3GPP TSG RAN#102
Edinburgh, Scotland, December 11-15, 2023

RP-233147

Overview on RAN4-led Rel-19 topics

Agenda: 9.1.4.1
Source: Samsung
Document for : Discussion and decision

Suggestions on RAN4-led Rel-19 package (1/2)

- Observations for RAN4 impact from Rel-19 RAN-1/2/3 package in RP-232745
  - Big RAN4 impact is foreseen for some of RAN-1/2 led items e.g. Ambient IoT, Air Interface AI/ML, MIMO evo, Duplex Evo, NTN enhancement, Mobility enhancement and Mobility with AI/ML
  - RAN4 early involvement is required for some of RAN-1/2 led items e.g. Ambient IoT, LP-WUS, AI/ML, Duplex Evo and AI/ML (mobility)
  - ~ 12 TUs (6 for RF and 6 for RD) are left for RAN4-led non-spectrum topics from 3Q' 2024 to 3Q' 2025.

- Experience from previous releases for RAN4 workload management
  - Typically UE RF/OTA, BS RF, RRM and demodulation areas are covered by different experts in RAN4 group
  - RAN4 work load on RRM areas are extremely high
    - Much effort waste on the cases with different combinations of parameters and conditions/features which lack of evidence on business/commercial demand
  - RAN4 can't proceed the work to specify RRM and demodulation requirements without sufficient progress in other WGs for RAN-1/2 led items

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Suggestions on RAN4-led Rel-19 package (2/2)

- Proposals
  - To control RAN4 workload, each individual WI/SI shall not exceed 3 items and total number of non-spectrum WIs/SIs shall not exceed Rel-18 (less than 12 items preferred).
    - Focus on essential items which gather wide business demand
    - Balance the work among RF/OTA/RRM/Demod areas
    - RAN4 umbrella WIs on RF/RRM/Demod areas can be maintained if essential items identified
  - Staggered timeline between RAN4 led-WIs/SIs and other WGs led-WIs/SIs can be considered i.e.
    - RAN4-led items can be started and closed earlier.
    - RAN4 only starts the work to specify requirements after RAN-1/2 features are stable enough
  - Rel-19 spectrum related proposals can be considered from June RAN#103 onwards.

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Summary of potential items

Items in Blue are Samsung's high priority items

RF

FR1 RF
- 6Rx/3Tx for handheld UE
- UL coverage enhancement with MPR/A-MPR reduction (Study phase required)

HPUE
- HPUE for CA/DC [RP-233148]
- HPUE fo NTN UE

BS RF
- FFS

RRM

RRM enhancement
- FR2 RRM enhancement (Study phase required) [RP-233149]
- Rel-18 left over

Demod

Demod enhancement
- MMSE-IRC for uplink inter-cell interference [RP-233149]
- FFS for UE side

OTA

MIMO OTA
- Dynamic Channel model (test method only)
- FR1/FR2 new bands

TRP TRS
- Test enhancement for Multi-TX
- FR1 new bands/band combinations

FR2 Test enhancement
- Test method for STxMP (non handheld UE)

Cross areas

FR2 UE enhancement [RP-233150]
- FR2 UE with STxMP for non-handheld UE
- FR2 UE with multi-Rx enhancement

Intra-band NC CA/DC enhancement
- 4 layers

ATG enhancement

Spectrum

Baskets WIs for HPUE, CA, 4Rx bands
Simplification of band combinations SI

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Observations for proposals from RAN#101

- FR1 UE RF and FR2 UE RF

Item	Proposals from companies	General observations	Initial Samsung position
FR1 UE RF	1. Number of Tx, Rx enhancement a) 6Rx for handheld UE with up to 4 layers b) 3Tx for handheld UE c) 4Rx for smartphone below 1GHz 2. Tx switching a) Extend Tx switching to CA b) SRS Antenna switching 3. UL coverage enhancement with MPR/A-MPR reduction 4. NB-IoT operating in NR-NTN guard band or in NR-NTN channel specific RB 5. Other proposal with single proponent a) 1024QAM and 256QAM evolution b) Enhanced TxD with 3Tx c) RF enhancement for Sidelink d) 8Tx for FWA e) New requirement antenna correlation for FR1 multiple Tx	• 6Rx and 3Tx gather widely supporting from operators	• Focus on common interesting items only e.g. 6Rx and 3Tx • Study phase required for item 3. UL coverage enhancement with MPR/A-MPR reduction
FR2 UE RF	1. FR2 UE enhancement a) FR2 UE with STxMP in UL b) Requirements enhancement for FR2 UE with Multi-Rx Chain 2. FR2-1 CA enhancement: a) Intra-band +inter-band CA (DL only) b) Inter-band UL CA c) UL coverage enhancement d) MPR reduction for CA e) Relaxed Tx EVM and non-linear receiver in BS side 3. Other proposal with single proponent a) FR2 MPE mitigation enhancement b) 3Tx with FR2 bands	• No strong request on FR2 UE RF enhancement foreseen except FR2 UE enhancement	• Deprioritize unless strong business demand foreseen • FR2 UE enhancement with STxMP and Multi-Rx have impact on both RF and RRM which can be handled under cross area instead of RF area

Observations for proposals from RAN#101

- HPUE and BS RF

Item	Proposals from companies	General observations	Initial Samsung position

HPUE	1. HPUE for for Single carrier and CA DC with 2Tx/3Tx
	  1. PC1.5 for Intra-band CA
	  • PC2 and PC1.5 HPUE for UL inter-band CA
	  • FDD single band PC1.5
	2. HPUE for NTN and IoT over NTN
	3. HPUE for Redcap
		• HPUE for CA, DC and HPUE for NTN gather widely supporting especially from operators	Supportive for HPUE, detailed scope need to be clarified including target PC

BS RF	1. FR2 Multi-band BS
	2. Proposals with single proponent
	  a) OTA requirements for BS type 1-H
	  b) FR1 MB-BS enhancement
	  c) Femtocell/Home gNB for FR2
		• Item.1 FR2 Multi-band BS WI
		  • Rel-18 SI already concluded at least with single frequency group is feasible in FR2
		• Lack of common interesting for other items
			Positive if clear operators' request received for item.1

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Observations for proposals from RAN#101

- OTA and EMC

Item	Proposals from companies	General observations	Initial Samsung position
FR2 Test enhancement	1. Test method for STxMP 2. Dynamic OTA testing 3. RC test for FR2-1	• Dynamic OTA testing already proposed and dropped in previous release	Supportive for item.1
MIMO OTA	1. Study on dynamic channel model in FR1/dynamic OTA testing 2. OTA requirements on new bands FR1, and FR2 3. Phantom based MIMO OTA test method for FR1	• Phantom test method already discussed in Rel-18 with conclusion not feasible with existing QZ size	• For item 1, study test method only if considered in Rel-19 • Operators' feedback required for new bands
TRP TRS	1. Test method for new UE type XR, NTN UE 2. Optimized test method for TxD, UL-MIMO 3. Requirements for PC 1.5, PC3 RedCap UE, CA 4. MSD OTA test method		• Deprioritize item 4 • Operators' feedback required for new bands
EMC	EMC for Multi-band IAB, repeater, multi-carrier SBFD, ATG BS EMC		Deprioritize if no strong business demand received

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Observations for proposals from RAN#101

- RRM area

Item	Proposals from companies	General observations	Initial Samsung position
Gap enhancement	1. Joint configuration NCSG+ Pre-MG 2. Gap capability 3. Enhanced collision handling for concurrent MG 4. NSCG enhancement a) Preconfigured NSCG b) Parallel measurement with NCSG c) NCSG enh for deactivated Scell	• Companies' proposals quite diverge • No clear operators' request and common business demand foreseen	Deprioritize unless clear strong business demand received
RRM enhancement	1. FR2 RRM requirements enhancement 2. R18 left over a) Enhancement TCI switching b) HO with Pscell for new scenario c) Scell, PSCell activation enhancement d) Relaxed RRM for non RedCap UE e) SRS interruption enhancement f) L1/L2 mobility enhancement 3. AI/ML based RRM enhancement a) Rx beam sweeping b) RRM measurement 4. mTRP operations with RTD>CP 5. Proposals with single company a) Redcap RRM enhancement , RACH-less handover b) Requirement for 1Rx NTN c) eDRX from LTE to NR d) Further enhanced Early Measurement Reporting (FeEMR) e) L3 CSI-RS, Inter-cell L1 enhancement measurement enhancement	• Companies' proposals quite diverge • No clear operators' request and business demand foreseen except item 1, • Item 1. FR2 RRM requirements enhancement gather widely support • Item 3. AI/ML based RRM enhancement seems potential new areas for RAN4 lead AI/ML new use cases	• Supportive for item 1 • Deprioritize other items unless strong business demand received

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Observations for proposals from RAN#101

- Demod area

Item	Proposals from companies	General observations	Initial Samsung position
BS Demod	1. MMSE-IRC for uplink	• Uplink interference more server than LTE due to HPUE, CLI	• Supportive for MMSE-IRC considering the benefits to handle cross link interference
UE Demod	1. Soft-IC for SU-MIMO 2. ATP enhancement a) 4 layers b) OLLA 3. Proposal with single propoent a) CRI reporting b) Demod for MU-MIMO with Rel-18 DMRS, Demod for PDSCH FDM'd with PDCCH c) CQI for R-ML d) CRS-IM for RedCap UE with 1Rx e) Spatial component to fading channel, CSI for precoded MU-MIMO	• No much input from companies especially from operators • Item 2 ATP with OLLA already discussed in previous release, no conclusion on that. • Item 3.3 spatial component already discussed in previous release, test feasibility and test cost was major concern.	• Deprioritize if no clear business demand

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Observations for proposals from RAN#101

- Cross area

Item	Proposals from companies	General observations	Initial Samsung position
Less than 5MHz enhancement	1. CA/DC Handover reliability (Tunnel scenario and 500km/h) 2. HPUE	• Not clear the impact with HPUE to support less than 5MHz CHBW	Neutral or positive if business demand foreseen for CA/DC
FR2 Multi-Rx UE Enhancement	1. CA 2. FR2 RRM enhancement		Supportive，FR2 UE enhancement can be merged together as single WI
FR2 UE with STxMP(non-handheld UE)	1. RF：Power related requirements(EIRP and new spherical requirement); BC; MPE 2. RRM: UL TCI, scheduling restriction 3. Demod: Uplink demod with STxMP		Supportive as R18 MIMO leftover，FR2 UE enhancement can be merged together as single WI
ATG enhancement	1. CA 2. FR2		Neutral or positive if business demand foreseen
Intra-band non-collocated EN-DC/NR-CA Enhancement	4 layer （case 3、case 4）	• Special request from Korea and Japanese operators with non-collocated deployment scenario	Supportive
Irregular channel bandwidth	1. Solution to address irregular channel bandwidth	• Previous SI already concluded possible solutions to support irregular channel BW	Neutral or deprioritize

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Observations for proposals from RAN#101

- Spectrum

Item	Proposals from companies	General observations and business intelligence	Samsung position
NTN Ku band	New demands for NTN NR at Ku band. [DL:10.7–12.75 GHz; UL 12.75–13.25 GHz & 13.75–14.5 GHz]	• This item may have cross WGs impact i.e. RAN1/RAN2 • Additional co-existence study required	FFS
Further simplification of band combination SI			Supportive

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