

3GPP TSG RAN Rel-19 workshop  
Taipei, June 15 - 16, 2023  
Agenda Item: 4

RWS-230104

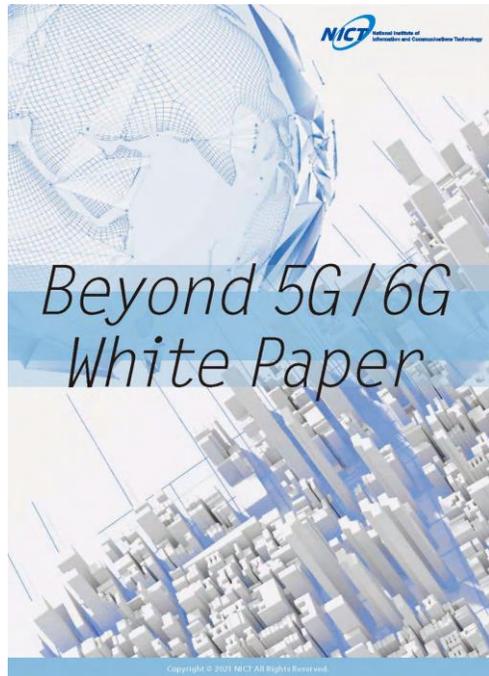
# NICT's view on Rel-19

---

Wireless Systems Laboratory,  
National Institute of Information and Communications Technology (NICT), Japan

## ● Development of Human Robot society

- ▶ Needs: a declining birthrate, aging population and associated labor shortage.
- ▶ Solution: Develop core technologies related to cyborg and avatars.
- ▶ Goal: Free human beings from limitations of body, brain, space, and time.



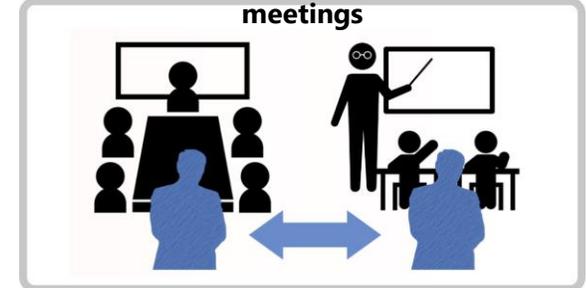
XR teleconf. among 3D avatars with haptic



Training and Operating in case of disaster



Simultaneously participate in multiple meetings



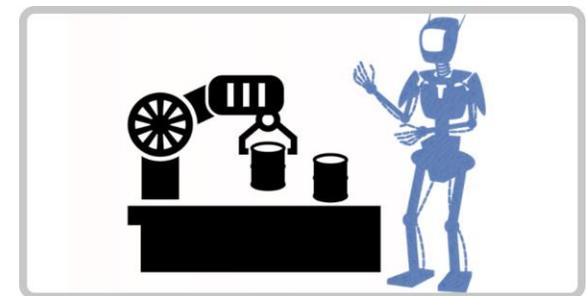
Refresh body and soul by XR activities



Remote controlling an assistive devices



Low delay remote work by a local avatar robot



NICT's beyond 5G vision on human robot society

<https://beyond5g.nict.go.jp/en/future/diary/index.html>

**Toward Human Robot society, the provision of compound capability of high data rate and URLLC is demanded to realize :**

- Low latency and high data rate communication to offer ultimate reality
- Mission-critical communication to address sudden and emergent situations

**Following technologies are expected to boost 3GPP RAN capabilities for high data rate and URLLC :**

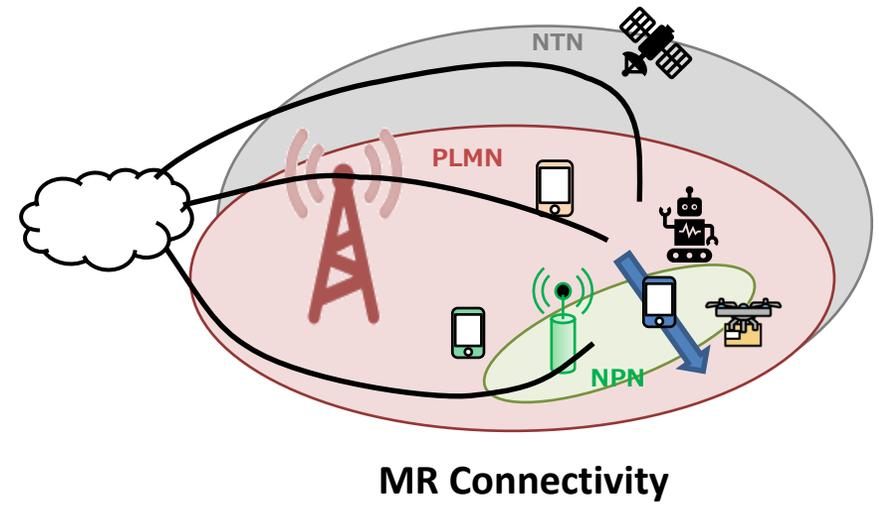
- A) Multi Radio (MR) Connectivity
- B) Utilization of Higher Frequencies
- C) Full Overlap Full Duplex

## Multi Radio (MR) Connectivity

- Devices are connected through PLMN, NPN, NTN, ...

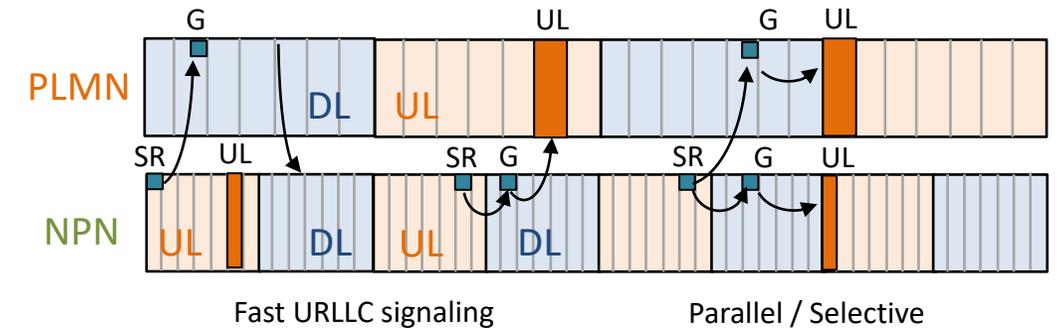
## MR connectivity can achieve

- High data rate by using parallel MR paths
- Increased reliability by selecting better path(s)
- Low latency by coordinated signaling



## Possible RAN issues

- Frame synchronization
- MR connection management
- MR coordinated signaling



MR coordinated signaling

# B) Utilization of Higher Frequencies

## Higher Frequencies (e.g. sub-terahertz band ) can offer

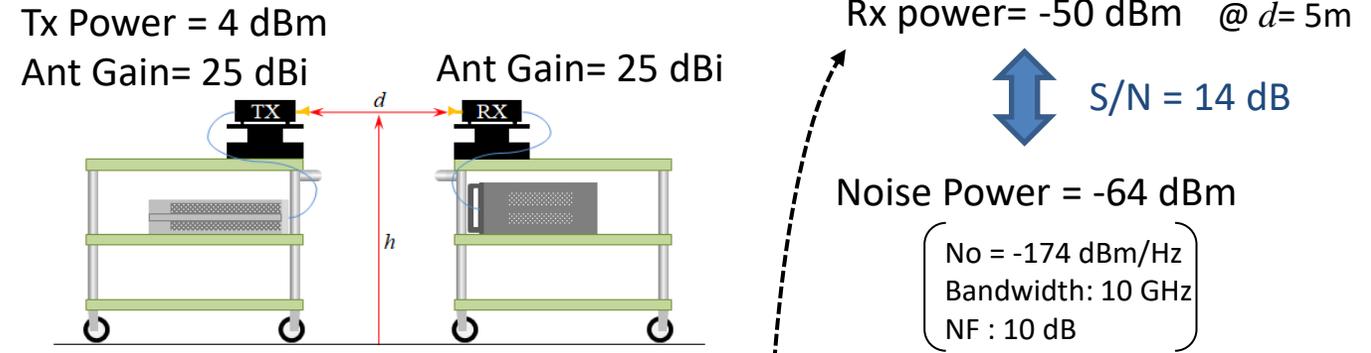
- Ultra high data rate
- Shorter TRX cycle

## Challenges

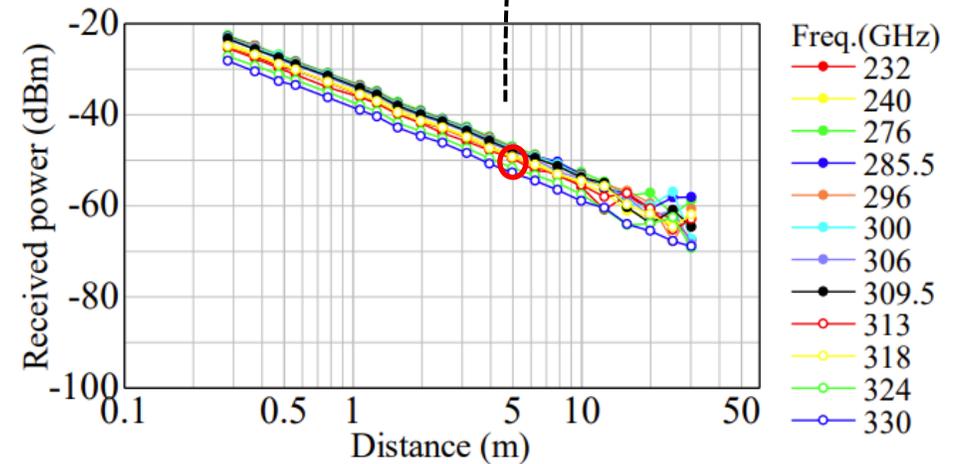
- Energy-limited channel
- LoS blockage

## Possible RAN issues

- Propagation modeling
- New numerology
- TRP identification/synchronization
- Beam forming management



Measurement Setup

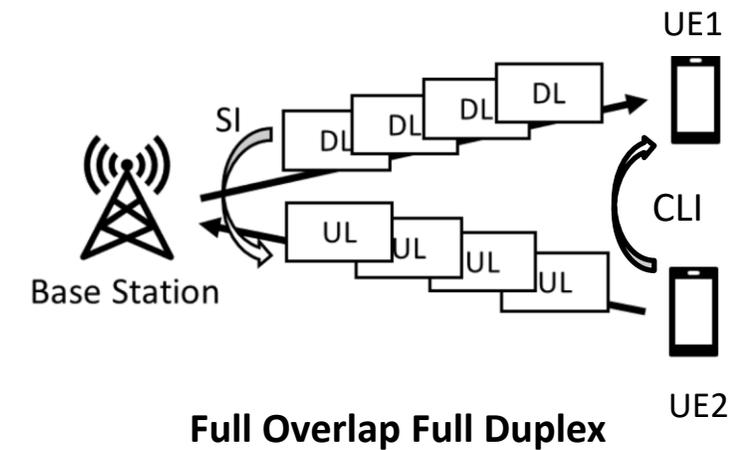


Measurement Results

# C) Full Overlap Full Duplex

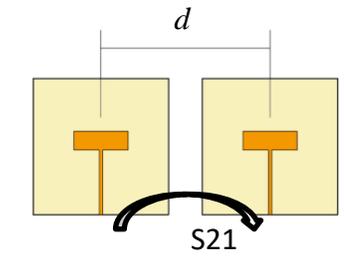
## Full Overlap Full Duplex can offer

- More data throughput than SBFD<sup>(\*)</sup>
- Low latency for UEs with FDM



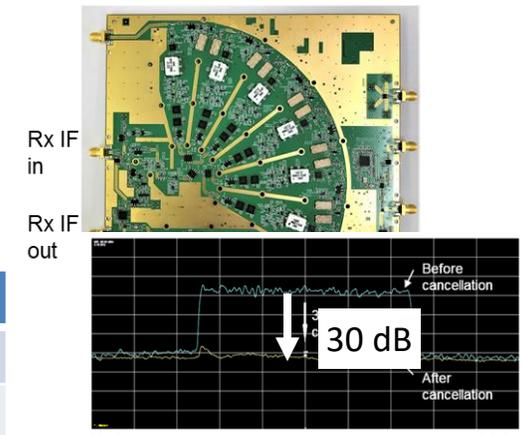
## Challenges

- Self interference (SI) cancel
  - 110dB attenuation (Antenna + Analog IC + Digital IC) has been confirmed to be achieved in our experimental environment



Frequency	$d$	Isolation
4.7 GHz	150 mm	48 dB
28 GHz	40 mm	56 dB

Parallely placed patch antennas



Analog IC ( $f=4.7$  GHz)

## Possible RAN issues

- Backward compatibility with legacy UEs
- Resource management schemes for inter gNB/UE CLI mitigation
  - RB allocation, Tx power, BF, etc.

(\*) SBFD: Sub-Band Full Duplex

**Toward Human Robot society, the provision of compound capability of high data rate and URLLC is demanded.**

**Following technologies should be studied in RAN.**

- Multi Radio Connectivity
- Utilization of Higher Frequencies
- Full Overlap Full Duplex

# Thank you for your attention