

3GPP TSG RAN#84

3-6 June 2019

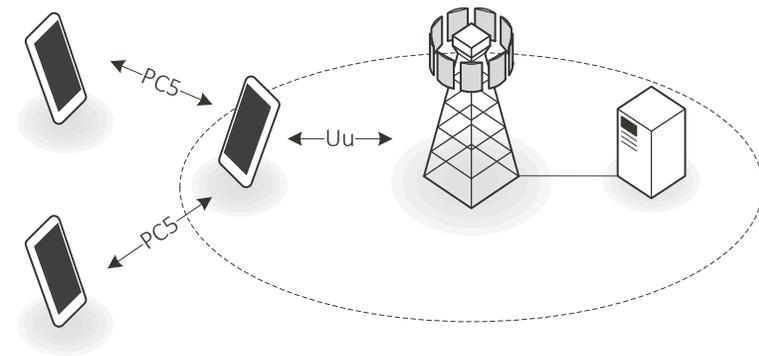
Newport Beach, California, US

RP-191097

Agenda Item 8

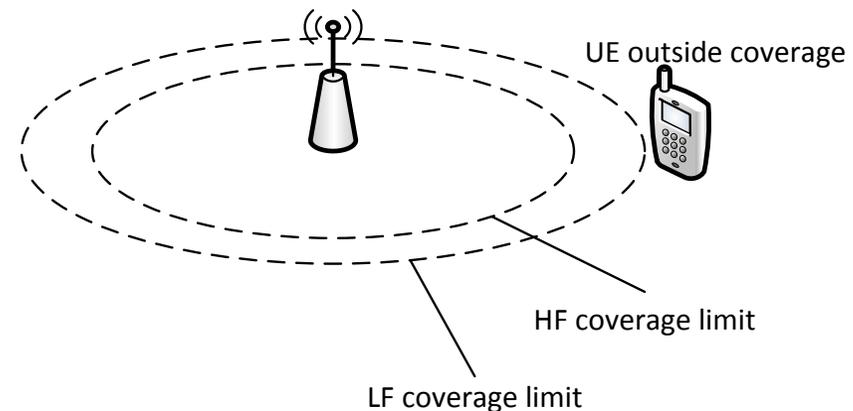
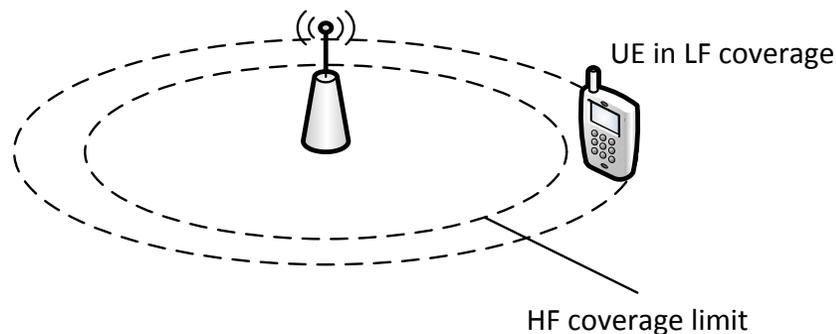
Rel-17 NR Coverage Enhancement

MediaTek Inc.



Addressing the coverage gap in new NR bands

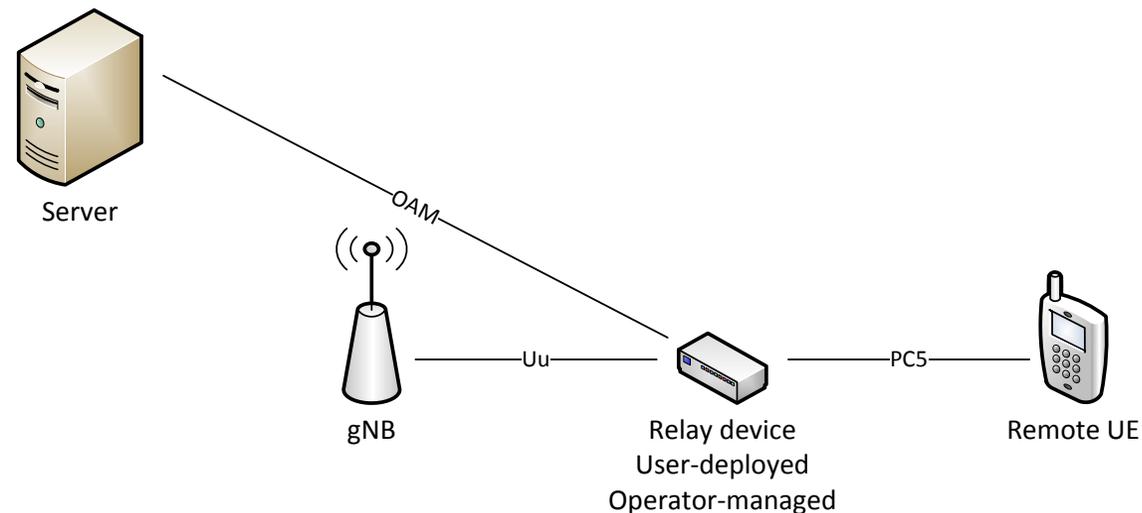
- **Challenging “deep indoor” penetration for new NR bands**
 - Majority of additional NR spectrum in High-Frequency bands: C band (3-6GHz) and mmW
 - Challenging propagation and wall penetration for C-Band
 - Extremely challenging outdoor->indoor penetration for mmW
- **Low-Frequency bands below 2GHz deliver NR deep indoor coverage, but not NR data rates**
 - Limited spectrum availability limits end user data rates
 - Similar user experience as for 4G devices
- **“Deep Indoor” coverage in higher bands essential to deliver NR eMBB data rates**



Consumer-Grade Relay Devices

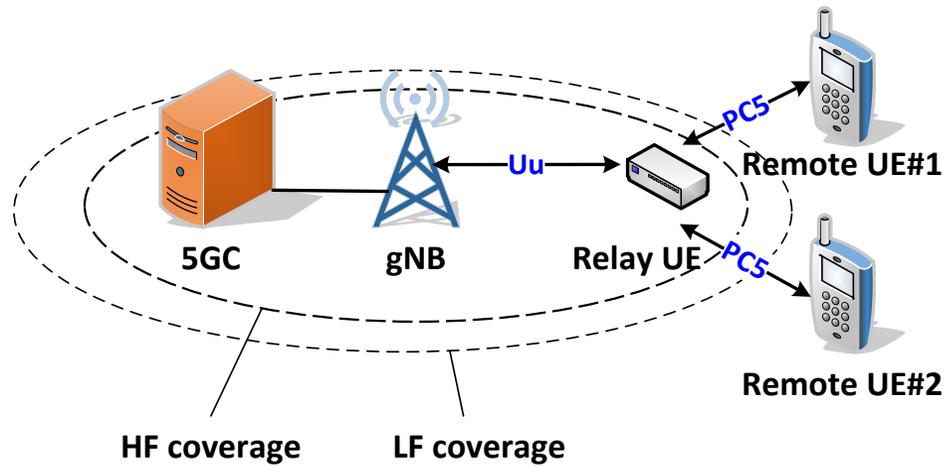
User-Deployed and Network-Controlled

- **Small-cell deployments are the preferred choice for NR indoor high data rate experience**
 - Small-cell footprint primarily in densely populated areas and private premises
 - Unlikely deployed in some scenarios, e.g. suburban residential and rural areas
- **Complementary approach to small cells for areas where small cells not deployed**
- **Fast roll-out with lower cost: end-users to install relays**
 - Fast roll-out: No qualified technicians on site during installation
 - Seamless 'out-of-the-box' installation by user with very limited user intervention
 - Relay devices distributed to users through existing retail channels
- **Network operators keep full control of relay devices (remote access)**
 - Reduced network planning: Manage licensed spectrum to minimise interference and guarantee service quality



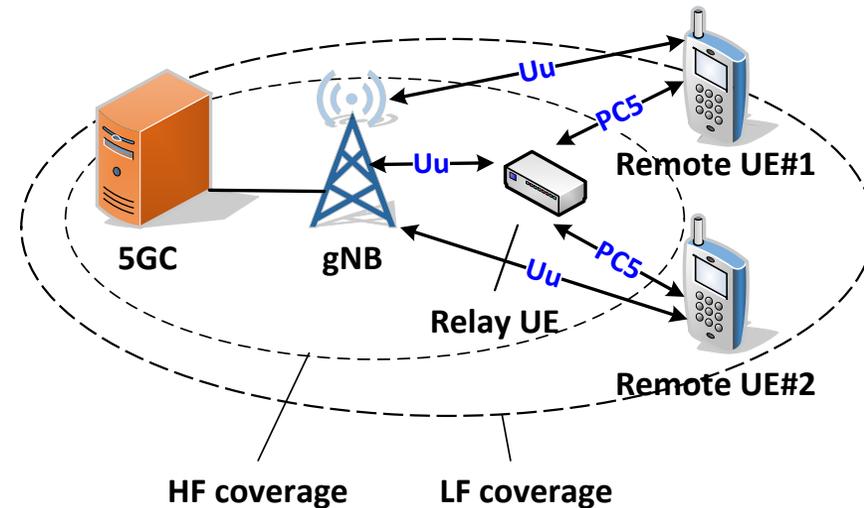
Sidelink relaying scenarios

- Case 1: Remote UE out-of-coverage



- RRC control via relay for all RRC states
- U-Plane via relay
- Should be supportable to cope with “black hole” deployment problems

- Case 2: Remote UE only in LF coverage



- Lower standardization effort, restricted to UE connected state
- Uu C/U-Plane direct to remote UE using LF
- Uu/PC5 U-Plane via relay using HF

Proposed SI/WI scope

- **Rel-17 study item for operator-controlled sidelink coverage extension**
 - Identify deployment scenarios for evaluation, including both licensed and unlicensed spectrum ≤ 52.6 GHz [RAN1/2]
 - Study and evaluate potential physical-layer enhancements on sidelink, including at least the following aspects [RAN1]
 - Physical layer channel/signals
 - Physical layer procedures
 - Resource allocation including interference management under operator control
 - Operation in unlicensed spectrum
 - Study a relaying architecture for coverage extension over PC5 [RAN2]
 - Study sidelink relaying scenarios e.g. CP/UP split
 - Study PC5 for relay, e.g. potential re-use from FeD2D study
 - Study Uu/PC5 relay, e.g. CA/DC, U-plane, and mobility
 - gNB awareness of the remote UEs is beneficial: e.g. allows reuse of RRC states/procedures
- **Work item in Rel-17**
 - Specify the lower-impact solutions
 - One example could be the CP/UP split assuming available low data rate coverage on LF layer
 - Important to have usable indoor coverage extension ASAP
- **Potential enhancements in a future Rel-18 work item**
 - More complex scenarios may need more time to specify
 - E.g. multihop, group mobility, unlicensed sidelink