



3GPP TSG RAN Rel-19 workshop  
Taipei, June 15 - 16, 2023

RWS-230230

Source: Apple  
Agenda Item: 5

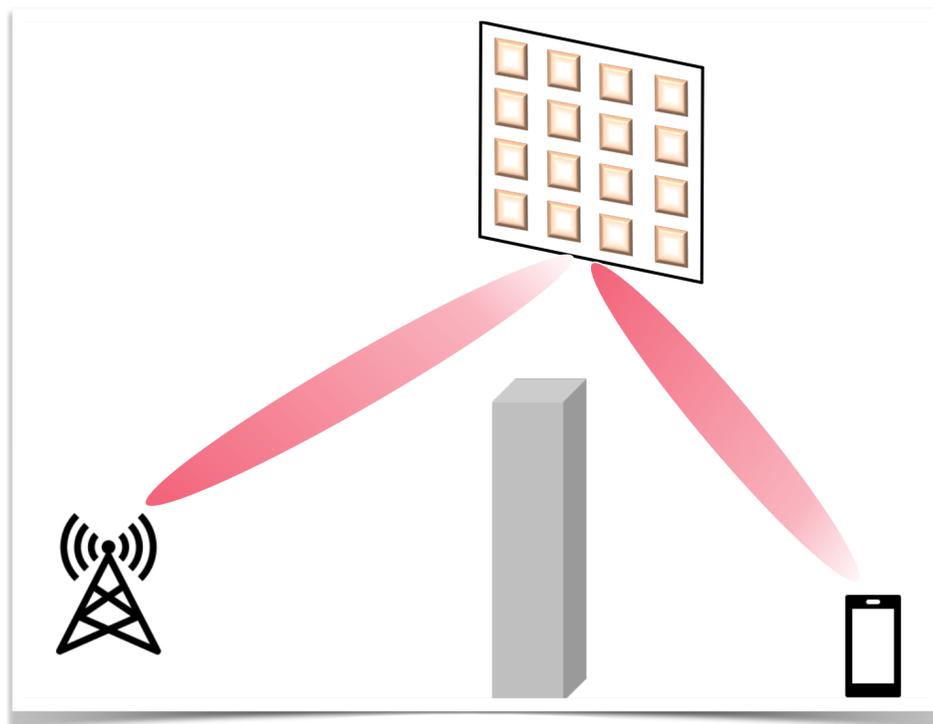
# Views on Reconfigurable Intelligent Surfaces (RIS) for Rel-19

Apple

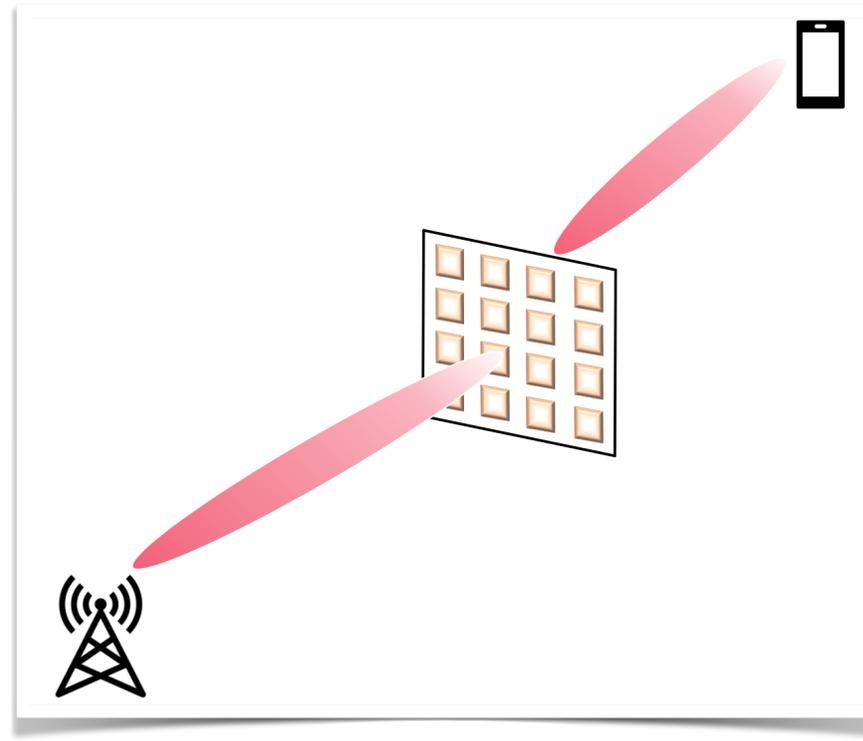
# Overview | Reconfigurable Intelligent Surfaces (RIS)

- Low-power and low-complexity node to **assist with gNB and/or UE communication**:
  - Composed of periodically arranged elements of meta-materials in 2D-planar structure
  - **Nearly-passive device without power amplifiers**
  - Configurable elements to modify the properties of impinging electromagnetic waves
  - Capable of **different types** such as reflective, refractive and absorptive

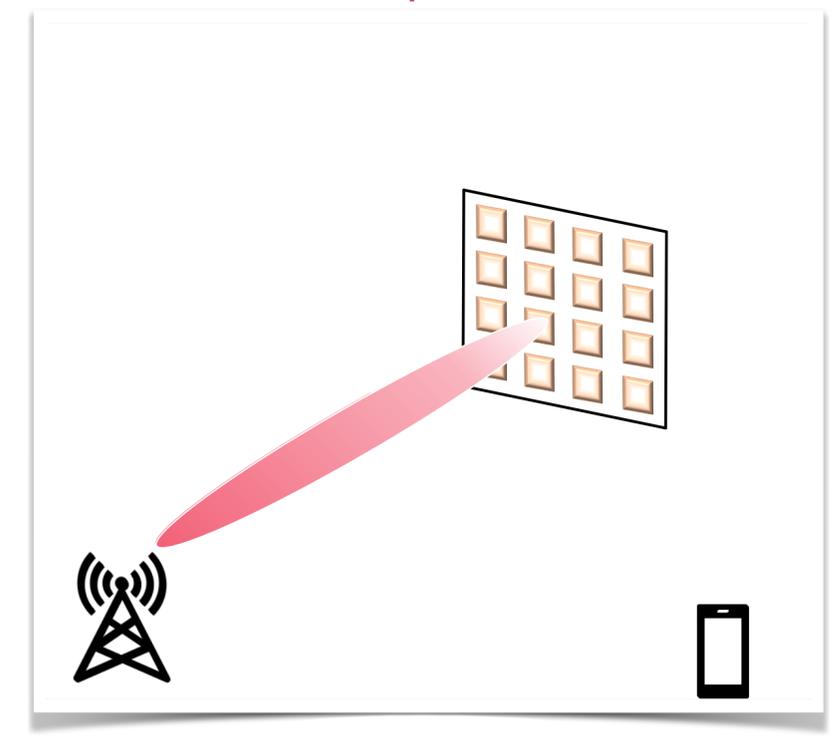
Reflective RIS



Refractive RIS



Absorptive RIS



# Use-Cases | Reconfigurable Intelligent Surfaces (RIS)

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## ■ Coverage

- Coverage in blockage scenarios (via reflection)
- Outdoor-to-indoor coverage extension (via refraction)

## ■ Interference Management

- Blocking unwanted reflections and scattering of signals (via absorption)

## ■ Capacity

- Enhanced capacity by spatial multiplexing of direct path(s) between Tx-Rx and additional path(s) between Tx-RIS-Rx

## ■ Improved Positioning

- Enhanced positioning accuracy by providing additional LoS path(s)

## ■ Diversity

- Spatial diversity
- Time diversity
- Frequency diversity

## ■ Power Saving

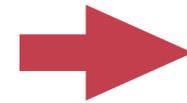
- Passive RIS may reduce overall network and UE power consumption



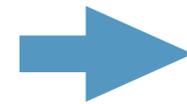
# Justification | Reconfigurable Intelligent Surfaces (RIS)

- How the 5G is evolving?

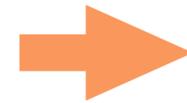
Energy efficient system



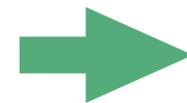
Enhanced FR2 experience



Low-complexity solutions



Ease of deployment



- What RIS can potentially offer?

Passive Node

Coverage Extension in FR2

No active Rx, no active Tx, No PA

Easily Integrable as fixed or portable solution

# Study Details (1/2) | Reconfigurable Intelligent Surfaces (RIS)

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- Essential to **study the benefits and performance gains of RIS** in comparison to current NR technologies such as network-controlled repeaters
- Study can focus on at least following aspects including:
  - RIS types
    - RIS can operate as passive or active nodes, however, **3GPP may focus only on passive RIS in NR Rel-19**
  - RIS operations and channel modeling
    - Different modes of operations possible, but, **3GPP may focus on reflective, refractive and absorptive RIS**
    - **Study channel modeling** considering different modes of operation



# Study Details (2/2) | Reconfigurable Intelligent Surfaces (RIS)

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- (Contd..) Study can focus on at least following aspects including:
  - Evaluation methodology
    - Identify the **evaluation methodology** for different modes of operation
      - Consider at least the **performance metrics** including control information signaling overhead, coverage range (with focus on FR2), power consumption requirements including both RIS elements and controller
  - RIS control interface
    - **Study control information** for RIS configuration and identify required enhancements
    - Study **feasibility of different controlling types for RIS**
      - Depending up on the use-cases and deployment scenarios, control of RIS by network and/or UE can be considered

# Proposals' Summary | Reconfigurable Intelligent Surfaces (RIS)

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- Considering RIS as a relatively new technology, 3GPP can consider only a study phase for RIS in NR Rel-19
- Study considers only passive RIS
- Channel modeling considered for different modes of operation focusing on reflection, refraction and absorption
- Study required control information for RIS and feasibility of different controlling types for RIS
- Evaluate performance at least in terms of signaling overhead, coverage and power consumption

