

Source: ZTE, Sanechips, China Unicom
Agenda: 4.1

Support of Reconfigurable Intelligent Surface for 5G Advanced



Ubiquitous antennas - Reconfigurable Intelligent Surface (RIS)

- RIS is beneficial for coverage/throughput/energy efficiency with following intrinsic features
 - Nearly passive with less power consumption
 - Contiguous surface to shape the radio wave
 - Signal quality improvement (e.g., SINR) without D-A/A-D and PA
- It can also be flexibly deployed in various scenarios including indoor, outdoor and O2I

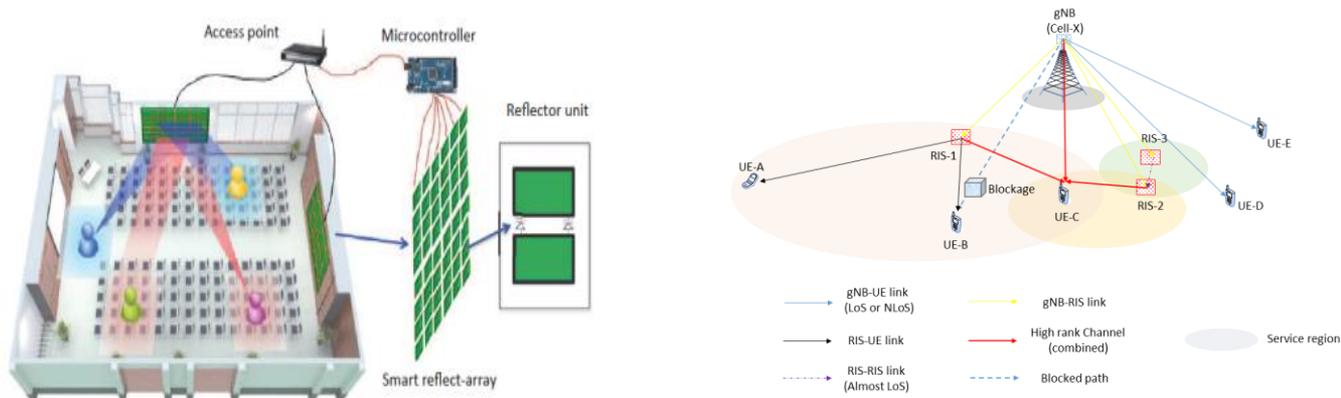
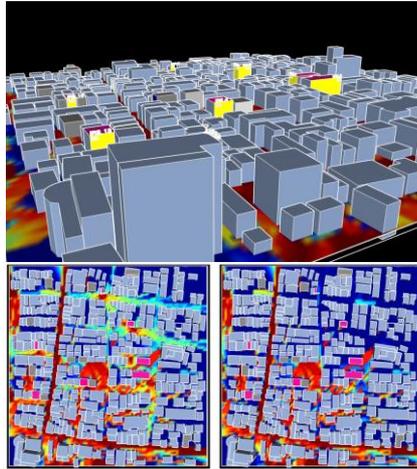


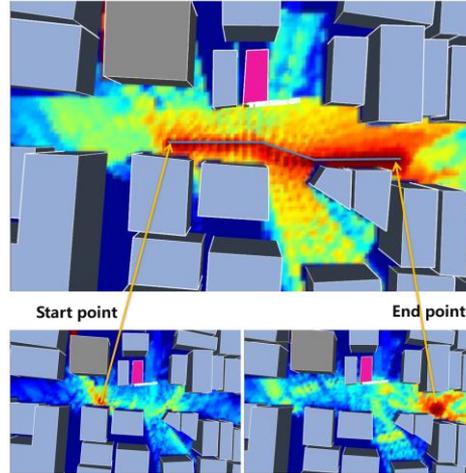
Illustration on deployment of RIS

Ubiquitous antennas - Reconfigurable Intelligent Surface (RIS)

- Performance benefits can be achieved in both Cell specific and UE specific way from simulation and measurements from the field.



(a) Cell-specific coverage



(b) UE-specific beam tracking

With RIS, 10dB-20dB RSRP improvement is observed in this area where gNB-UE link is not LOS.

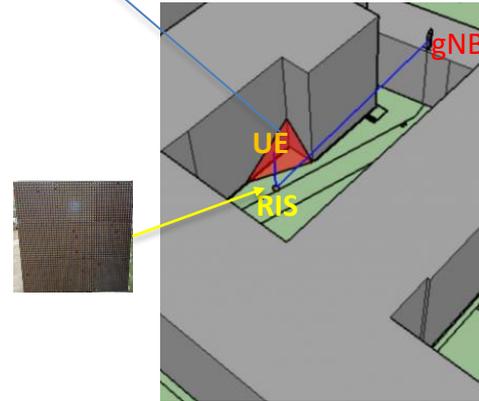


Illustration on the improvement of coverage (by initial field measurements) @28GHz

Illustration on the improvement of coverage (by Hybrid modeling) @28GHz

Objectives to support RIS: channel modeling methodology

- Methodology for channel modeling
 - Scenarios setup: e.g., indoor, dense urban, etc.
 - RIS component modelling
 - Topology/Type (e.g., active/passive)
 - Element response pattern/RF characteristic
 - Channel component for study:
 - Principle for modeling:
 - Hybrid channel model: RIS is taken as one entity in the propagation environment, with realistic calculation/modelling channel properties
 - Statistic channel model: Updated procedure and parameter sets for each channel component

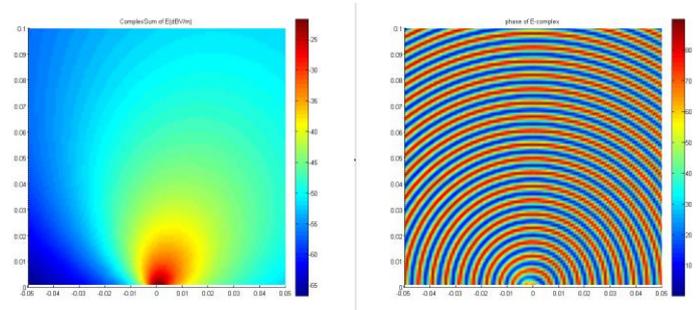
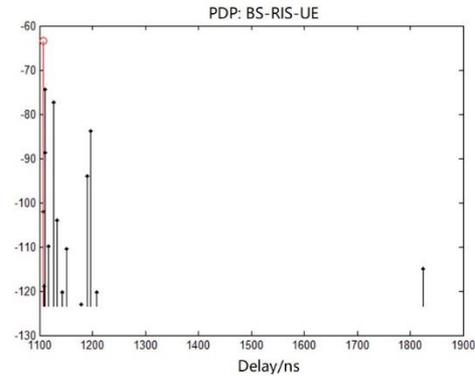
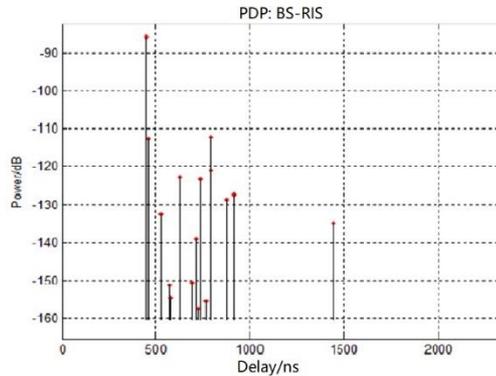


Illustration on an example of response pattern

Objectives to support RIS: channel modeling methodology

- Key component for RIS channel analysis
 - gNB-RIS, RIS-RIS, RIS-UE, e.g., cascading transmission



- Large scale:
 - » Decaying slope for large scale attenuation: Sum-distance model $(d1+d2)^2$ vs product-distance model $(d1*d2)^2$
 - $d1, d2$ refers to the separation distance between gNB-RIS, RIS-UE, respectively.

Objectives to support RIS: channel modeling methodology

- Small scale
 - LoS/NLoS probability
 - » Considering the potential high-rise deployment of RIS to define the model for gNB-RIS link
 - Potential reuse of model defined for UAV (TR36.777)
 - Multi-paths association between rays/cluster among the links
 - » Additional delay for RIS-UE link for synthetic channel combined with gNB-UE link
 - » Angular domain parameters association between gNB-RIS link and RIS-UE link
 - » Potential key-hole impacts for transmission-based RIS
 - Polarization
 - » Per path and per polarization impacts for RIS,
 - e.g., semi-deterministic calculation instead of XPR used for whole procedure
 - Reciprocity
 - » Reciprocity of channel is kept for BS-RIS-UE link with negligible impacts on the RIS implement

Objectives to support RIS: technical enhancements

- Motivation on the enhancement: To enable the **UE-specific** optimization
- Potential impacts with higher priority:
 - Beam management/CSI enhancement
 - Training/CSI mechanism for RIS-gNB / RIS-UE (considering near/far field)
 - Control interface between RIS-gNB
 - Including synchronization mechanism with accuracy up to symbol level
 - RACH enhancement
 - Cope with the issue for extended coverage.
 - Interference coordination/mitigation

Thanks



Tomorrow never waits

