

Agenda Item: 4 (High-level overview proposals for Rel-19)

Source: VIAVI Solutions

RWS-230414



High-level Release 19 Proposal

3GPP TSG RAN Rel-19 workshop

VIAVI Solutions

June 15th-16th, 2023

Observation for Release 19

- Mobile Industry requires more AI driven automated system.
- Release 19 must consider:
 - Sustainability
 - Energy/spectrum efficiency
 - AI/ML driven optimized system
 - Diverse portfolio with interoperability
 - Zero Trust Network
 - Fully Interoperable System and Testability
 - When UE/RAN/Core have AI/ML capability, testability is much more important compared to previous system.

High-level Release 19 Proposals

1. Study on Use Case Based Testing (UCBT) Framework and Specification
 - Normative work in Release 19 preferred to some use cases
2. Normative work on AI/ML Air interface Testing
3. Study on Rate Splitting Multiple Access (RSMA)

1. Study on Use Case Based Testing (UCBT) Framework and Specification

- Study on Framework in Release 19, normative work in later Release 19 or Release 20.
 - This study should include what "normative work" means in the context of a learning system in a specific scenario DUT/SUT with different history and learning context will generate a different result.
- Use Case Based Testing (UCBT) should be studied and specified per feature or appropriate criteria (e.g., Network Energy Savings, ISAC, Cell-free MIMO, XR, NTN, NPN, Network Slicing, ...).
- Framework should also consider:
 - Flexible architectural configuration for DUT, SUT or E2E network
 - AI/ML system
 - Cloud deployment
 - Automated testing
 - E2E and/or compartment performance testing
 - Use case interaction & conflict mitigation
 - RAN Digital Twin based testing (with collaboration with ETSI ISG ZSM potentially)

2. Normative work on AI/ML Air Interface Testing

- From the work plan for the RAN4 aspects of the Release 18 Study on the AI/ML Air Interface, Q4 2023 should see recommendations towards normative work
- It is crucial that this normative work begins from Release 19 so the industry can begin to develop standardized tests for AI/ML enabled gNBs and/or UEs
- Depending upon the outcome of the Release 18 study, the following aspects may need to be agreed and specified:
 - Reference dataset generation, for training, testing and reproducibility
 - Reference encoders/decoders
 - Interoperability tests for UE-gNB collaboration
 - KPIs or Key Value Indicators (KVI) to appropriately measure gains accounting for AI/ML-related aspects
- Further details can be found in RAN4#107 contribution [R4-2308189](#) (VIAVI)

3. Study on Rate Splitting Multiple Access (RSMA)

Multi-user communications: Key to meet the demand for increasing data rate and connectivity requirements

5G

5G-Advanced/6G

Multi-user MIMO (MU-MIMO)

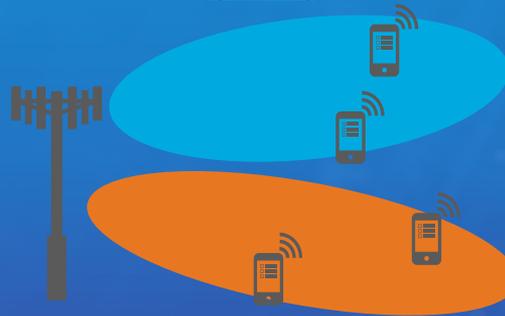


Definition: Serves multiple users in same time and frequency by separate RF beams for each user.

Advantages: High data rate when base station has perfect knowledge of wireless channels of users to be served (which is not possible in practice).

Challenges: Severe performance degradation under multi-user interference, which occurs due to imperfect knowledge of wireless user channels resulting in imperfect beams.

Non-Orthogonal Multiple Access (NOMA)



Definition: Serves multiple users in same time and frequency by combined RF beams for multiple users.

Advantages: Useful when users are aligned with different distances to base station.

Challenges: Performance degradation compared to MU-MIMO except for several special scenarios, extra processing needed at receivers.

Rate-Splitting Multiple Access (RSMA)



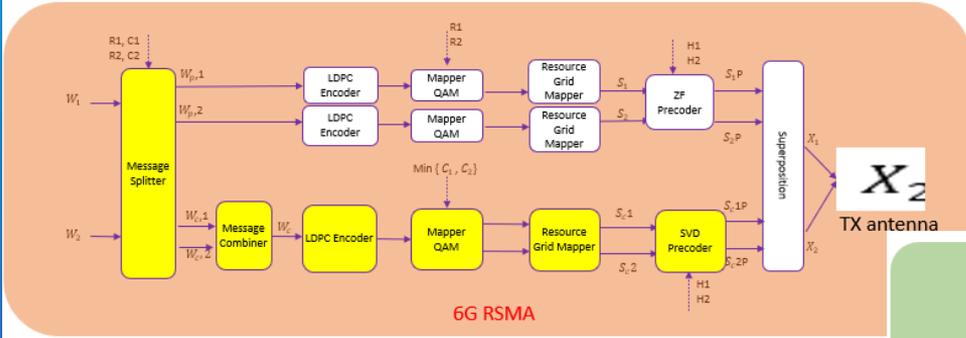
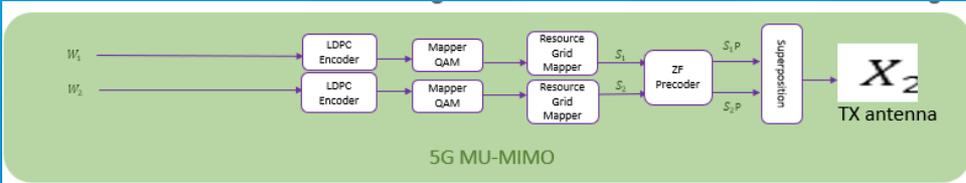
Definition: Serves multiple users in same time and frequency by separate and combined RF beams.

Advantages: Generalizes MU-MIMO and NOMA, high data rate with perfect and imperfect knowledge of wireless channels of users to be served.

Challenges: Extra processing needed at receivers.

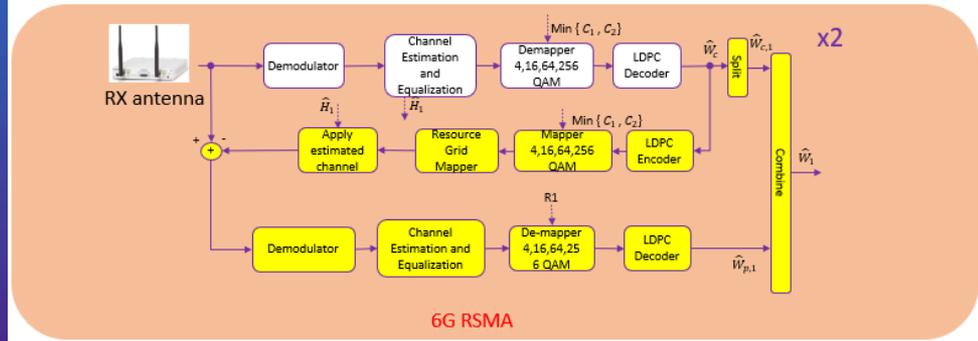
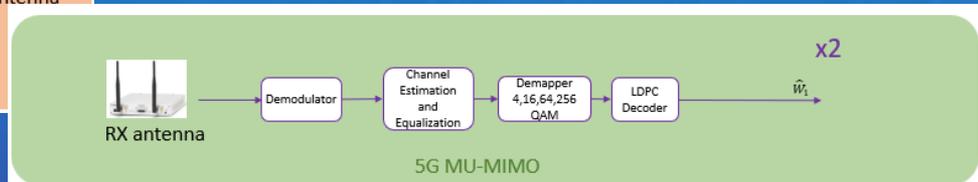
- Yijie Mao, Onur Dizdar, Bruno Clerckx, Robert Schober, Petar Popovski and H. Vincent Poor, "Rate-Splitting Multiple Access: Fundamentals, Survey, and Future Research Trends," in *IEEE Communications Surveys & Tutorials*, 2022.
- Onur Dizdar, Yijie Mao, Yunnuo Xu, Peiyang Zhu and Bruno Clerckx, "Rate-Splitting Multiple Access for Enhanced URLLC and eMBB in 6G: Invited Paper," *2021 17th International Symposium on Wireless Communication Systems (ISWCS)*, 2021, pp. 1-6.

3. Study on Rate Splitting Multiple Access (RSMA), Cont.



TX: 5G MU-MIMO vs 6G RSMA

RX: 5G MU-MIMO vs 6G RSMA



The logo consists of the letters 'VI.AVI' in a bold, white, sans-serif font. The 'V' and 'I' are stylized with a slight gap between them, and the 'A' is also stylized. The 'V' and 'I' are larger than the 'A'. The 'A' has a small dot above it, and the 'V' and 'I' have a small dot above them as well. The logo is centered horizontally and vertically in the upper half of the image.

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