3GPP TSG RAN Rel-19 workshop RWS-230269

Taipei, June 15 - 16, 2023

# Multi-carrier Evolution in Rel-19

Agenda Item: 5

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# Background - 1

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## Multi-carrier technologies in NR

**Carrier Aggregation: The most essential functionality for LTE-A and NR**

- Achieving higher throughput
  - FDD-FDD, TDD-TDD, TDD-FDD
- Avoiding degradation in cell edge by inter-site CA

**Dual Connectivity: Used to aggerate two carriers which have different characteristics**

- E-UTRA – NR
- FR1 – FR2
- Inter-vendor
- At maximum 2 legs

## Example of issues

**Differentiation from LTE is brought by "add-on" functionalities external to legacy CA framework**

- e.g. UL switching/SUL

**CA functionality is one of the biggest contributor to make the RAN1/2 specification complicated**

- e.g. CA with different SCS carrier, collision handling

**Complicated RAN4 specs**

- DL: Large amount of band combinations
- UL: Combination of CA, MIMO, power class and Tx switching/SUL

**Multi-carrier functionalities are the most important technology in NR**
**Clear evolution in the next generation is required!**



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# Background - 2

**Our observation 1 (for RAN1 and 2):**
The complication in 5G was caused because single carrier operation is the baseline for NR

⇨ **Multi-carrier native system design may be beneficial to achieve clear distinction**

**Our observation 2 (for RAN4):**
The complication in NR spec is caused because RAN4 had no common understanding on the UE architecture

⇨ **RAN4 should spend more time to discuss the baseline (and simplification) discussion before the 6G discussion starts**

**Study on the fundamental design of multi-carrier operation is important in Rel-19 for the successful 6G standardization**



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# Example area for improvements

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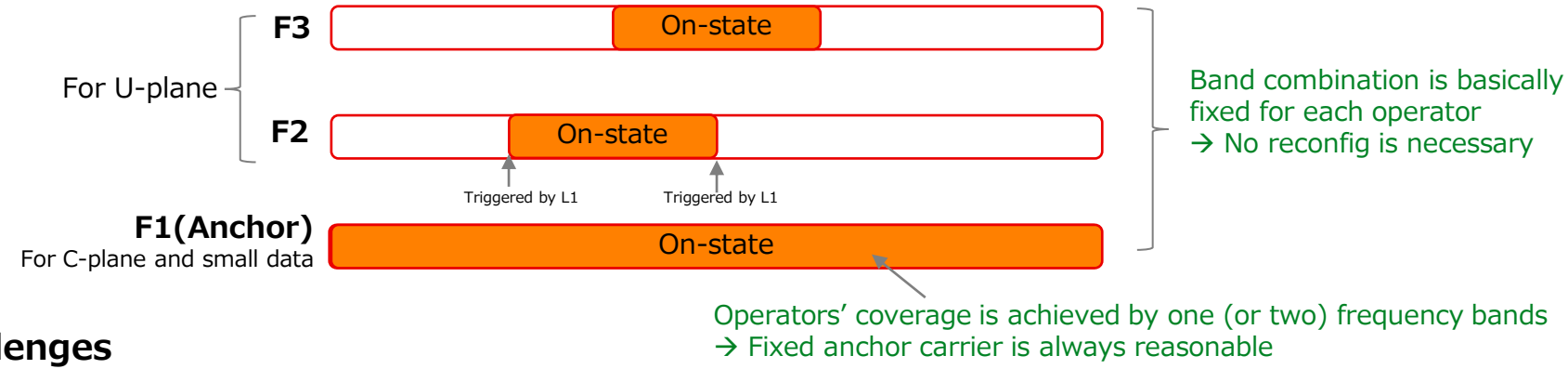
**Example of 4G/5G functionalities caused by single carrier native design**

- IDLE/Connected mode load balancing
- Use of additional carriers based on RRC-reconfiguration

**Example of design goal for next generation multi-carrier system**

- Subsequent CA (i.e. do not require RRC reconfiguration for CA)
- Introduction of C-plane specific anchor carrier




**Challenges**

- UE power consumption
- Support of lower-tier UEs (i.e. for IoT)



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# Potential area for Rel-19 SI

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- **Study the drawbacks/problems of NR multicarrier functionalities, and develop a simplified multicarrier operation (RAN2, RAN1)**
  - The goal is to develop a mechanism where <u>multiple carrier is a default operation</u>
  - Consider at least the following aspects
    - Solution to completely avoid idle/inactive/connected mode load balancing among carriers, e.g.
      - by introducing C-plane only carrier and C-plane less carrier
    - Solution of easy & fast use of multi-carriers by, e.g.
      - configuring multiple carriers more than UE capability, and control the on-off state of the carrier(s) by DCI
    - Potential drawbacks when multi-carrier operation is a default operation mode, e.g.
      - UE power consumption
      - Support of lower-tier UEs

- **Study UE architecture for multicarrier-native operation in next generation (RAN4)**
  - The goal is to simplify the future RAN4 discussions by having a common understanding on the UE architecture



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# Thank you

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