3GPP TSG RAN Rel-19 Workshop
Taipei, June 15-16, 2023

RWS-230224

Initial views on RAN4-led Rel-19 topics

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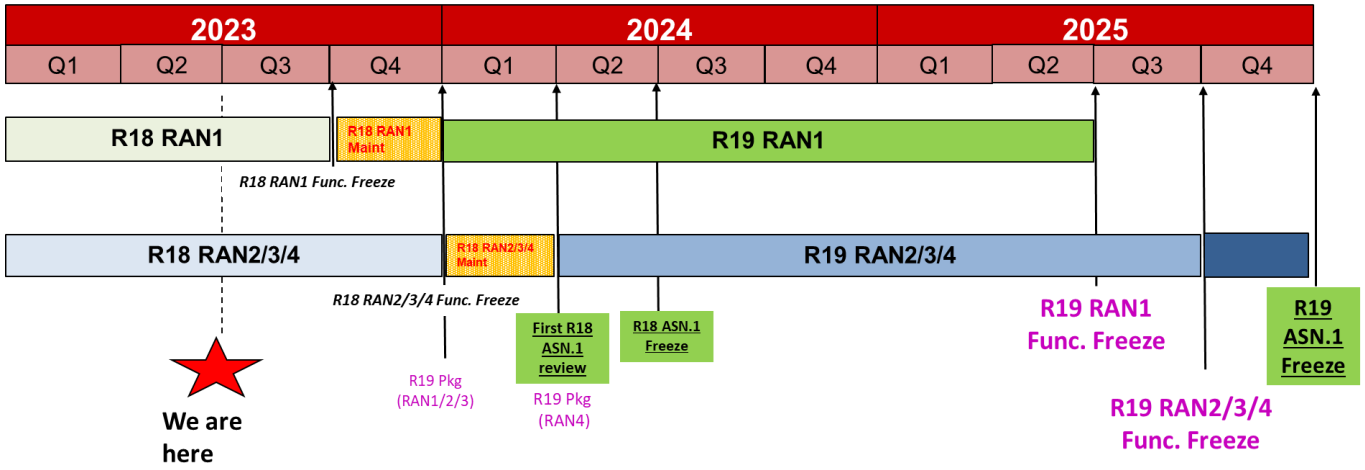
Suggestions on the organization of RAN4-led Rel-19 topics

R19 RAN4 package will be approved in March 2024 RAN#103, which has 3 month shift compared to RAN1/2/3 package.



Endorsed timeline from RP-230050

- Enough TUs shall be reserved for RAN4 led-proposals when approve Rel-19 RAN1/2/3 package：
  - Balance TU budget between RAN4-led WI/SI and RAN4 related objectives of WI/SI led by other WGs;
  - Taking previous release experience, almost half RAN4 TUs can be reserved for RAN4-led topics.
- E-mail discussion over NWM can be considered in 2024 Q1 prior to March 2024 RAN#103：
  - Candidate date 22~26 January 2024 (if January ad-hoc confirm to be cancelled) or 29 January ~ 2 February 2024
  - The discussion can be organized as RF, RRM, Demod, OTA, and cross areas for non-spectrum related proposals.

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Samsung's high priority Rel-19 RAN4-led items

RF area

- HPUE for new scenario

RRM area

- FR2 RRM enhancement

Demod area

- MMSE-IRC receiver for uplink inter-cell interference

Cross area

- Intra-band non-collated CA/EN-DC
- New use cases with AI/ML-assisted advanced receiver (RAN4-led) *(Details refer to slide 7 and 8 in RWS-230210)*

HPUE for new scenario [RAN4]

PC1.5 with 2Tx for TDD intra-band UL NR-CA and TDD-TDD inter-band UL NR-CA

Justification

- Increasing demand to improve UE UL coverage for commercial network deployments.
- Many UEs already have hardware capable of supporting PC2+PC2 TDD+TDD intra/inter UL NR CA.

Higher power capability	Introduced since
PC1.5 for single TDD band	Rel-16
PC1.5 for intra-band EN-DC	Rel-16
PC2 inter-band EN-DC	Rel-16
PC2 for single FDD band	Rel-17
PC2 inter-band UL NR-CA	Rel-17
DL CA with PC1.5 single UL TDD band	Rel-17
Enabling "Increasing UE power high limit " feature to support 27.8dBm for NR-CA and EN-DC	Rel-17
PC1.5 for 2-band inter-band UL NR-CA/EN-DC with 3Tx	Rel-18 under discussion

Roadmap of HPUE in previous release

Potential objectives

- Introduction of PC1.5 for TDD intra-band UL NR-CA
  - Specify the necessary UE RF requirements to support the configuration.
  - Band combinations considered in this WI are n77(2A), n78(2A) and n77C.
- Introduction of PC1.5 for TDD (PC2)-TDD (PC2) inter-band UL NR-CA
  - Specify the necessary UE RF requirements to support the configuration.
  - Band combination considered in this WI is CA_n41A-n77A.

Note: The assumed Tx Chain is 2Tx in total

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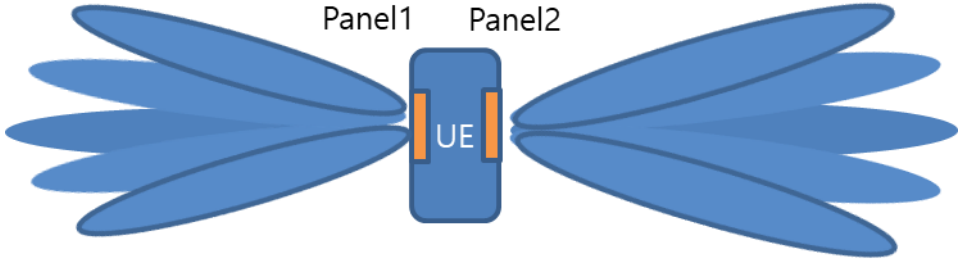
RRM enhancement [RAN4/RAN2]

Justification

- FR2 RRM enhancement:
  - Existing FR2 L3 measurement requirements are specified based on the assumption with Tx/Rx beam sweeping at UE side. The measurement delay in FR2 is much longer than FR1.
  - Rel-18 FR2 Multi-Rx WI only focused on L1 measurement delay reduction for FR2-1 UE with simultaneous DL reception from different directions (AoAs).



Potential objectives

- Study and if identified specify enhanced FR2-1 L3 RRM measurement requirements i.e. [RAN4]
  - Scheduling/measurement restrictions
  - L3 measurement delay
- Study and specify necessary capability signaling [RAN4, RAN2]

Note: Focus on FR2-1 UE which Supports simultaneous reception with different QCL Type-D RSs. (Feature 16-2c)

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MMSE-IRC receiver for uplink [RAN4]

Justification

- In existing NR specification, several advanced receivers are specified on DL side to handle different type of interference

Rel-15	Rel-17	Rel-18
R-ML for inter-stream interference under SU-MIMO	MMSE-IRC for Inter-cell MMSE-IRC for inter-user CRS-IM for CRS interference	Advanced receiver for MU-MIMO

- Existing BS requirements are specified under noise limited condition only.
- Uplink inter-cell interference scenario is typical scenario for FR1 NR deployment.
- MMSE-IRC receiver is already widely implemented by Infra-vendors.
- Requirements need to be introduced to verify receiver performance with proper processing for inter-cell interference suppression .

Potential objectives

- Specify advanced receiver for suppressing uplink inter-cell interference (FR1 only) [RAN4]
  - Define PUSCH demodulation requirements
  - Reference receiver: MMSE-IRC with DMRS based interference covariance estimation
    - Note: use the DMRS for served target UE's PUSCH.
  - Reuse LTE interference profiles as starting point
  - Focus on slot-based transmission and aligned SCS among cells

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Intra-band non-collated CA/EN-DC [RAN4]

General Description

- During Rel-18 Intra-band non-collated CA/EN-DC WI discussion , following potential UE types identified:

UE Type	CC#	antenna / LNA		Mixer	Analog BB	#Rx	NRCA/ ENDC	power imbalance
2	1	2	4 total	2	2	2Rx	NRCA	25dB full range
	2	2		2	2	2Rx	ENDC	
[3a]	1	4 shared		4	4	4Rx	ENDC	6<P≤25dB partial range
	2			2	2	2Rx		
[3b]	1	4 shared		4	4	4Rx	NRCA	6<P≤25dB partial range
	2			4	4	4Rx	ENDC	
[4a]	1	4	6 total	4	4	4Rx	ENDC	25dB full range
	2	2		2	2	2Rx		
[4b]	1	4	8 total	4	4	4Rx	NRCA	25dB full range
	2	4		4	4	4Rx	ENDC	

- Based RAN4#106 conclusion, Rel-18 WI focused on Type 2 UE and Type 3/4 UE suggest to be postponed to future release.

Potential objectives

- Core part [RAN4]
  - Study the feasibility to support non-co-located scenarios for FR1 intra-band non-contiguous NR-CA/EN-DC for 4-layer (Phase I)
  - Note: Rel-18 study can be used as starting point.
  - Pending on feasibility conclusion (Phase II):
    - Specify MRTD and MTTD requirements and other identified RRM requirement impact(s) (if any) in non-collocated deployment
    - Discuss and decide if additional RF requirements required
  - Note: Work is limited to CA/EN-DC for EN-DC/NR-CA for bands 42, n77/n78
- Performance part
  - Specify necessary UE demodulation requirements and RRM test cases

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