**3GPP TSG-SA5 Meeting #139e *S5-215062***

**October 11 – 20, 2021, e-Meeting** *s5-abcde*

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| *CR-Form-v11.4* |
| **CHANGE REQUEST** |
|  |
|  | **28.313** | **CR** | **-** | **rev** | **-** | **Current version:** | **17.2.0** |  |
|  |
| *For* [***HELP***](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 |  | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Add D-LBO and C-LBO procedures |
|  |  |
| ***Source to WG:*** | Intel |
| ***Source to TSG:*** | S5 |
|  |  |
| ***Work item code:*** | eSON\_5G |  | ***Date:*** | 2021-10-01 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *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 canbe 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:*** | The D-LBO and C-LBO procedures are missing in TS 28.313 |
|  |  |
| ***Summary of change:*** | Add D-LBO and C-LBO procedures, and various minor changes to LBO use cases, requirements and MnS information |
|  |  |
| ***Consequences if not approved:*** | Rel. 17 eSON\_5G WI cannot be completed. |
|  |  |
| ***Clauses affected:*** | 6.4.1.x(new), 6.1.1.x (new), 6.4.2.x (new), 6.1.2.x (new), 7.1.x(new), 7.2.x (new), 8.2.x(new), 8.3.x(new) |
|  |  |
|  | **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 ... |
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| ***Other comments:*** | This is input to the Rel-17 28.313 draft CR S5-211487 for eSON\_5G |

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| **First Modified Sections** |

## 6.4 Use cases

### 6.4.1 Distributed SON management

#### 6.4.1.x LBO (Load Balancing Optimisation)

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To automatically distribute user traffic among neighboring cells to ensure the radio resources are efficiently used, while providing quality end-user experience and performance. |  |
| **Actors and Roles** | D-SON management function to support LBO function. |  |
| **Telecom resources** | * The producer of provisioning MnS
 |  |
| **Assumptions** | N/A |  |
| **Pre-conditions** | * D-LBO is in operation.
 |  |
| **Begins when**  | The D-SON management function decides to enable D-LBO function. |  |
| **Step 1 (M)** | The D-SON management function requests the producer of provisioning MnS to set the handover and/or reselection parameters ranges (see clause 15.5.1.4 in TS 38.300 [7]), and to enable the D-LBO function. |  |
| **Step 2 (M)** | The D-LBO function perform load balancing as describe in clause 15.5 in TS 38.300 [7])” and may notify D-LBO management function when the LBO action has been performed. |  |
| **Step 3 (M)** | The D-SON management function collects LBO related measurements. |  |
| **Step 4 (M)** | The D-SON management function analyses the measurements to evaluate the LBO performance, and may request the producer of provisioning MnS to update the ranges for HO and/or reselection parameters. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The LBO performance has been optimized. |  |
| **Traceability**  | **REQ-DLBO-FUN-1, REQ-DLBO-FUN-2, REQ-DLBO-FUN-3** |  |

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| **Next Modified Sections** |

## 6.1 Requirements

### 6.1.1 Distributed SON management

#### 6.1.1.2 LBO (Load Balancing Optimisation)

**REQ-DLBO-FUN-1** Provisioning MnS for D-LBO function should have a capability allowing an authorized consumer to set or update the ranges of HO and/or reselection parameters , and control parameters for LBO function.

**REQ-DLBO-FUN-2** Performance assurance MnS for D-LBO function should have a capability allowing the authorized consumer to collect the LBO related performance measurements that are used to evaluate the LBO performance.

**REQ-DLBO-FUN-3** Provisioning MnS for D-LBO function should have a capability to notify the authorized consumer about the LBO actions being performed.

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| **Next Modified Sections** |

### 6.4.2 Centralized SON

#### 6.4.2.x LBO (Load Balancing Optimisation)

| Use case stage | Evolution/Specification | <<Uses>>Related use |
| --- | --- | --- |
| **Goal**  | To automatically distribute user traffic among neighboring cells to ensure the radio resources are efficiently used, while providing quality end-user experience and performance. |  |
| **Actors and Roles** | C-LBO function to support LBO. |  |
| **Telecom resources** | * The producer of provisioning MnS
 |  |
| **Assumptions** | Both Domain Centralized SON and Cross-Domain Centralized SON are supported. |  |
| **Pre-conditions** | * The C-LBO has been enabled.
 |  |
| **Begins when**  | The C-LBO function is enabled. |  |
| **Step 1 (M)** | The C-LBOfunction collects LBO load measurements by consuming the MnS of performance assurance.  |  |
| **Step 2 (M)** | The C-LBOfunction analyses measurements to determine the actions to optimize the traffic load distributions among neighboring cells that include consuming the MnS of provisioning to update the ranges for handover parameters. |  |
| **Step 3 (M)** | The C-LBOfunction collects LBO related measurements, and analyses them to evaluate the LBO performance, and may request the producer of provisioning MnS to update the ranges for HO and/or reselection parameters. |  |
| **Ends when**  | All the steps identified above are successfully completed. |  |
| **Exceptions** | One of the steps identified above fails. |  |
| **Post-conditions** | The LBO performance has been optimized. |  |
| **Traceability**  | **REQ-CLBO-FUN-1, REQ-CLBO-FUN-2** |  |

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| **Next Modified Sections** |

### 6.1.2 Centralized SON

#### 6.1.2.x LBO (Load Balancing Optimisation)

**REQ-CLBO-FUN-1** Provisioning MnS for C-LBO function should have a capability allowing an authorized consumer to set or update the ranges of HO and/or reselection parameters for LBO function.

**REQ-CLBO-FUN-2** Performance assurance MnS for C-LBO function should have a capability allowing the authorized consumer to collect the LBO load and LBO related performance measurements.

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| **Next Modified Sections** |

# 7 Management services for SON

## 7.1 Management services for D-SON management

### 7.1.x LBO (Load Balancing Optimisation)

#### 7.1.x.1 MnS component type A

Table 7.1.x.1-1: D-LBO type A

|  |  |
| --- | --- |
| MnS Component Type A | Note |
| Operations and notifications defined in clause 5 of TS 28.532 [3]:- createMOI operation- getMOIAttributes operation- modifyMOIAttributes operation- deleteMOI operation- notifyMOIAttributeValueChanges- notifyMOICreation - notifyMOIDeletion - notifyMOIChanges | It is supported by Provisioning MnS for NF, as defined in TS 28.531 [11]. |
| Operations defined in clause 11.3.1.1.1 in TS 28.532 [3] and clause 6.2.3 of TS 28.550 [12]:- establishStreamingConnection operation- notifyFileReady operation- reportStreamData operation | It is supported by Performance Assurance MnS for NFs, as defined in TS 28.550 [12]. |

#### 7.1.x.2 MnS Component Type B definition

##### 7.1.x.2.1 Control information

The parameter is used to control the LBO function.

Table 7.1.x.2.1-1: D-LBO control information

| Control parameter | Definition | Legal Values |
| --- | --- | --- |
| D-LBO function control | This attribute allows the operator to enable/disable the LBO functionality. | BooleanOn, off |

##### 7.1.x.2.2 Parameters to be updated

Table 7.1.x.2.2-1: Ranges of HO and cell selection parameters

| Control parameters | Definition | Legal Values |
| --- | --- | --- |
| Maximum deviation of Handover Trigger | This parameter defines the maximum allowed absolute deviation of the Handover Trigger, from the default point of operation (see clause 15.5.1.4 in TS 38.300 [7] and clause 9.2.2.61 in TS 38.423 [17]). See attribute maximumDeviationHoTrigger in TS 28.541 [13]. | [-20 .. 20] in unit 0.5 dB |
| Minimum time between Handover Trigger changes | This parameter defines the minimum allowed time interval between two Handover Trigger change performed by MRO. This is used to control the stability and convergence of the algorithm (see clause 15.5.1.4 in TS 38.300 [7]). See attribute minimumTimeBetweenHoTriggerChange in TS 28.541 [13]. | [0 .. 604800] in unit Seconds |

#### 7.1.x.3 MnS Component Type C definition

##### 7.1.x.3.1 Performance measurements

Performance measurements related LBO are captured in Table 7.1.x.3.1-1:

Table 7.1.x.3.1-1. D-LBO related performance measurements

| Performance measurements | Description | Note |
| --- | --- | --- |
| DL Total PRB Usage | This measurement provides the total usage (in percentage) of physical resource blocks (PRBs) on the downlink (see clause 5.1.1.2.1 in TS 28.552 [5]). |  |
| UL Total PRB Usage | This measurement provides the total usage (in percentage) of physical resource blocks (PRBs) on the uplink (see clause 5.1.1.2.2 in TS 28.552 [5]).  |  |
| Distribution of DL Total PRB Usage | This distribution measurement is to monitor when a cell may experience overload situation in the downlink (see clause 5.1.1.2.3 in TS 28.552 [5]).  |  |
| Distribution of UL Total PRB Usage | This distribution measurement is to monitor when a cell may experience overload situation in the uplink (see clause 5.1.1.2.4 in TS 28.552 [5]). |  |
| DL PRB used for data traffic | This measurement provides the number of physical resource blocks (PRBs) in average used in downlink for data traffic (see clause 5.1.1.2.5 in TS 28.552 [5]). |  |
| UL PRB used for data traffic | This measurement provides the number of physical resource blocks (PRBs) in average used in uplink for data traffic (see clause 5.1.1.2.7 in TS 28.552 [5]). |  |
| Mean number of RRC Connections | This measurement provides the mean number of users in RRC connected mode during the granularity period (see clause 5.1.1.4.1 in TS 28.552 [5]). |  |
| Max number of RRC Connections | This measurement provides the maximum number of users in RRC connected mode during the granularity period (see clause 5.1.1.4.2 in TS 28.552 [5]). |  |
| Mean number of stored inactive RRC Connections | This measurement provides the mean number of users in RRC inactive mode during each granularity period (see clause 5.1.1.4.3 in TS 28.552 [5]). |  |
| Max number of stored inactive RRC Connections | This measurement provides the maximum number of users in RRC inactive mode during each granularity period (see clause 5.1.1.4.3 in TS 28.552 [5]). |  |

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| **Next Modified Sections** |

### 7.2 Management services for C-SON

### 7.2.x LBO (Load Balancing Optimisation)

#### 7.2.x.1 MnS component type A

Table 7.2.x.1-1: C-LBO type A

|  |  |
| --- | --- |
| MnS Component Type A | Note |
| Operations and notifications defined in clause 11.1.1 of TS 28.532 [3]:- createMOI operation- getMOIAttributes operation--- modifyMOIAttributes operation- - deleteMOI operation- - notifyMOIAttributeValueChanges- notifyMOICreation- notifyMOIDeletion- notifyMOIChanges | It is supported by Provisioning MnS for NF, as defined in 28.531 [11]. |
| Operations defined in clause 11.3.1.1.1 in TS 28.532 [3] and clause 6.2.3 of TS 28.550 [12]:- establishStreamingConnection operation- notifyFileReady operation- reportStreamData operation | It is supported by Performance Assurance MnS for NFs, as defined in 28.550 [12]. |

#### 7.2.x.2 MnS Component Type B definition

##### 7.2.x.2.1 Control information

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| --- | --- | --- |
|  |  |  |

##### 7.2.x.2.2 Parameters to be updated

Table 7.2.x.2.2-1: Ranges of HO and cell selection parameters

| Control parameters | Definition | Legal Values |
| --- | --- | --- |
| Maximum deviation of Handover Trigger | This parameter defines the maximum allowed absolute deviation of the Handover Trigger, from the default point of operation (see clause 15.5.2.5 in TS 38.300 [7] and clause 9.2.2.61 in TS 38.423 [17]). See attribute maximumDeviationHoTrigger in TS 28.541 [13]. | [-20 .. 20] in unit 0.5 dB |
| Minimum time between Handover Trigger changes | This parameter defines the minimum allowed time interval between two Handover Trigger change performed by MRO. This is used to control the stability and convergence of the algorithm (see clause 15.5.2.5 in TS 38.300 [7]). See attribute minimumTimeBetweenHoTriggerChange in TS 28.541 [13]. | [0 .. 604800] in unit Seconds |

#### 7.2.x.3 MnS Component Type C definition

##### 7.2.x.3.1 Performance measurements

Table 7.2.x.3.1-1. lists the performance measurements that are used to monitor the load of NR cells (see clause 15.5.1.2 in TS 38.300 [7]).

Table 7.2.x.3.1-1. C-LBO load performance measurements

|  |  |  |
| --- | --- | --- |
| Performance measurements | Description | Note |
| DL Total PRB Usage | This measurement provides the total usage (in percentage) of physical resource blocks (PRBs) on the downlink (see clause 5.1.1.2.1 in TS 28.552 [5]). |  |
| UL Total PRB Usage | This measurement provides the total usage (in percentage) of physical resource blocks (PRBs) on the uplink (see clause 5.1.1.2.2 in TS 28.552 [5]).  |  |
| Distribution of DL Total PRB Usage | This distribution measurement is to monitor when a cell may experience overload situation in the downlink (see clause 5.1.1.2.3 in TS 28.552 [5]).  |  |
| Distribution of UL Total PRB Usage | This distribution measurement is to monitor when a cell may experience overload situation in the uplink (see clause 5.1.1.2.4 in TS 28.552 [5]). |  |
| DL PRB used for data traffic | This measurement provides the number of physical resource blocks (PRBs) in average used in downlink for data traffic (see clause 5.1.1.2.5 in TS 28.552 [5]). |  |
| UL PRB used for data traffic | This measurement provides the number of physical resource blocks (PRBs) in average used in uplink for data traffic (see clause 5.1.1.2.7 in TS 28.552 [5]). |  |
| Mean number of RRC Connections | This measurement provides the mean number of users in RRC connected mode during the granularity period (see clause 5.1.1.4.1 in TS 28.552 [5]). |  |
| Max number of RRC Connections | This measurement provides the maximum number of users in RRC connected mode during the granularity period (see clause 5.1.1.4.2 in TS 28.552 [5]). |  |
| Mean number of stored inactive RRC Connections | This measurement provides the mean number of users in RRC inactive mode during each granularity period (see clause 5.1.1.4.3 in TS 28.552 [5]). |  |
| Max number of stored inactive RRC Connections | This measurement provides the maximum number of users in RRC inactive mode during each granularity period (see clause 5.1.1.4.3 in TS 28.552 [5]). |  |

Table 7.2.x.3.1-2 lists the performance measurements used to monitor the LBO performance:

Table 7.2.x.3.1-2. C-LBO related performance measurements

| Performance measurements | Description | Note |
| --- | --- | --- |
| Attempted RRC connection establishments | Includes the number of RRC connection establishment attempts (see clause 5.1.1.15.1 in TS 28.552 [5]).  |  |
| Successful RRC connection establishments | Includes the number of successful RRC establishments (see clause 5.1.1.15.2 in TS 28.552 [5]). |  |
| Number of RRC connection re-establishment attempts | Includes the number of RRC connection re-establishment attempts (see clauses 5.1.1.17.1 in TS 28.552 [5]). |  |
| Successful RRC connection re-establishment | Includes the number of successful RRC connection re-establishment (see clauses 5.1.1.17.2 and 5.1.1.17.3 in TS 28.552 [5]). |  |
| Number of RRC connection resuming attempts | Includes Number of RRC connection resuming attempts (see clause 5.1.1.18.1 in TS 28.552 [5]).  |  |
| Successful RRC connection resuming | Includes the number of successful RRC connection resuming (see clause 5.1.1.18.2 in TS 28.552 [5]). |  |

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| **Next Modified Sections** |

# 8 SON procedures

## 8.1 Introduction

The procedures listed in clause 8 are some of all the possibilities, and are not exhaustive.

## 8.2 Distributed SON

### 8.2.x LBO (Load Balancing Optimisation)

Figure 8.2.x-1 depicts a procedure that describes how D-SON management function can manage the LBO function. It is assumed that the D-SON management function has consumed the performance assurance MnS to create PM jobs to collect handover related measurements.



Figure 8.2.x-1: D-LBO procedure

1. The D-SON management function consumes the management service for NF provisioning with *modifyMOIAttributes* operation (see clause 5.1.3 in TS 28.532 [3]) to configure the ranges of HO and/or reselection parameters for the LBO function.

1.a The MnS of provisioning sets the ranges for MRO function (NOTE).

2. The D-SON management function consumes the NF provisioning MnS with *modifyMOIAttributes* operation to enable the LBO function for a given NR cell if it is not enabled.

2.a The provisioning MnS enables the LBO function (NOTE).

3. The LBO function collects real-time load information to determine theactions to balance the traffic loads among NR cells.

4. The LBO function indicates that LBO actions have been performed (NOTE).

4.a The MnS of provisioning sends a notification *notifyMOIAttributeValueChange* to the D-SON management function with sourceIndicator = SON\_operation\_D-LBO (see clause 11.1.1.9.2 in TS 28.532 [3]) to indicate the LBO actions have been performed.

5. D-SON management function collects LBO related performance measurements.

6. The D-SON management function analyses the measurements to evaluate the LBO performance,

7. The D-SON management function consume the MnS of provisioning with *modifyMOIAttributes* operation to update the ranges of handover parameters if the LBO failed to meet expection,

7.a. The MnS of provisioning updates the ranges of HO and/or reselection parameters (NOTE).

NOTE: The interface between provisioning MnS and D-LBO function is not subject to standardization.

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| **Next Modified Sections** |

## 8.3 Centralized SON

### 8.3.x LBO (Load Balancing Optimisation)

Figure 8.3.x-1 depicts a procedure to describe how C-LBO function performs load balancing among NR cells. It is assumed that PM jobs have been created to collect LBO related measurements.



Figure 8.3.x-1: C-LBO procedure

1. The C-LBO function collects LBO related performance measurements (see clause 7.2.x.3.1).

2. The C-LBO function analyses the measurements to evaluate the LO performance,

3 The C-LBO function performs the following actions, if the LBO performance failed to meet expection:

3.1. Consume the MnS of provisioning with *modifyMOIAttributes* operation to update the ranges of HO and/or reselection parameters.

3.1.a The MnS of provisioning updates the ranges of handover parameters (NOTE).

3.2. Receive a notification *notifyMOIAttributeValueChange* rfrom the producer of provisioning MnS with sourceIndicator = SON\_operation\_C-LBO (see clause 11.1.1.9.2 in TS 28.532 [3]) to indicate the ranges of handover parameters have been changed.

NOTE: The interface between provisioning MnS and NR cell(s) is not subject to standardization.

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| **End of Modified Sections** |