**3GPP TSG-RAN WG2 Meeting #109 electronic R2-20xxx**

24th Feb – 6th Mar 2020

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **37.340** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **16.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Correction of TS 37.340 on the support of MR-DC for IAB | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IAB Core | | | | |  | ***Date:*** | | | 2020-02-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | RAN2 and RAN3 have made the following agreements on the support of MR-DC for IAB.  **Agreements in RAN2#105bis meeting:**   * *R2 assumes that the NR DC framework (e.g. MCG SCG related procedures) is used to configure dual radio links used as IAB bh links with two parent nodes.*   **Agreements in RAN2#106 meeting:**   * *In NR-DC framework for IAB nodes PDCP is not supported for BH RLC channels, so any PDCP related functions like “split bearer” is not supported. For routing etc BAP is used.* * *In Rel-16, the d’ option is supported.* * *For IAB node using EN-DC, from BAP and backhaul RLC channels point of view, this is a single link deployment (BAP route only by NR link).*   **Agreements in RAN2#107 meeting:**   * *Also the d’ can be supported by DC, by assigning the roles of MN and SN to the IAB nodes serving the outer leaf access IAB node.*   **Agreements in RAN2#108 meeting:**   * *SRB2 is used for transport of all F1AP messages in EN-DC.* * *Extend LTE DL Information Transfer and UL Information Transfer RRC procedures for F1AP transport since they already use SRB2.* * *Container that carries F1AP message is carried directly in LTE RRC, i.e. there is no additional NR RRC container, assumes protocol stack of “option 1b”.*   Those IAB specific features should be captured in the TS 37.340 for the MR-DC scenarios. | | | | | | | | |
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| ***Summary of change:*** | | In section 4.1.1, add the IAB specific general description supported in MR-DC;  In section 6.X, add BAP specific description suppported in MR-DC;  In section 7.1, clarify the system informiaton handling for IAB;  In section 7.X, add the support of F1-AP over LTE.  **Impact analysis**  Impacted 5G architecture options: EN-DC, NR-DC  Impacted functionality:  Stage 2  Inter-operability:   1. If the UE is implemented according to this CR but the network is not, there is no inter-operability issue foreseen. 2. If the network is implemented according to this CR but the UE is not, there is no inter-operability issue foreseen. | | | | | | | | |
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| ***Consequences if not approved:*** | | IAB is not supported in the MR-DC scenario. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 3, 4.1.1, 6.X, 7.1, 7.X | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

**------------------------------------------------1st Change -----------------------------------------------------**

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[3] 3GPP TS 38.300: "NR; NR and NG-RAN Overall description; Stage 2".

[4] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[5] 3GPP TS 38.423: "NG-RAN; Xn application protocol (XnAP)".

[6] 3GPP TS 38.425: "NG-RAN; NR user plane protocol".

[7] 3GPP TS 38.401: "NG-RAN; Architecture description".

[8] 3GPP TS 38.133: "NG-RAN; Requirements for support of radio resource management".

[9] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[10] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[11] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[12] 3GPP TS 38.101-1: "User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[13] 3GPP TS 38.101-2: "User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[14] 3GPP TS 38.101-3: "User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[15] 3GPP TS 36.323: "Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) specification".

[16] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

[Xy] 3GPP TS 38.340: “Backhaul Adaptation Protocol (BAP) specification”.

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] and TS 36.300 [2].

**Child node**: IAB-node-DU’s next hop neighbour node; the child node is also an IAB-node.

**En-gNB:** node providing NR user plane and control plane protocol terminations towards the UE, and acting as Secondary Node in EN-DC.

**IAB-donor:** gNB that provides network access to UEs via a network of backhaul and access links.

**IAB-MT:** IAB-node function that terminates the Uu interface to the parent node using the procedures and behaviours specified for UEs unless stated otherwise.

**IAB-node:** RAN node that supports NR access links to UEs and NR backhaul links to parent nodes and child nodes. The IAB-node does not support backhauling via LTE.

**Master Cell Group**: in MR-DC, a group of serving cells associated with the Master Node, comprising of the SpCell (PCell) and optionally one or more SCells.

**Master node**: in MR-DC, the radio access node that provides the control plane connection to the core network. It may be a Master eNB (in EN-DC), a Master ng-eNB (in NGEN-DC) or a Master gNB (in NR-DC and NE-DC).

**MCG bearer**: in MR-DC, a radio bearer with an RLC bearer (or two RLC bearers, in case of CA packet duplication) only in the MCG.

**MN terminated bearer:** in MR-DC, a radio bearer for which PDCP is located in the MN.

**MCG SRB**: in MR-DC, a direct SRB between the MN and the UE.

**Multi-Radio Dual Connectivity:** Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes.

**Ng-eNB**: as defined in TS 38.300 [3].

**Parent node:** IAB-node-MT’s next hop neighbour node; the parent node can be IAB-node or IAB-donor-DU.

**PCell**: SpCell of a master cell group.

**PSCell**: SpCell of a secondary cell group.

**RLC bearer:** RLC and MAC logical channel configuration of a radio bearer in one cell group.

**Secondary Cell Group**: in MR-DC, a group of serving cells associated with the Secondary Node, comprising of the SpCell (PSCell) and optionally one or more SCells.

**Secondary node**: in MR-DC, the radio access node, with no control plane connection to the core network, providing additional resources to the UE. It may be an en-gNB (in EN-DC), a Secondary ng-eNB (in NE-DC) or a Secondary gNB (in NR-DC and NGEN-DC).

**SCG bearer**: in MR-DC, a radio bearer with an RLC bearer (or two RLC bearers, in case of CA packet duplication) only in the SCG.

**SN terminated bearer:** in MR-DC, a radio bearer for which PDCP is located in the SN.

**SpCell**: primary cell of a master or secondary cell group.

**SRB3**: in EN-DC, NGEN-DC and NR-DC, a direct SRB between the SN and the UE.

**Split bearer:** in MR-DC, a radio bearer with RLC bearers both in MCG and SCG.

**Split PDU Session (or PDU Session split):** a PDU Session whose QoS Flows are served by more than one SDAP entities in the NG-RAN.

**Split SRB**: in MR-DC, a SRB between the MN and the UE with RLC bearers both in MCG and SCG.

**User plane resource configuration:** in MR-DC with 5GC, encompasses radio network resources and radio access resources related to either one or more PDU sessions, one or more QoS flows, one or more DRBs, or any combination thereof.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 36.300 [2].

DC Intra-E-UTRA Dual Connectivity

EN-DC E-UTRA-NR Dual Connectivity

IAB Integrated Access and Backhaul

MCG Master Cell Group

MN Master Node

MR-DC Multi-Radio Dual Connectivity

NE-DC NR-E-UTRA Dual Connectivity

NGEN-DC NG-RAN E-UTRA-NR Dual Connectivity

NR-DC NR-NR Dual Connectivity

SCG Secondary Cell Group

SMTC SS/PBCH block Measurement Timing Configuration

SN Secondary Node

# 4 Multi-Radio Dual Connectivity

## 4.1 General

### 4.1.1 Common MR-DC principles

Multi-Radio Dual Connectivity (MR-DC) is a generalization of the Intra-E-UTRA Dual Connectivity (DC) described in TS 36.300 [2], where a multiple Rx/Tx capable UE may be configured to utilise resources provided by two different nodes connected via non-ideal backhaul, one providing NR access and the other one providing either E-UTRA or NR access. One node acts as the MN and the other as the SN. The MN and SN are connected via a network interface and at least the MN is connected to the core network.

All functions specified for a UE are equally applicable for an IAB-MT unless otherwise stated. Similar as specified for UE, the IAB-MT can access the network using either one network node or using two different nodes with EN-DC and NR-DC architectures. In EN-DC, the backhauling traffic over the E-UTRA radio interface is not supported.

NOTE 1: MR-DC is designed based on the assumption of non-ideal backhaul between the different nodes but can also be used in case of ideal backhaul.

NOTE 2: All MR-DC normative text and procedures in this version of the specification show the aggregated node case. The details about non-aggregated node for MR-DC operation are described in TS 38.401 [7].

### 4.1.2 MR-DC with the EPC

E-UTRAN supports MR-DC via E-UTRA-NR Dual Connectivity (EN-DC), in which a UE is connected to one eNB that acts as a MN and one en-gNB that acts as a SN. The eNB is connected to the EPC via the S1 interface and to the en-gNB via the X2 interface. The en-gNB might also be connected to the EPC via the S1-U interface and other en-gNBs via the X2-U interface.

The EN-DC architecture is illustrated in Figure 4.1.2-1 below.

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Figure 4.1.2-1: EN-DC Overall Architecture

### 4.1.3 MR-DC with the 5GC

#### 4.1.3.1 E-UTRA-NR Dual Connectivity

NG-RAN supports NG-RAN E-UTRA-NR Dual Connectivity (NGEN-DC), in which a UE is connected to one ng-eNB that acts as a MN and one gNB that acts as a SN.

#### 4.1.3.2 NR-E-UTRA Dual Connectivity

NG-RAN supports NR-E-UTRA Dual Connectivity (NE-DC), in which a UE is connected to one gNB that acts as a MN and one ng-eNB that acts as a SN.

#### 4.1.3.3 NR-NR Dual Connectivity

NG-RAN supports NR-NR Dual Connectivity (NR-DC), in which a UE is connected to one gNB that acts as a MN and another gNB that acts as a SN. In addition, NR-DC can also be used when a UE is connected to two gNB-DUs, one serving the MCG and the other serving the SCG, connected to the same gNB-CU, acting both as a MN and as a SN.

#### 4.3.1.3 MR-DC with 5GC

In MR-DC with 5GC (NGEN-DC, NE-DC and NR-DC), the involved core network entity is the AMF. NG-C is terminated in the MN and the MN and the SN are interconnected via Xn-C.

**------------------------------------------------2nd Change -----------------------------------------------------**

# 6 Layer 2 related aspects

## 6.1 MAC Sublayer

In MR-DC, the UE is configured with two MAC entities: one MAC entity for the MCG and one MAC entity for the SCG. The serving cells of the MCG other than the PCell can only be activated/deactivated by the MAC Control Element received on MCG, and the serving cells of the SCG other than PSCell can only be activated/ deactivated by the MAC Control Element received on SCG. The MAC entity applies the bitmap for the associated cells of either MCG or SCG. PSCell in SCG is always activated like the PCell (i.e. deactivation timer is not applied to PSCell). With the exception of PUCCH SCell, one deactivation timer is configured per SCell by RRC.

In MR-DC, semi-persistent scheduling (SPS) resources can be configured on both PCell and PSCell.

In MR-DC, both contention based random access (CBRA) and contention free random access (CFRA) procedure are supported on PSCell as on PCell.

In MR-DC, the BSR configuration, triggering and reporting are independently performed per cell group. For split bearers, the PDCP data is considered in BSR in the cell group(s) configured by RRC.

In MR-DC, separate DRX configurations are provided for MCG and SCG.

## 6.2 RLC Sublayer

Both RLC AM and UM can be configured for MR-DC, for all bearer types (MCG, SCG and split bearers).

## 6.3 PDCP Sublayer

In EN-DC, CA duplication (see [3]) can be applied in the MN and in the SN, but MCG bearer CA duplication can be configured only in combination with E-UTRAN PDCP and MCG bearer CA duplication can be configured only if DC duplication is not configured for any split bearer.

In NGEN-DC, CA duplication can only be configured for SCG bearer. In NE-DC, CA duplication can only be configured for MCG bearer. In NR-DC, CA duplication can be configured for both MCG and SCG bearers.

In MR-DC, RoHC (as described in TS 36.323 [15] and TS 38.323 [16]) can be configured for all the bearer types.

## 6.4 SDAP Sublayer

In MR-DC with 5GC, the network may host up to two SDAP protocol entities for each individual PDU session, one for MN and another one for SN (see clause 8.1). The UE is configured with one SDAP protocol entity per PDU session.

## 6.X BAP Sublayer

In EN-DC and NR-DC, IAB-node and IAB-donor-DU can be configured with BAP sublayer for backhaul traffic (as described in TS 38.300 [3] and TS 38.340 [Xy]). In EN-DC, the BAP sublayer routes the backhaul traffic via only the NR interface. In NR-DC, the BAP sublayer can route the backhaul traffic via the two NR interfaces to the same IAB-donor.

# 7 RRC related aspects

## 7.1 System information handling

In MR-DC, the SN is not required to broadcast system information other than for radio frame timing and SFN. System information for initial configuration is provided to the UE by dedicated RRC signalling via the MN. The UE acquires, at least, radio frame timing and SFN of SCG from the PSS/SSS and MIB (if the SN is an eNB) / NR-PSS/SSS and PBCH (if the SN is a gNB) of the PSCell. In EN-DC, SN may broadcast system information to allow only IAB-MT to access the SN.

Additionally, upon change of the relevant system information of a configured SCell, the network releases and subsequently adds the concerned SCell (with updated system information), via one or more *RRC reconfiguration* messages sent on SRB1 or SRB3, if configured.

**------------------------------------------------3rd Change -----------------------------------------------------**

## 7.9 Inter-node Resource Coordination

For MR-DC operations, MN and SN may coordinate their UL and DL radio resources in semi-static manner via UE associated signalling.

## 7.X F1-AP transfer over E-UTRA

In EN-DC, the F1-AP message can be transferred between IAB-donor and IAB-node via E-UTRA. SRB2 is used for transport the F1-AP message between IAB-MT and MN [10], and the F1-AP message is transferred as a container via X2-AP between MN and SN.

**----------------------------------------------- End of Change -----------------------------------------------------**