DOCOMO's 5G launch



NTT
docomo