3GPP TSG RAN#101
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Views on Rel-19 RAN4 topics

Xiaomi

Candidate Rel-19 RAN4 Topics

RAN4 UE RF

- **UE RF FR1**
  - High power UE
    - PC1.5 for intra-band CA
    - PC1.5 for inter-band CA
  - 6Rx for UE on high bands
- **UE RF FR2**
  - Inter-band CA enhancements in FR2-1
  - Inter-band CA enhancements in FR2-2
  - Inter-band CA between FR2-1 and FR2-2 based on CBM/IBM
- **NTN high power UE**
  - Specify RF requirements to support UE PC2 (+26dBm) for handheld UE
  - Investigate the feasibility to support PC1.5 (+29dBm) for handheld UE
- **Multi-Tx chain (STxMP)**
  - RF requirements
  - TX switching from different schemes of STxMP
  - PC3 is prioritized

RAN4 RRM

- **Measurement Gap Evolution**
  - Joint configuration of gap features
  - Parallel measurement upon gap occasions collision
  - Pre-configured NCSG
- **RRM requirement Evolution**
  - TCI state switching delay enhancement
  - Reduced FR2 delay requirements for L3 measurements
  - L1 measurement with Type-2 MG/NCSG/NeedforGap
- **Enhancement of Multi-RX in FR2**
  - Unified TCI state switch for Multi-RX
  - Enhancement on delay reduction for L1/L3 measurement
  - Enhancement on scheduling/measurement restriction relaxation
  - RRM requirement to improve Multi-RX performance, e.g. TRP specific CBD enhancement, GBBR reporting
  - RRM requirement when RTP>CP

Test

- **MIMO OTA**
  - FR1
    - New bands requirements
    - Phantom based MIMO OTA test method
    - UL MIMO with new test method and new FoM
  - FR2
    - Consider more FR2-1 bands
    - Study new bands covering FR2-2

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FR1 RF Evolution – High Power UE

Motivation

- Increasing the transmit power of UE has significant benefits on extending cell coverage area and improving the experience of cell edge users. The potential PC1.5 could be considered for intra-band CA and inter-band CA
- 6Rx for UE had been discussed as one of candidates for Rel-18 scope, it could be studied in R19.

Objectives

- High power UE related issue
  - PC1.5 for TDD intra-band CA
    - Specify the necessary RF requirements, e.g. MOP, MPR, A-MPR, ACLR .etc.
    - Example band combinations could be n77C/n78C, n77(2A)/n78(2A)
  - PC1.5 for TDD inter-band CA with 2Tx
    - Specify the SAR solution
    - Specify the necessary UE RF requirements for PC2+PC2, e.g. MOP, MSD if needed. etc
    - Example band combination could be n41+n79

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FR1 RF Evolution – 6Rx UE

Motivation

- 8Rx for non-handheld UE has been introduced from Rel-18.
- 6Rx for UE had been discussed as one of candidates for Rel-18 scope, it could be studied in R19.

Objectives

- Investigate the feasibility to support 6Rx for handheld UE on high bands
- Study and specify the necessary Rx requirements, e.g. ΔRIB,6R
- Study and specify the requirements to support SRS antenna switching
- Example bands can be n79/n77/n78

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FR2 RF Evolution

Motivation

- CA
  - The inter-band UL/DL CA has been introduced from R17. However, due to limited timeline, there are some restrictions: i.e. only FR2-1 band is involved and only based on IBM. To ensure the flexibility of inter-band UL/DL CA applications, the Tx and Rx RF requirements of inter-band UL/DL CA should be researched and defined based on CBM.
  - The requirements of FR2-2 for singe carrier and intra-band contiguous DL CA in unlicensed operation have been defined in R-17. To ensure the flexibility of intra-band CA applications, the RF requirements of intra-band contiguous UL CA and intra-band non-contiguous UL/DL CA should be researched and defined.
- Others
  - The remaining issue from R18

Objectives

- CA
  - Inter-band CA enhancements in FR2-1
    - Research and define the Tx and Rx RF requirements for inter-band UL/DL CA based on CBM in FR2-1
      - The example band combination could be limited to 28GHz + 28GHz and/or 39GHz + 39GHz
    - Research and define the Tx and Rx RF requirements for inter-band and intra-band UL/DL CA/DC enhancement in FR2-1
      - The example band combination could reuse the defined band combinations for inter-band CA based on IBM
  - Inter-band CA enhancements in FR2-2
    - Research and define the Tx RF requirements for intra-band contiguous UL CA enhancement in FR2-2.
    - Research and define the Tx and Rx RF requirements for intra-band non-contiguous UL/DL CA enhancement in FR2-2
  - Inter-band CA between FR2-1 and FR2-2 based on CBM/IBM
    - Define the Tx and Rx RF requirements for support of UL/DL CA/DC between FR2-1 and FR2-2 based on CBM/IBM
      - The example band combinations based on operator's demand
- Other remaining objectives from R18 if needed

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NTN high power UE

Motivation

- The UE power class for all the existing NTN FR1 bands is limited to PC3 (+23dBm)
- High power UE for FDD bands have already been introduced from R17.
- Higher power classes are quite essential for the FR1 NTN bands to improve UL coverage, availability ad throughput performance.

Objectives

- Specify RF requirements to support UE power class 2 (+26dBm) for handheld UE
  - Specify the necessary requirements to support PC2, e.g. MOP, A-MPR, reference. etc
- Investigate the feasibility to support Power class 1.5 (+29dBm) for handheld UE
  - Specify the necessary requirements to support PC1.5, e.g. MOP, A-MPR, reference. etc

NOTE: above new NTN UE power classes are applicable to all the existing NTN FR1 bands

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Multi-Tx chain (STxMP)

Motivation

- During the Rel-18, the multi-RX chain WID was approved to consider the UE with multi-RX chain capability RF/RRM/Demod requirements as well as the test method enhancement.
- The STxMP topic is under discussion in RAN1 and RAN4 in Rel-18 with the following agreement:
  - Support STxMP PUSCH+PUSCH transmission in multi-DCI based system in Rel-18.
  - Support SFN-based transmission scheme for STxMP PUSCH transmission in single-DCI based mTRP system in Rel-18.
  - RAN4 discussed the issues for Pcmax/Pumax for STxMP in Rel-18, but related RF requirements don't define in Rel-18.

Objectives

- Introduce necessary requirement(s) for enhanced UEs with STxMP with up to 4 layer UL MIMO
  - Specify RF requirements, mainly the power requirement and the MPR requirement.
  - TX switching from different schemes of STxMP
  - PC3 will be prioritized, other power classes should be considered after the PC3 requirements framework is finalized

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Measurement Gap Evolution

- Pre-configured NCSG
  - **Motivation:** In Rel18 WI, the joint discussion among pre-configured MG and NCSG was precluded. But some scenarios below in which the disadvantages of non pre-configured NCSG was identified.
    - When SCell measured was being deactivated, UE receiving DL scheduled data could be outraged because of the processing on RRCReconfiguration to release associated NCSG.
    - Additionally, when SCell measured was being switched from deactivated to activated, UE may not perform the measurements on the SSBs on the deactivated SCell before UE complete RRCReconfiguration for the new NCSG or MG.
  - Objectives
    - The mechanism to configure Pre-configured NCSG
    - The activation/deactivation procedure for Pre-configured NCSG
    - UE capability to support Pre-configured NCSG
- Parallel measurements with NCSG
  - **Motivation:** In case of concurrent MGs in which one of NCSG was configured, the parallel measurements on the multiple collided concurrent gaps are feasible if UE has more than one vacant RF chain(s). This can improve both NW and UE's efficiency significantly.
  - Objectives
    - The necessary requirements for the parallel measurements with NCSG and other measurement gaps
- Interworks among NTN/MUSIM/PreMG/Concurrent gaps
  - **Motivation:** In Rel19, the joint operations with the multiple advanced gap aspects after Rel17 (e.g. Pre-configured, concurrent gaps, and NTN) are desired. But in Rel18, due to lack of time, these issues were postponed.
  - Objectives
    - The requirements for inter-works among NTN/MUSIM/Pre-MG/Concurrent gap.

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RRM Requirement Evolution

Motivation

- In legacy TCI state switching requirements, the time gap of first available SSB has impact on the throughput, therefore, it is necessary to enhance on delay reduction for TCI state switching.
- In Rel-18, the mechanism of delay reduction has been specified in topic of FR2 unknown SCell activation, and, the FR2 measurement delay reduction is another important aspect to improve the FR2 utilization experience in real.
- In Rel-18, L1 inter-frequency measurement with type1 gap has been supported in LTM, in order to improve the LTM mobility performance, it is beneficial to introduce L1 measurement with type2 gap/NCSG/NeedforGap.

Objectives

- Specify the enhanced requirement for active TCI state switching
- Specify the reduced FR2 delay requirements for L3 measurements, e.g. UE Rx scaling factor reduction.
- Support L1 measurement with Type-2 MG/NCSG/NeedforGap in LTM

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Enhancement of Multi-RX in FR2

Motivation

- Rel-15/16/17 leftover, basic requirement and limited enhancement is defined for intra-cell mTRP with RTD<CP, e.g.
  - Delay reduction for L1 measurement based on UE capability
  - Scheduling/measurement restriction relaxation in limited scenarios
  - Rel-15/16 based dual TCI activation requirement
- Data+RS, RS+RS based on Multi-RX can be extend to more scenarios in Rel-19.

Objectives

- Unified TCI state switch for Multi-RX
- Enhancement on delay reduction for L1/L3 measurement
- Enhancement on scheduling/measurement restriction relaxation, e.g. L3 measurement, Data+RS or RS+RS with dual TCI states not reported in GBBR
- RRM requirement to improve Multi-RX performance, e.g. TRP specific CBD enhancement, GBBR reporting
- RRM requirement when RTP>CP

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MIMO OTA potential enhancement

Motivation

- The MIMO OTA WID of Rel-18 is on-going and mainly focus on the FR2 performance requirement definition with hybrid method including simulation and measurement method.
- The FR1 MIMO OTA enhancement to reflect the UE UL MIMO throughput has not been considered yet while the UL enhancement with higher throughput and better UL coverage is under discussion in Rel-18 WID.
- The FR2-2 test methods have been discussed in the Rel-17 SID of FR2 test method enhancement while the MIMO OTA test method is not covered.

Objectives

- FR1 MIMO OTA enhancement
  - New bands requirements
  - Phantom based MIMO OTA test method
  - UL MIMO with new test method and new FoM can be studied
    - Study on dynamic channel model
- FR2 MIMO OTA enhancement
  - New bands covering FR2-2 can be studied
    - Potential new test method/enhancement
- More FR2-1 bands to be considered with agreed framework

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Thanks！