RP-232050
3GPP TSG RAN Meeting #101
8A. 2. 11 Channel Modeling

# Discussion on Channel Modeling of RIS in Rel.19

**KDDI corporation**

# Background



- In the RAN-Release 19 workshop, the endorsed chairman's summary [1] lists a channel modeling study for ISAC, FR3, and RIS as a candidate for Rel-19.
- It is also mentions that it is very challenging to carry out all the items, thus strongly encouraging limiting the scope.

Channel Modeling (& possibly additional aspects e.g. for ISAC) for further evolution

- Strong interest in exploring study in new areas (RAN plenary invovlement?)
  - Very strong interest in channel modeling for integrated sensing and communication (ISAC), and also interest in other possible areas (e.g., use cases, scenarios, key performance metrics (KPIs), potential spec impact, etc.)
  - Reasonable interest in exploring study in new spectrum, such as 7-24GHz
    - Channel modeling study only?
  - Reasonable interest in RIS (Reconfigurable Intelligent Surface) related study
    - Channel modeling study only?
- Very challenging if study is to be carried out for all the above items
  - Which one(s) should be the focus? Necessity for future standard evolution?

# 1. High-level use case study



- For ISAC, we see benefits on having a RAN plenary-level study to identify its RAN level use cases based on SA 1 study outcome, it's just similar approach we had in ambient IoT in Rel-19.
- But for RIS, use cases are not so complicated, so we don't expect having RAN plenary-level study.
- Instead, we should converge target high level use cases before starting RIS channel modeling study from 2024. Q1.
- Target high-level use cases include RIS mode, RIS size, frequency, deployment scenario (potentially include distance between BS/RIS/UE and height of BS/RIS/UE.

**Proposal 1:** RAN agree to converge high level use cases before starting RIS channel modeling study.

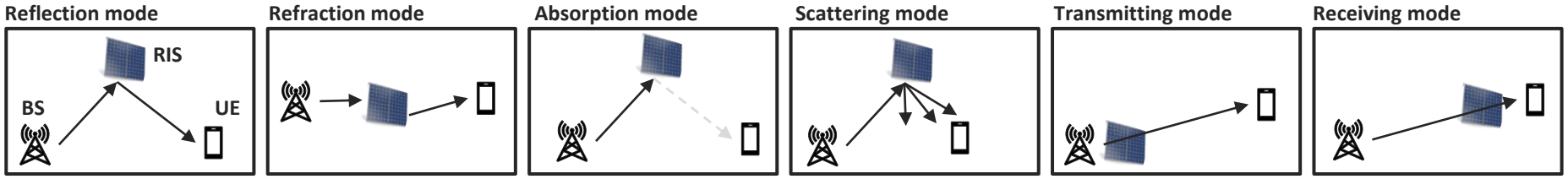
# 2. RIS mode



- In Rel-19 workshop, several RIS modes (Reflection, Refraction, Absorption, Scattering, Transmitting, Receiving) were proposed.
- But considering expected time unit for channel modeling study will be 1 – 2 TU every meeting and have not only RIS but also FR3 and ISAC, discussion time for RIS is considerably limited, we believe RAN should focus on one or two modes.
- Since the verification of reflection mode is demonstrated by several companies, we consider the “reflection mode” will be prioritized.

**Proposal 2**: RAN agree to focus on the limited mode of RIS to save discussion time, at least reflection (additionally refraction if feasible) for RAN channel modeling study.

RIS mode



# 3. RIS size and frequency



- The size of RIS panel needs to be sufficiently (electrically) large so that the reflected/ refracted signal power meets requirements.
- If we assume pass-loss of RIS assumed to be equivalent to free space path loss (FSPL), the RIS is required to cover the 1st Fresnel's zone.
- The size might become several hundreds of wavelength for RIS use in a microcell area.
  - For the use in 3.5GHz (FR1), the size becomes ten meters.
  - For the use in 28 GHz (FR2), the size becomes several meters.
- Since ten meters size of RIS is not so feasible in terms of actual deployment, we propose to prioritize FR2 over FR1.

**Proposal 3**: RAN agree to prioritize FR2 over FR1 for RIS channel modeling study considering actual RIS size.

# 4. Deployment scenario



- For RIS channel modeling, three links, BS-UE, BS-RIS, and RIS-UE are considered.
- We expect that current 3GPP model (TR 38.901) can be applied to model each hop of a link, specifically UMi (street canyon, open area), UMa, and Indoor models can be applied for each link.
- If the distance between BS and RIS or RIS and UE is very small, a pure LOS channel model is applicable.
- ETSI GR RIS 003 also mentions that 3GPP model (TR 38.901) can be applied in its chapter 6 channel models.
- O2I for UMi, UMa is also possible scenarios to be considered, in that case penetration loss modeled in 3GPP can be reused.
- Addition to that, to avoid blockages in a complicated environment, multiple RIS can be configured in a cascaded manner so that LOS between BS and RIS, RIS and UE, RIS and RIS are ensured substantially for coverage extension, this is also a possible scenario to be studied.

# 4. Deployment scenario (Cont'd)



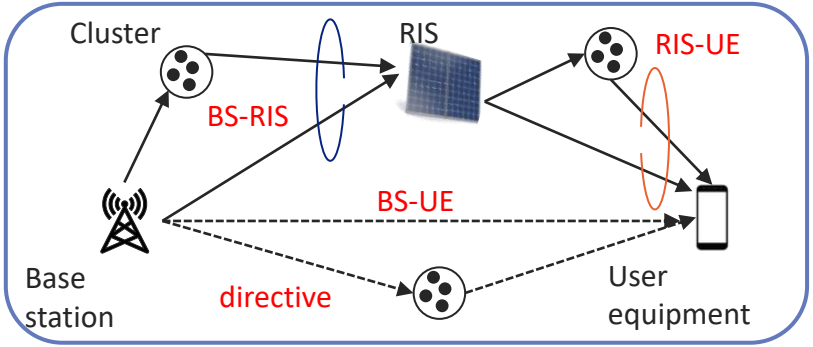
**Proposal 4**: RAN agree to study RIS channel model for both outdoor and indoor scenarios.

**Proposal 5**: RAN agree to assume reusing the current 3GPP model, UMi, UMa, Indoor to model RIS link, BS-UE, BS-RIS, RIS-UE to cover outdoor and indoor scenarios.

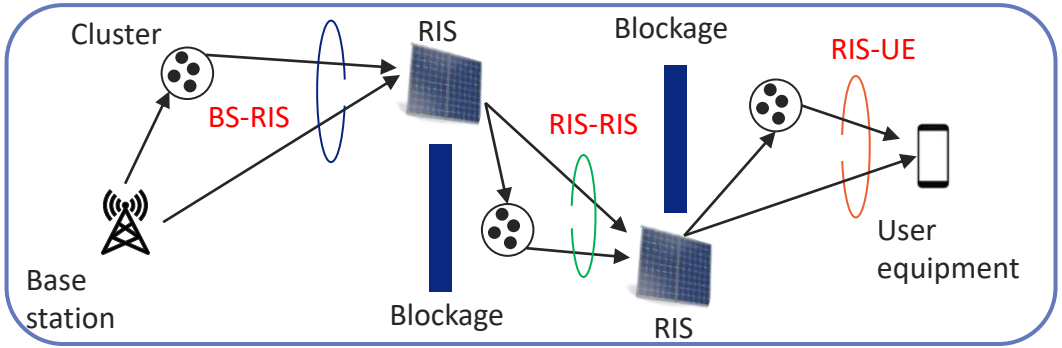
**Proposal 6**: RAN discuss weather to study RIS-RIS link.

**Proposal 7**: RAN discuss whether to study both O2O and O2I or only O2O.

**Single RIS model**




**Multiple RIS model**



# 5. RIS study group outside of 3GPP



- Outside of 3GPP, there are some groups which study RIS, such as ETSI INDUSTRY SPECIFICATION GROUP (ISG) ON RECONFIGURABLE INTELLIGENT SURFACE (RIS), RIS TECH Alliance (RISTA) in China.
- Those groups also study the channel model, for example, in ETSI RIS GR 003, there are some study results on RIS channel models including path loss models, multi path models, RIS element modeling.
- We are expecting that 3GPP reuse/refer the outcome from those groups to speed up the discussion and save discussion time in RAN1.
- So, we propose:

**Proposal 8**: RAN agree to start the RIS channel modeling study from investigation on the existing RIS channel model of ETSI ISG RIS and RISTA.

# References



[1] RWS-230488, RAN Chair's summary of Rel-19 workshop, RAN Chair (Qualcomm), June 2023.

[2] ETSI RIS GR 003 V1.1.1, June 2023.

[3] 3GPP TR 38.901 V14.0.0, May 2017.

Tomorrow, Together

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