**3GPP TSG RAN Meeting #89-e Draft RP-201531**

**Electronic meeting, September 14 – 18, 2020**

**Agenda Item:**  **9.2.9**

**Source: Ericsson**

**Title:** **Summary of WI** **on Multi-RAT Dual-Connectivity and Carrier Aggregation enhancements (LTE, NR)**

**WI code(s): LTE\_NR\_DC\_CA\_enh**

**leading WG: RAN2**

**Release: Rel-16**

### 1 Introduction

The LTE and NR Work Item [1] introduces enhancements to Multi-RAT Dual Connectivity (MR-DC) and Carrier Aggregation (CA) operation, mainly focusing on reducing setup delays and improving robustness and deployment flexibility. This is addressed by introducing idle/inactive measurements for DC/CA, allowing SCG/SCell configuration during transition from idle/inactive state, introducing dormant SCell in NR, introducing fast recovery from MCG link failure, introducing support for asynchronous NR-DC operation and cross carrier scheduling with different numerologies. Changes triggered by the work item are captured into TS 36-, 37- and 38-series specifications in [2]-[30].

### 2 Description

The key functionalities introduced in this work item include the following:

* **Support for asynchronous NR-DC**: Allowing non-co-located deployments by relaxing synchronization requirements for gNBs involved in NR-DC operation. Both semi-static and dynamic uplink power control is supported for deployments with bands of the same frequency range in MCG and SCG.
* **Idle/inactive measurement reporting:** Allowing the eNB to assign UE to do measurements during IDLE or INACTIVE that the network can use for when the UE enters CONNECTED mode.
  + This may include limitations on which cells are measured, how long the measurements are done and in which cells the measurements are applicable.
  + UE can indicate the availability of the measurements at connection setup or resume, and network can decide whether to query them via RRC reporting.
* **Direct SCG/SCell configuration:** Allowing the network to configure the UE to store the SCG/SCell configuration upon transition to INACTIVE state, so that it can be quickly restored upon transition back to CONNECTED, thus minimizing signaling overhead and latency.
* **Dormant NR SCell:** SCell dormancy is introduced for NR. UE stops monitoring PDCCH on the dormant SCell, but continues performing RRM/CSI measurements, AGC and beam management, if configured.
  + Switching between dormant and normal operation is network controlled and reuses the existing Bandwidth Part (BWP) framework of NR. One dormant BWP can be configured for an SCell. DCI is used to control entering/leaving the dormant BWP.
  + The SpCell and PUCCH SCell cannot be configured with a dormant BWP.
* **Fast MCG link recovery:** Support fast recovery from MCG link failure by allowing the UE in MR-DC to send an MCG Failure Information message to the MN via the SCG upon the detection of a radio link failure on the MCG. Based on measurement information received in MCG Failure Information message the network can then determine the correct action to restore the MCG connection, e.g. change of PCell.
  + Fast MCG link recovery requires that both UE and network support the feature, and that the UE is configured with either split SRB or SCG SRB.
  + The UE initiates the RRC connection re-establishment procedure if it does not receive a reconfiguration message from the network within a certain time after fast MCG link recovery was initiated.
* **Cross-carrier scheduling with different numerologies:** Support for cross carrier scheduling in carrier aggregation, with different numerology on the scheduling and scheduled carriers.
* **CA with unaligned frame boundary**: Support for NR inter-band carrier aggregation with slot alignment, but with unaligned frame boundary and partial SFN alignment.
* **Enhancements to single Tx switched uplink for EN-DC:** Various improvements introduced for using the reference TDD pattern, e.g. support is added for LTE TDD PCell and for dual-Tx UL with harmonic interference issue. LTE PRACH operation is not restricted by the reference TDD pattern.
* **Aperiodic CSI-RS triggering with different numerologies:** Support for triggering Aperiodic CSI-RS with different numerology between CSI-RS and triggering PDCCH is introduced.
* **Minimum requirements for NR-DC:** RF requirements for both synchronous and asynchronous operations.

### 3 References

[1] RP-200791, Revised WID on DC and CA enhancements, Ericsson, RAN#88e

[2] R2-2002395, Introduction of CA/DC enhancements to 37.340, vivo, Ericsson, RAN2#110e

[3] R2-2002411, CR for 36.300 for CA&DC enh, Ericsson, RAN2#109e

[4] R2-2002412, CR for 38.300 for CA/DC enhancements, Ericsson, RAN2#109e

[5] R2-2002382, Introduction of dormant BWP operation and Async CA, Oppo, RAN2#109e

[6] R2-2002391, CR for 38.331 for CA&DC enh, Ericsson, RAN2#109e

[7] R2-2002392, CR for 36.331 for CA&DC enh, Ericsson, RAN2#109e

[8] R3-197779, CR for TS 36.423, Resuming SCG in RRC Resume, Ericsson, RAN3#106

[9] R3-197781, CR for TS 36.423, Fast MCG link recovery via SRB3, Huawei, RAN3#106

[10] R3-197743, CR for TS 38.401, Support of SN Resume during the RRCResume procedure, Huawei, China Telecom, RAN3#106

[11] R3-197600, CR for TS 38.423, Resuming SCG in RRC Resume, Ericsson, RAN3#106

[12] R3-197782, CR for TS 38.423, Fast MCG link Recovery with SRB3, Huawei, RAN3#106

[13] R3-197845, CR for TS 38.473, CR for TS38.473 on supporting SN Resume during the RRCResume procedure, China Telecom, Huawei, RAN3#106

[14] R4-2002237, CR for 38.133 on Direct SCell activation, Huawei, RAN4#94e

[15] R4-2008605, CR for 38.133 on Direct SCell activation, Ericsson, RAN4#95e

[16] R4-2007836, CR for 38.133 on Direct SCell activation, Huawei, RAN4#95e

[17] R4-2007837, CR for 36.133 on Direct SCell activation, Huawei, RAN4#95e

[18] R4-2007782, CR for 38.133 on Direct SCell activation, Ericsson, RAN4#95e

[19] R4-2006063, CR for 38.133 on Direct SCell activation, ZTE, RAN4#95e

[20] R4-2008608, CR for 38.133 on SCell dormancy, Huawei, RAN4#95e

[21] R4-2008609, CR for 38.133 on SCell dormancy, Huawei, RAN4#95e

[22] R4-2012115, CR for 38.133 on Direct SCell activation, Ericsson, RAN4#96e

[23] R4-2011151, CR for 36.133 on Direct SCell activation, Huawei, RAN4#96e

[24] R4-2012116, CR for 38.133 on Direct SCell activation, RAN4#96e

[25] R4-2010703, CR for 38.133 on SCell dormancy, Oppo, RAN4#96e

[26] R4-2012275, CR for 38.133 on SCell dormancy, Ericsson, RAN4#96e

[27] R4-2012276, CR for 38.133 on SCell dormancy, Huawei, RAN4#96e

[28] R4-2012277, CR for 36.133 on SCell dormancy, Huawei, RAN4#96e

[29] R4-2006997, CR for 38.101-1 on Introduction of NR DC, ZTE Corporation, Ericsson, RAN4#95e

[30] R4-2007799 CR to 38.101-1 on Introduction of requirements for NR-DC, Ericsson, RAN4#95e