

# KYOCERA Perspectives on eLTE - for the Realistic 5G -

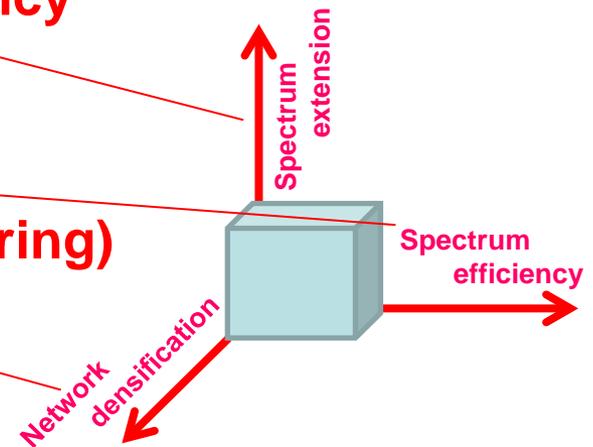
RWS-150017

3GPP RAN Workshop on 5G

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# KYOCERA Perspectives

- ❑ 5G systems to be commercialized in 2020
  - Further enhanced LTE on 3.5GHz~6GHz band is still necessary as well as New RATs.
- ❑ TDD system is quite compatible with 5G requirements
  - Suitable for small cell **with higher frequency**
  - **Highly efficient** with Massive MIMO
  - **Autonomous spatial ICIC (e.g. Null steering)** exploiting channel reciprocity



## Proposal :

- 5G should focus more on TDD-specific features.

# TDD Advantages(1)

- ❑ Enhanced Mobile Broadband
  -
  
- ❑ Massive Machine Type Communications
  -
  
- ❑ Ultra-reliable & Low Latency Communications
  -

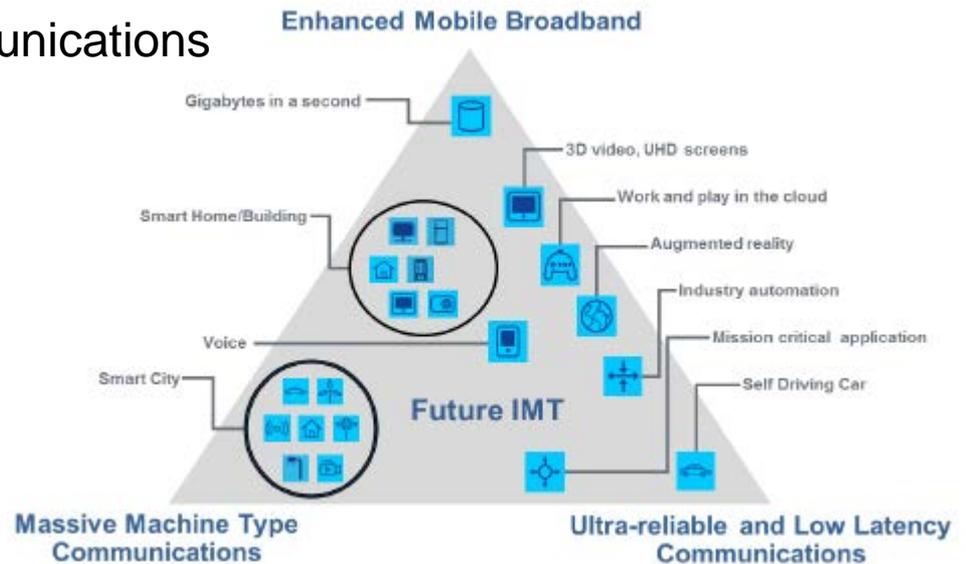


Figure Usage Scenarios of IMT for 2020 and beyond \*1

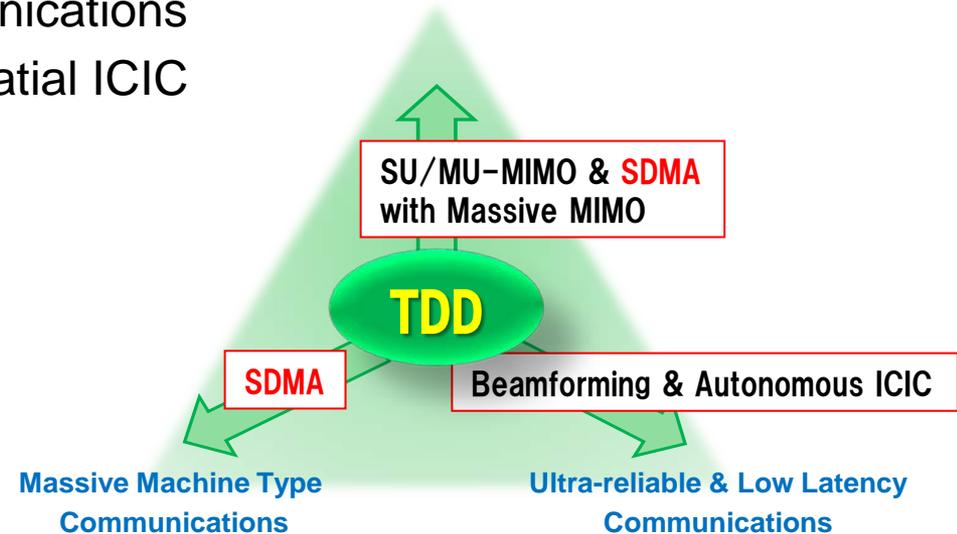
\*1 Recommendation ITU-R.[IMT.Vision], document, "Framework and overall objectives of the future development of IMT for 2020 and beyond"

# TDD Advantages(2)

- ❑ Enhanced Mobile Broadband
  - SU/MU-MIMO incl. **SDMA/Spatial ICIC** with Massive MIMO
- ❑ Massive Machine Type Communications
  - **SDMA** ← **Low complexity at UE even with only 1 antenna**
- ❑ Ultra-reliable & Low Latency Communications
  - Beamforming & Autonomous spatial ICIC

**Low overhead and high accuracy CSI**

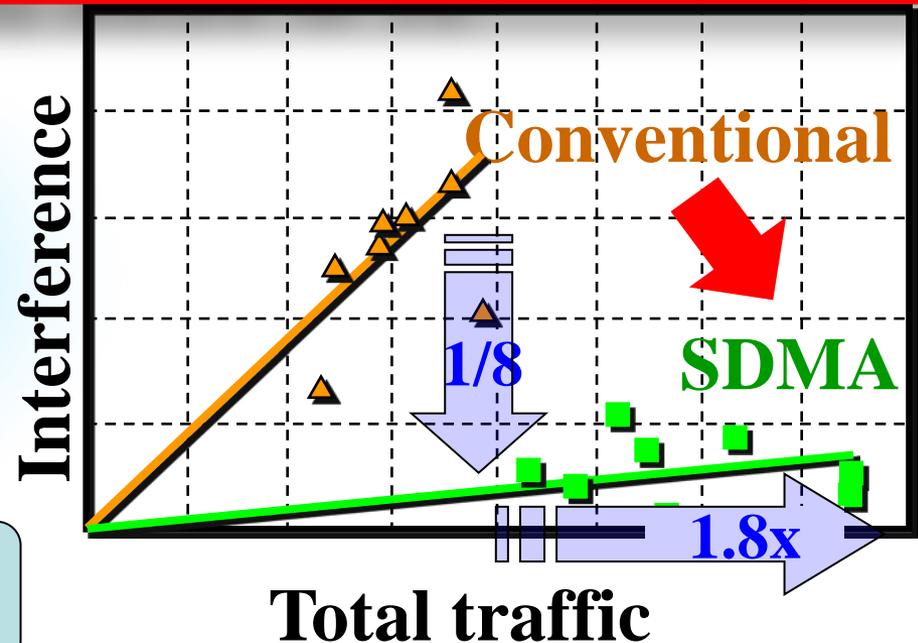
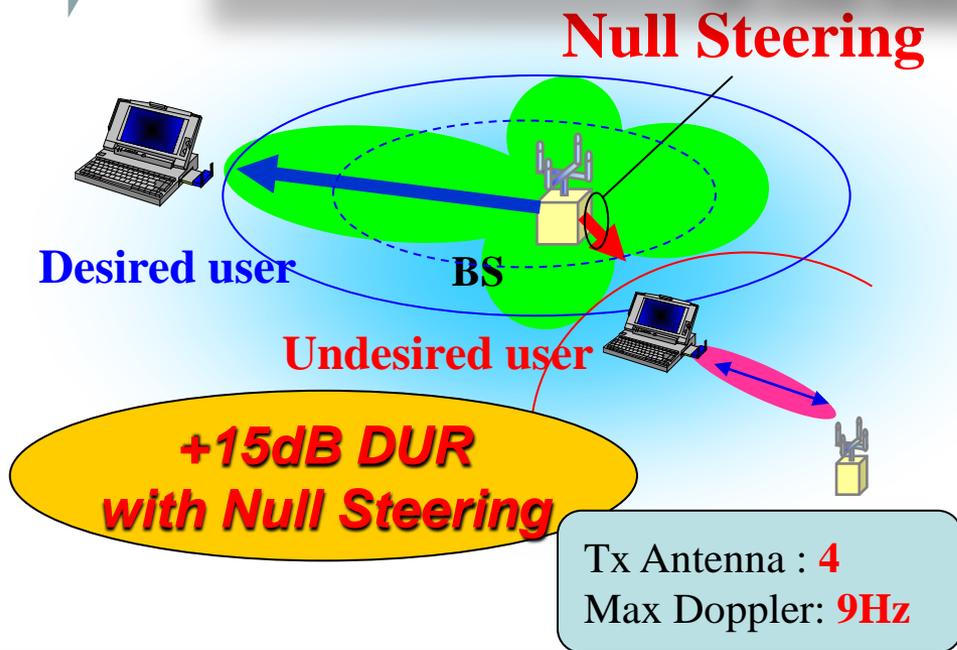
Enhanced Mobile Broadband



# SDMA/Spatial ICIC features

- ❑ Already available and NOT JUST SLIDEWARE
- ❑ Low Complexity required at UE side
- ❑ Great Contribution to all of eMBB, mMTC and uMTC.

**Spatial filtering technology exploiting channel reciprocity is the key feature for 5G**



# Current Issues

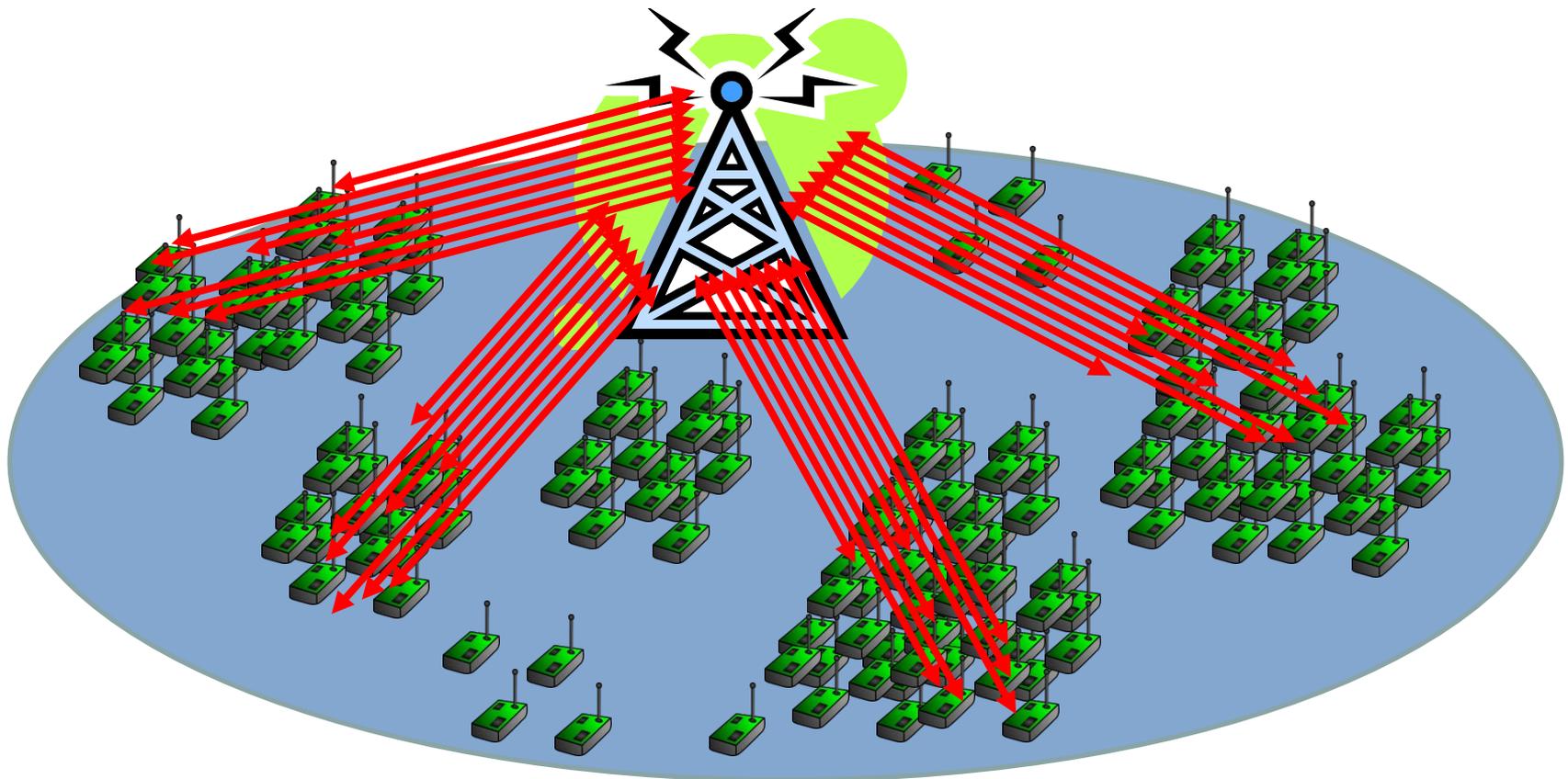
- ❑ Sufficient CSI estimation
  - Due to DL/UL imbalance (e.g. 3DL/1UL CA, DL heavy traffic, UL transmission power)
- ❑ The maximum number of possible spatially multiplexed UEs
  - Due to DMRS and UE-specific RS configurations, corresponding DCI
- ❑ Appropriate CQI feedback
  - CQI calculation under spatially filtered transmission like AAS/SDMA

## Introduce more TDD-specific features like...

- ❑ To exploit channel reciprocity more efficiently;
  - HARQ ACK/NACK enhancement
    - e.g. multiplex ACK/NACKs from plurality of UEs in a PUSCH resource (SC-FDMA symbol order)
      - HARQ-ACK enhancement in RAN1 eCA can be a baseline
  - SRS enhancement
    - e.g. Intra-subframe hopping among system bandwidth or configured CCs
  
- ❑ To increase the number of possible spatially multiplexed UEs;
  - e.g. Enhance DMRS and UE-specific RS, specify corresponding DCI
    - DMRS enhancement in RAN1 EBF/FD-MIMO can be a baseline
  
- ❑ To achieve more useful CQI;
  - e.g. UE-specific RS-based CQI over RBs allocated for PDSCH

# For the enhancement of massive MTC accesses

- In addition to SDMA-like technology, further efficient multiple access scheme is necessary for DL as well as UL.



# KYOCERA drives 5G forward with various aspects,

## Electronic Components & Devices

- Duplexers, Filters and RF modules



## M2M Modules



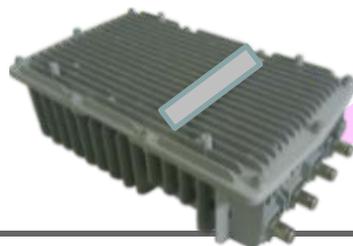
## Wireless Phones



## TORQUE<sup>®</sup> G02



## Base Stations



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