

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

Source: ZTE, Sanechips

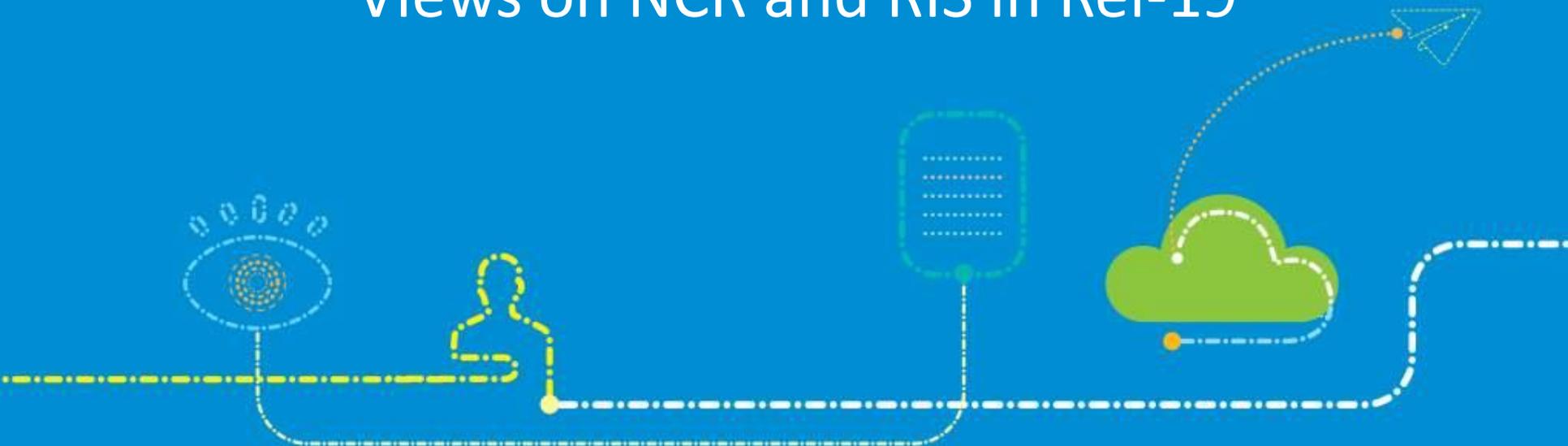
Agenda: 5

RWS-230292

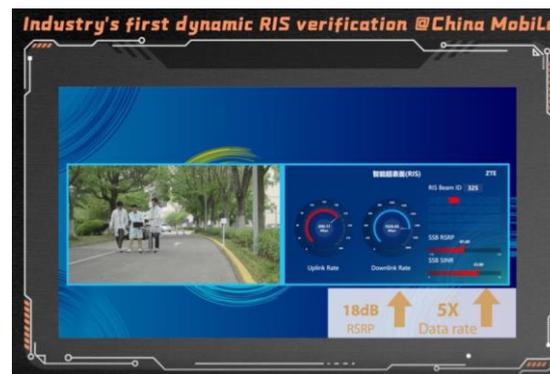
ZTE

Tomorrow never waits

Views on NCR and RIS in Rel-19



- **Prototype and Test:** A lot of justification have been provided to justify the benefits and maturity of RIS for commercial usage, e.g.,



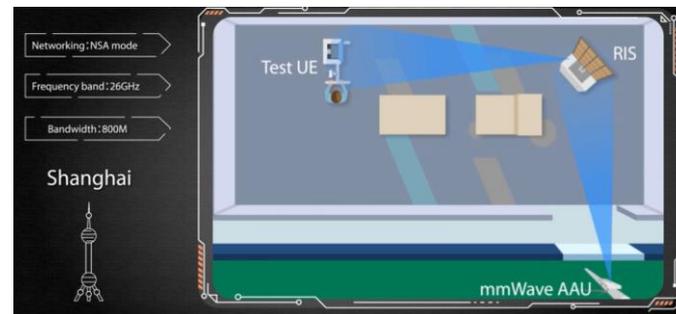
In field tests, the fixed-point coverage before and after dynamic RIS applications and coverage and rate tests under mobile scenarios are performed. The test results show that the dynamic RIS brings great gains in the test area, the **maximum RSRP is increased by 23 dB**, and the **user rate is increased by five times**.

[1] https://www.zte.com.cn/global/solutions_latest/5g-advanced/ris.html

[2] <https://www.zte.com.cn/global/about/news/20220909e3.html>



ZTE launches the 1st RIS-wing for Sub-6GHz commercial AAU deployment with improved average rate for DL (up to 15%) and UL (up to 100%)
 [1] https://www.zte.com.cn/global/solutions_latest/5g-advanced/ris.html



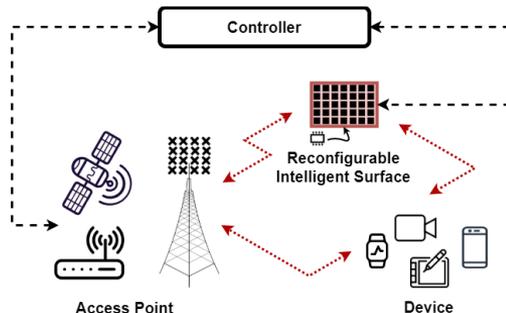
Coverage improvement with 20 dB.

[1] https://www.zte.com.cn/global/solutions_latest/5g-advanced/ris.html

– Efforts in other SDO & Organization, e.g., ETSI RIS ISG

“RIS is a new type of system node with reconfigurable surface technology, where its response can be adapted to the status of the propagation environment through control signalling.”

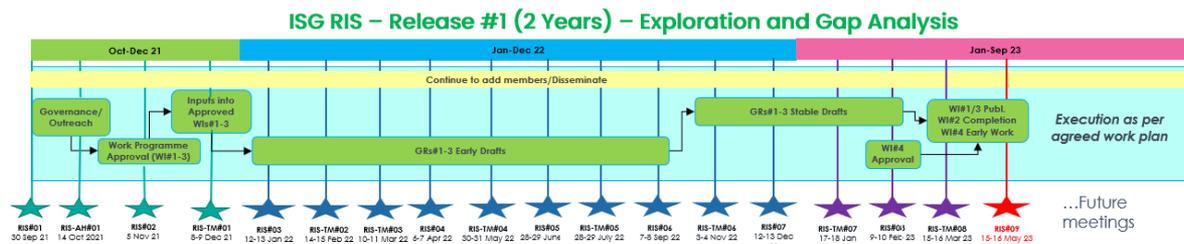
Ref: [BOARD\(21\)133_019 New ISG RIS Presentation](#)



ISG RIS Progress to Date

Release #1 Mission: To explore RIS technology and its applications across the wide spectrum of use cases and deployments, and identify any specification needs that may be required.

Release #1 Deliverables: ETSI Group Reports (GRs), PoCs, White Papers.



Study on many aspects, e.g., use case, channel model and technological aspect have been conducted on scheduled.

Ref: [RIS\(23\)009003](#), Chair’s slides for RIS ISG

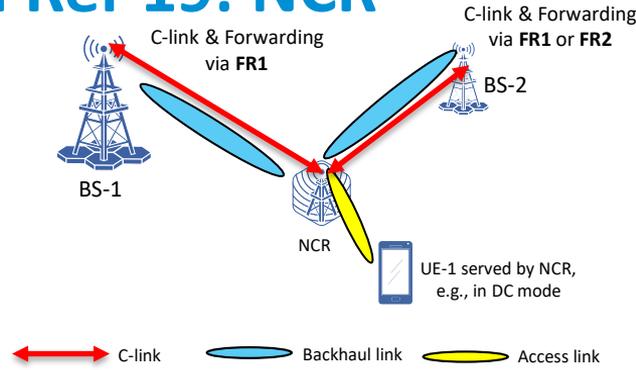
WIs:

- WI#01: “Use Cases, Deployment Scenarios and Requirements”, Rapporteur: [Vincenzo Sciancalepore](#) (NEC) [Status: Published]
- WI#02: “Technological Challenges and Impact on Architecture and Standards”, Rapporteur: [Nan Zhang](#) (ZTE) [Status: Stable Draft]
- WI#03: “Communication Models, Channel Models, and Evaluation Methodology”, Rapporteur: [Marco Di Renzo](#) (CNRS) [Status: Final Draft Approved]
- WI#04: “Implementation and Practical Considerations”, Rapporteur: [Mohsen Khalily](#) (ICS) [Status: Early Draft]

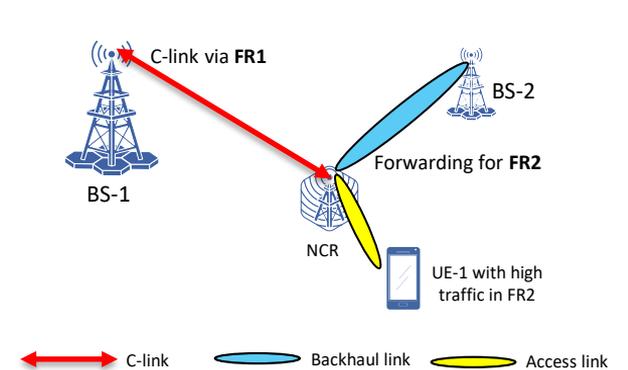
Technical aspects in Rel-19: NCR

For NCR (Network-Controlled repeater): Given the discussion in Rel-18 along with new motivation, the following aspects can be considered in **Rel-19**:

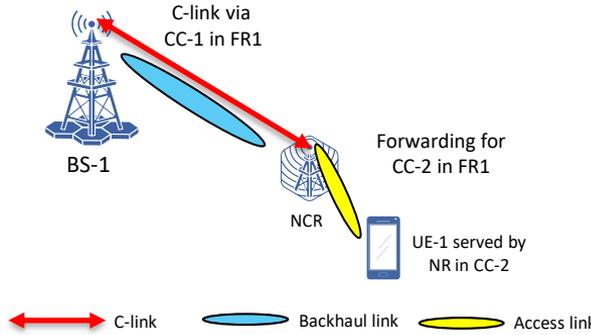
- **Out-of-band deployment:**
This enhancement is targeted to enable the flexible forwarding with more robust control.
- **To support this feature:**
 - ❖ Mechanism to maintain the forwarding link, e.g., the DL- and UL-timing, TDD configuration, beam indication;
 - ❖ Information exchanges among BSs



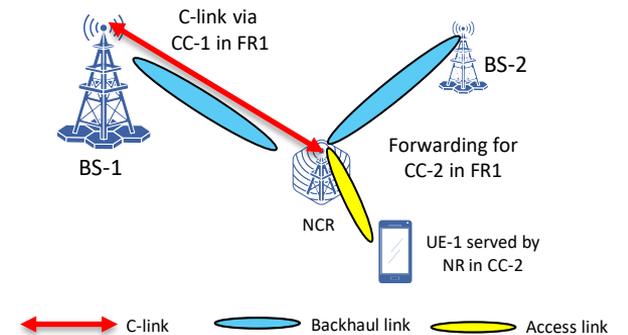
Case-1: Dual-leg control mode



Case-2: Single-leg control for the transmission from different BS in different CC

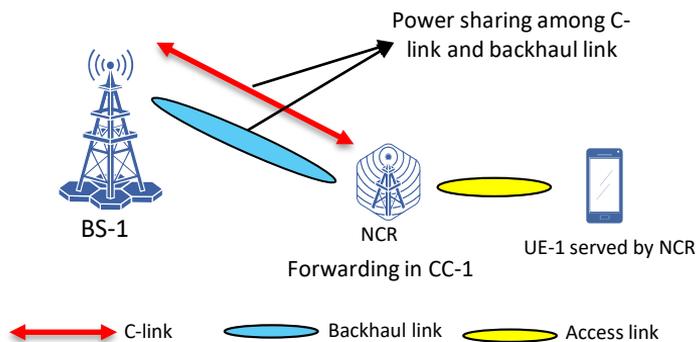


Case-3: Single-leg control for the transmission from same BS in different CC

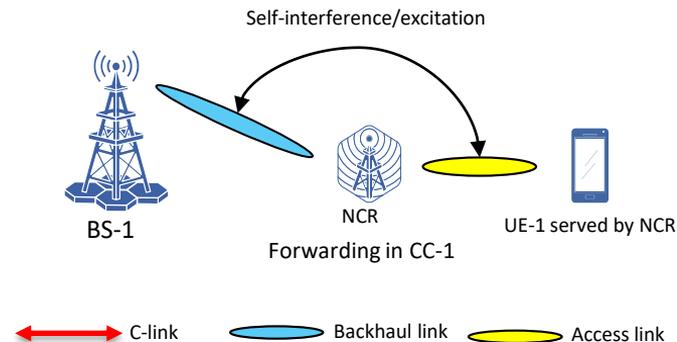


Case-4: Single-leg control for joint transmission from multiple nodes in different CC

- **Power control for NCR:** For PC control part, as one of the remaining issue of Rel-18, this aspect is driven by following two cases, especially for in-band repeater.



Case-1: Power sharing between C-link and backhaul link



Case-2: Power allocation to mitigate the interference

- **To support this feature:**

- ❖ For case-1:

- The capability of NCR-MT on power sharing should be considered;
- The mechanism to specify the power sharing among two link should be considered.

- ❖ For case-2:

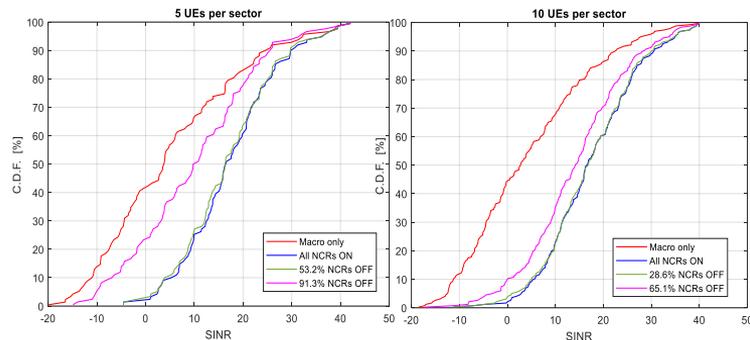
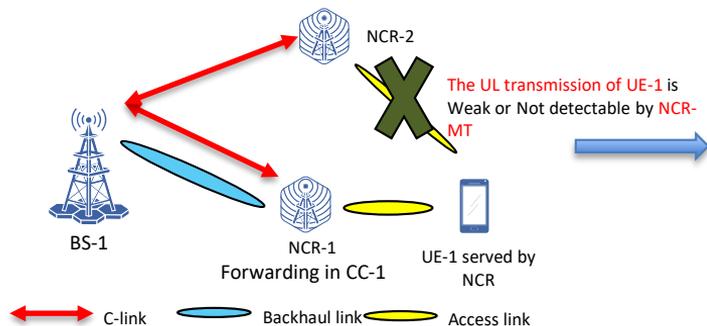
- The mechanism to specify the power allocation of access link, e.g., to minimize the impact of interference due to the self-excitation.
- The potential detection of occurs of self-excitation.

– **Enhancement on side control information (SCI) for advanced controlling**

- Aspect-1: Frequency-selective (e.g., RB-/pass-band/CC- level) beam scheduling and ON-OFF
 - ❖ *This feature is beneficial to improve energy efficiency along with mitigation of unnecessary interference.*
 - ❖ **To support this feature**: Indication of SCI with additional information, e.g., frequency information, is required.
- Aspect-2: Multiple-beams over the same T-F resource
 - ❖ *This feature is beneficial to support simultaneous service for multiple-UEs by single NCR. Meanwhile, the efficiency for common channel forwarding, e.g., SSB, can be improved by mapping one SSB occasion to multiple access beams.*
 - ❖ **To support this feature**: Optimization on the SCI to support the multiple beam indication.

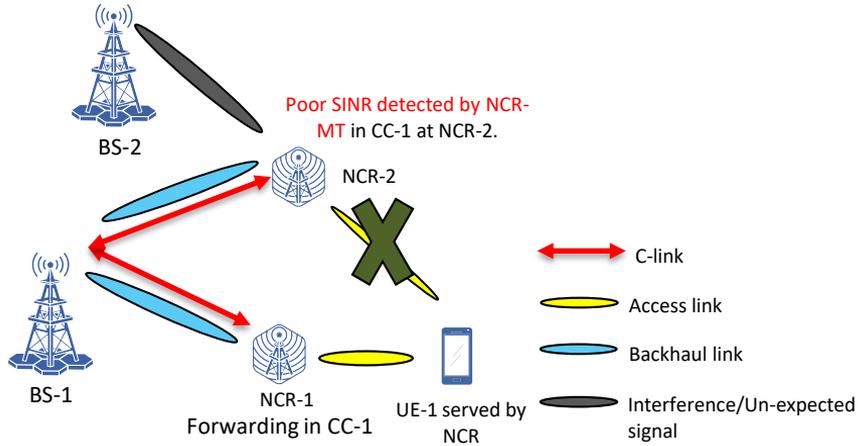
– **UE detection**: The enabling of UE detection via NCR-MT will provide significant benefits to optimize the single and multiple-NCR operation, e.g., decision on NCR ON-OFF, beam optimization and UE-NCR association.

- **To support this feature**: Mechanism to enable the measurement event of NCR-MT should be considered along with potential signal/sequence design from UE side in transparent or non-transparent way.



Observation: The **optimized SINR performance** and **energy efficiency** can be achieved by activating the NCRs according to the targeted UE detection.

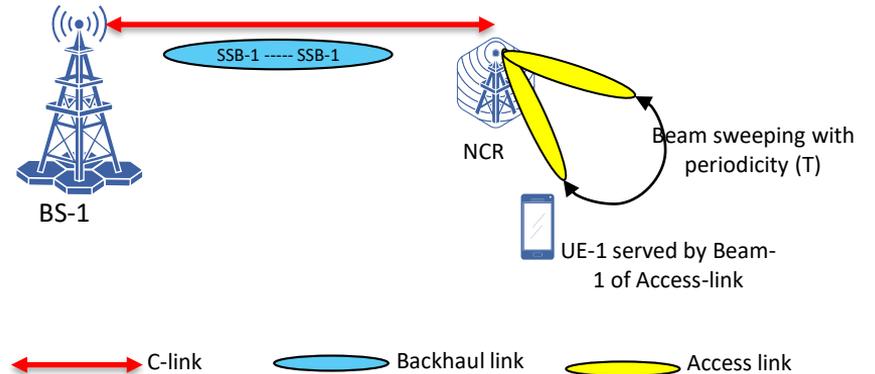
- **Signal quality assisted NCR operation:** The quality of target cell (BS-1) after forwarding can be guaranteed by turning off the NCR-2 based on the assessment of signal quality of target cell over NCR-2 (e.g., interference-level and noise).



❖ **To support this feature:** Mechanism to enable the measurement/report configuration NCR-MT should be considered.

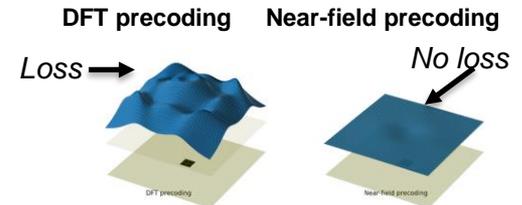
- **Enhancement on SSB design:** To avoid the impact on SSB measurement by UE (e.g., the periodicity of common channel (e.g., SSB) will be extended for the UE served by NCR due to beam sweeping at NCR)

❖ **To support this feature:** SSB pattern with additional SSB position can be considered.



Technical aspects in Rel-19: RIS

- Potential technical enabler of the deployment of RIS:
 - **Study on the channel mode & simulation methodology of RIS:**
 - ❖ Scenario: Generic model for all scenarios, cover both far- and near-field cases;
 - ❖ Modelling methodology: Both hybrid (with Ray Tracing) and statistic based approaches are needed;
 - ❖ Features:
 - RIS modeling, e.g., scattering pattern of RIS; Reciprocity feature of RIS; Cross-polarization of RIS;
 - Large scale channel model (e.g., PL)
 - Small scale channel model & procedure for channel realization:
 - ✓ Generation of rays for BS-RIS, RIS-UE link
 - ✓ Association among rays between BS-RIS and RIS-X link
 - Spatial non-stationary feature and spherical wave front assumption
(given the large size of RIS or RIS deployed close to UE/gNB)



– **Controlling of RIS:**

- For single RIS:

❖ **Part-1:** NCR feature can be considered as the stepping stone including **shared** enhancement in Rel-19.

<u>Technical aspects</u>		<u>RIS</u>
Out of band control		Yes (Note: Totally decoupled transmission/reception between forwarding and C-link is possible)
Advanced control	Frequency-selective	Possible
	Multiple-beams	Yes
	Per component control	Yes (Note: Per-element group or sub-surface, related to implementation)
UE detection		Yes (Note: Potential joint consideration with beam optimization for RIS)
Signal quality assisted NCR operation		No
Power control		No

❖ **Part-2:** RIS-specific enhancement based on intrinsic feature/use case.

- Non-stationary deployment of RIS: Since the RIS is more friendly to be integrated with moving vehicle, e.g., car, train. The controlling of RIS by assuming the non-stationary deployment is needed.
 - ✓ **To support this feature:** At least the mobility procedure should be supported for MT (within same CORE)
- Optimization on beam management: RIS is able to form multiple beams, the optimized beam management procedure should be considered.
 - ✓ **To support this feature:** At least UE detection based approach can be considered.

- Near-field communication: The large size of RIS, which is close to BS/UE can be considered. The optimization to match the near-field effect should be considered.
 - ✓ **To support this feature:** Enhancement on the DL/UL codebook can be introduced, e.g., based on the spherical wavefront assumption.

- For multiple-RIS:

- ❖ Coordinated transmission from multiple RIS is more realistic compared to other types of entity, e.g., repeater or RRH due to the naturally supported synchronization in OTA (i.e., the controller can be well synchronized to the same gNB).

- **To support this feature:** At least the following two aspects should be considered:

- ✓ Mechanism to construct the group of RIS for certain UE;
- ✓ Mechanism to control the RISs.

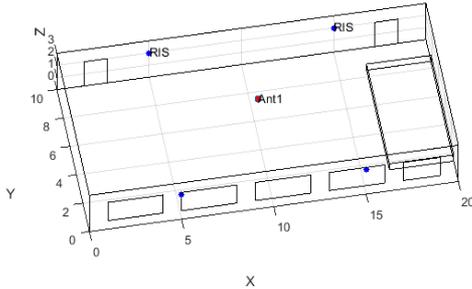
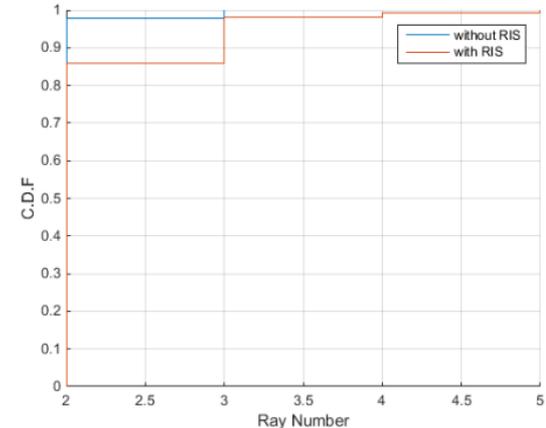
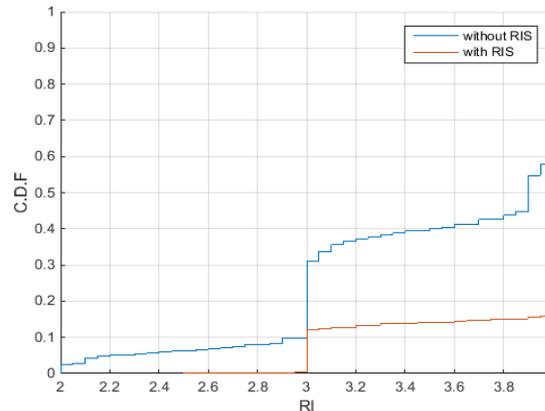


Illustration on the improvement of MIMO capabilities (by Ray-tracing based CM) @30GHz



Observation: The distribution of **RANK of UE** can be achieved due to the increased multiple-path by RIS (Ray within 3dB)

Recommendation & Work plan

- Based on the analysis before, as for recommendation:
 - **Proposal-1:** *it's beneficial to introduce the following enhancement for NCR including:*
 - ❖ *Out-of-band deployment*
 - ❖ *Power control for NCR*
 - ❖ *Enhancement on side control information for advanced controlling*
 - ❖ *UE detection*
 - ❖ *Signal quality assisted NCR operation*
 - ❖ *Enhancement on SSB design*
 - **Proposal-2:** *RIS related discussion can be triggered in Rel-19 including*
 - ❖ *Channel model & simulation methodology*
 - ❖ *RIS-specific enhancement including support of Non-stationary deployment of RIS, Optimization on beam training, DL and UL codebook design considering the near field and coordinated transmission from multiple RIS*
- Potential work plan
 - **Proposal-3:** *The channel model & simulation methodology related aspect for RIS can be conducted in the **dedicated SI for channel model** jointly with all interested features as proposed in RWS-230293.*
 - **Proposal-4:** *The RAN1-led WI on the aspect of technical solutions can be considered to cover all interested enhancement for both NCR and RIS including:*
 - ❖ *Study and specify enhancements for NCR (including shared aspects between NCR and RIS)*
 - ❖ *Study RIS-specific enhancements (e.g. evaluation based on RIS channel model)*

Thanks



Tomorrow never waits

