

# Views on RAN4 Rel-18: NR Demodulation enhancements

Agenda Item: 9.1.4.4

Source: Intel Corporation

Document for: Decision



# Introduction

The scope of Rel-18 Demodulation enhancements WI was discussed in Rel-18 workshop, pre-RAN #93 [RP-211667], pre-RAN #94 [RP-212682] and pre-RAN #95 [RP-220022] Rel-18 email discussions

Based on the pre-RAN #95 Rel-18 email discussions the following consensus was reached

- Proposal 1: The general aspects:
  - WI vs SI: WI (study phase can be included for some of objectives if needed)
  - WG leadership: RAN4, [potential secondary WG: RAN2 and/or RAN1]
- Proposal 2: It's proposed to drop following tentative work areas/objectives in Rel-18
  - Objective #3: Enhanced DL receivers for multi-DCI multi-TRP
  - Objective #4: Inter-cell CSI-RS/SSB interference mitigation
  - Objective #5: E-MMSE-IRC under uneven interference
  - Objective #8: Extend MMSE-IRC receiver for inter-cell and intra-cell MU-MIMO to CA case
- The following objectives were kept for further discussion
  - Objective #1: Advanced receiver to cancel inter-user interference for MU-MIMO
  - Objective #2: Soft-IC receiver under SU-MIMO interference
  - Objective #6: BS advanced receiver
  - Objective #7: ATP
  - Objective #9: CRS-IC receiver for NR PDSCH in scenarios with overlapping spectrum for LTE and NR

# Views on Rel-18 NR Demodulation WI scope

Based on the latest e-mail discussion on Rel-18, four topics for UE enhancements and one topic for BS enhancements are considered.

To balance the RAN4 workload and evolve both UE and BS performance, we suggest to consider 1-2 topics for UE enhancements and 1 topic for BS enhancements:

## ❖ UE enhancements

- ❖ Advanced receiver to cancel inter-user interference for MU-MIMO
- ❖ CRS-IC receiver for NR PDSCH in scenarios with overlapping spectrum for LTE and NR

## ❖ BS enhancements

- ❖ BS advanced receiver (MMSE-IRC)

Proposed WI objectives are provided in a New WID RP-220780 (based on RP-220050)

# UE Advanced Receivers

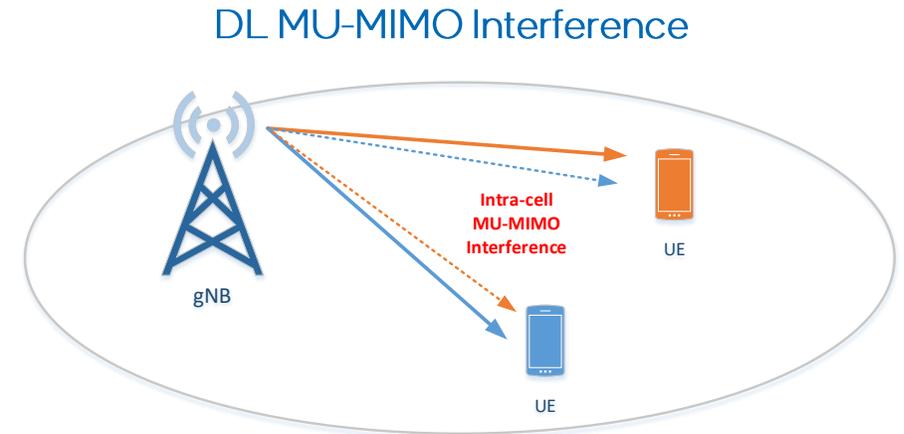
## Enhanced DL MU-MIMO receivers

### Motivation

- Definition of DL MU-MIMO performance requirements is under discussion in Rel-17 Enhanced Perf WI [RP-210920]. A basic MMSE-IRC receiver with serving signal demodulation and DMRS-based interference covariance matrix estimation is prioritized in Rel-17
- In LTE MUST WI several receiver enhancements including E-MMSE-IRC and R-ML were studied and defined to improve the performance for MU-MIMO DMRS-based TMs (MUST Case 3) exploiting the knowledge of co-scheduled UE parameters (presence and modulation)
- Rel-15 NR design guarantees alignment of DMRS parameters and PRG grids across co-scheduled UEs (TS 38.214 5.1.6.2)
- Enhanced receivers like LTE MUST Case 3 can be studied with the goal to further improve the demodulation performance for DL MU-MIMO scenarios
  - Enhanced MMSE-IRC (E-MMSE-IRC) receivers with joint serving & interference signal demodulation
  - R-ML receivers exploiting the knowledge on co-scheduled UE modulation

### Objectives

- Detailed objective from RP-220022 are fine for us. Suggest to remove “Note: Performance requirements shall be specified under single reference receiver assumption” and further discuss the details in RAN4.



# UE Advanced Receivers

## CRS-IC receiver

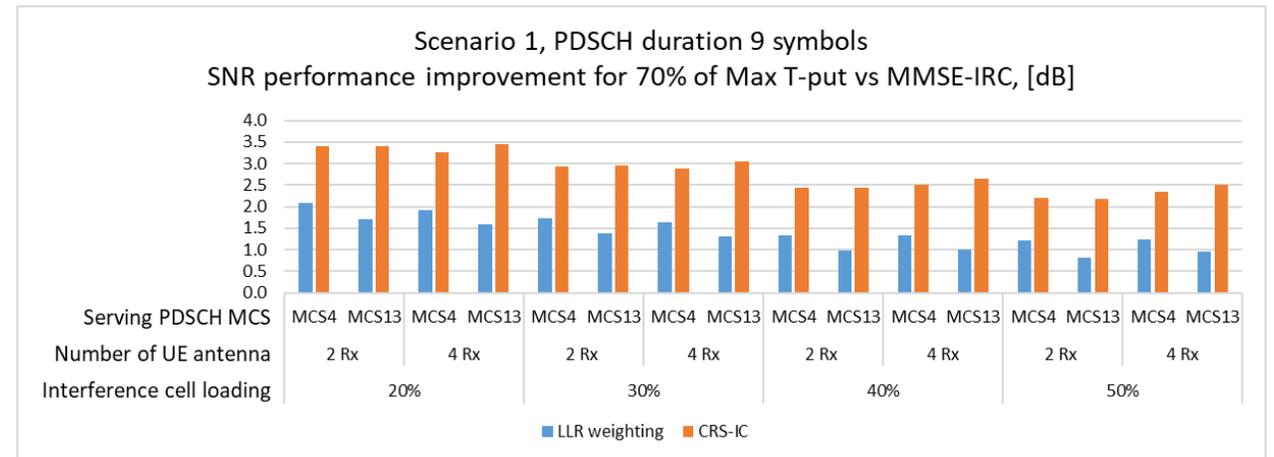
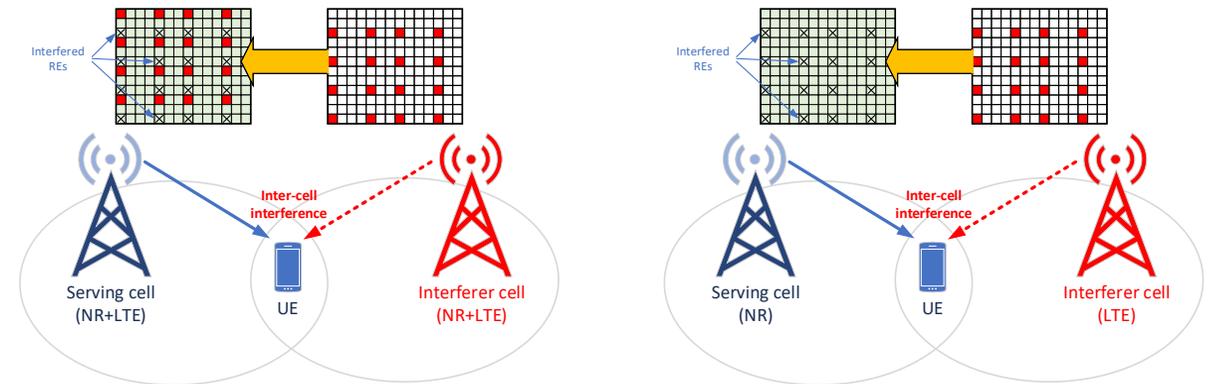
### Motivation

- CRS-IM requirements for scenarios with overlapping spectrum for LTE and NR are under discussion in the Rel-17
- LLR weighting was agreed as baseline algorithm for CRS-IM processing in Rel-17
- CRS-IC provides significant performance improvement (up to 2 dB) in comparison to LLR weighting for various scenarios
- Limited RAN4 workload is expected and most of agreements from Rel-17 discussion on test design and NWA signalling can be reused for Rel-18 discussion

### Objectives

- Tentative objectives from RP-220022 are fine for us

### CRS interference scenarios with overlapping spectrum for LTE and NR



# BS Advanced Receivers

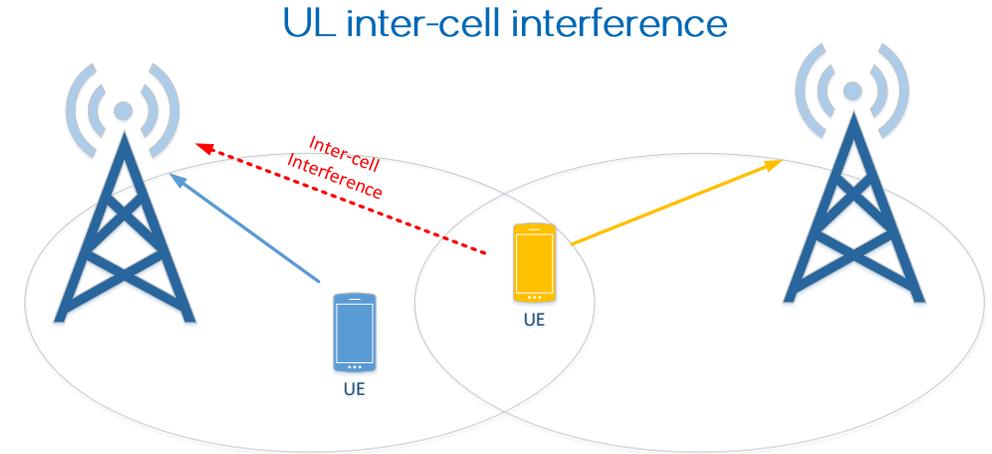
## MMSE-IRC for inter-cell interference

### Motivation

- Existing BS requirements are defined for noise limited conditions and do not allow verification of BS interference rejection capabilities under practical conditions
- Interference-limited conditions are quite typical for 5G deployments and support of MMSE-IRC processing is important to guarantee good performance in the field (see typical LTE profiles on the right)
- In RAN #89e (RP-202092) the definition MMSE-IRC for inter-cell interference was discussed and received a strong support, but was eventually deprioritized

### Objectives

- Support the detailed objectives from RP-220022



Typical UL DIP/INR values  
for 85% DIP CDF based on TR 36.884

	HomoNet		HetNet	
	DIP	INR	DIP	INR
Interf UE1	-1.11	7.29	-0.43	12.38
Interf UE2	-10.91	-2.51	-13.78	-0.97

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