3GPP TSG SA WG5 Meeting 135-e S5-211322

electronic meeting, online, 25 January - 3 February 2021

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **28.552** | **CR** | **0287** | **rev** | **-** | **Current version:** | **17.1.0** |  |
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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 |  | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | CHO measurements |
|  |  |
| ***Source to WG:*** | S5 |
| ***Source to TSG:*** | Ericsson |
|  |  |
| ***Work item code:*** | E\_HOO |  | ***Date:*** | 2021-01-15 |
|  |  |  |  |  |
| ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Currently, there are no measurements for Conditional Handover (CHO.)  |
|  |  |
| ***Summary of change:*** | Adding capability for measurements to cater for Conditional Handover. |
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| ***Consequences if not approved:*** | There is no way of observing Conditional Handover. |
|  |  |
| ***Clauses affected:*** | 3.1, 3.2, 5.1.1.6.1.1, 5.1.1.6.1.2, 5.1.1.6.1.3, 5.1.1.6.1.4, 5.1.1.6.1.5, 5.1.1.6.1.6, 5.1.1.6.1.7, 5.1.1.6.1.8, 5.1.1.6.1.9, 5.1.1.6.2.1, 5.1.1.6.2.2, 5.1.3.7.1.1, 5.1.3.7.1.2 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  |  |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**First change**

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

**Conditional Handover:** A handover which is executed by the UE.

**IP Latency:** the time it takes to transfer a first/initial packet in a data burst from one point to another.

**Legacy Handover**: A handover that is executed by the source gNB. In contrast to Conditional Handover.

**Mapped 5QI:** 5QI that is used for a DRB within the gNB when a single 5QI is assigned to the DRB.

NOTE1: In this case the mapped 5QI is used for separating certain measurements per QoS class.

NOTE 2: Individual QoS  flows into a common 5QI is specified in TS 38.473 [6].

**Packet Delay:** the time it takes to transfer any packet from one point to another.

**Packet Drop Rate:** share of packets that were not sent to the target due to high traffic load or traffic management and should be seen as a part of the packet loss rate.

**Packet Loss Rate:** share of packets that could not be received by the target,. including packets droped, packets lost in transmission and packets received in wrong format.

**Performance Indicators**: The performance data aggregated over a group of NFs which is derived from the performance measurements collected at the NFs that belong to the group, according to the aggregation method identified in the Performance Indicator definition.

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], 3GPP TS 23.501 [4] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1] and 3GPP TS 23.501 [4].

CHO Conditional Handover

HO Handover

kbit kilobit (1000 bits)

MN Master Node.

NG-RAN Next Generation Radio Access Network

SN Secondary Node.

TEID Tunnel Endpoint IDentifier

**Next change**

5.1.1.6.1 Inter-gNB handovers

5.1.1.6.1.1 Number of requested handover preparations

a) This measurement provides the number of handover preparations requested by the source gNB.

b) CC.

c) On transmission of HANDOVER REQUIRED message (see 3GPP TS 38.413 [11]) by the NR cell CU to the AMF, or transmission of HANDOVER REQUEST message (see 3GPP TS 38.423 [13]) by the source NR cell CU to target NR cell CU, for requesting the preparation of resources at the target NR cell CU. There are separate subcounters for HO and for CHO. In case of CHO, the counter shall only be incremented once for each UE, even if HANDOVER REQUEST messages are sent to multiple targets.

d) A single integer value per subcounter.

e) MM.HoPrepInterReq
MM.HoPrepInterReq.HO
MM.HoPrepInterReq.CHO

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

5.1.1.6.1.2 Number of successful handover preparations

a) This measurement provides the number of successful handover preparations received by the source NR cell CU.

b) CC

c) On receipt of HANDOVER COMMAND message by the NR cell CU from the AMF (see 3GPP TS 38.413 [11]), or receipt of HANDOVER REQUEST ACKNOWLEDGE message (see 3GPP TS 38.423 [13]) by the source NR cell CU from the target NR cell CU, for informing that the resources for the handover have been prepared at the target NR cell CU. There are separate subcounters for HO and for CHO. In case of CHO, the counter shall only be incremented once for each UE, even if HANDOVER REQUEST ACKNOWLEDGE messages are received from multiple sources.

d) A single integer value per subcounter.

e) MM.HoPrepInterSucc
MM.HoPrepInterSucc.HO
MM.HoPrepInterSucc.CHO

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

5.1.1.6.1.3 Number of failed handover preparations

a) This measurement provides the number of failed handover preparations received by the source NR cell CU. This measurement is split into subcounters per failure cause.

b) CC

c) On receipt of HANDOVER PREPARATION FAILURE message (see 3GPP TS 38.413 [11]) by the NR cell CU from the AMF, or receipt of HANDOVER PREPARATION FAILURE message (see 3GPP TS 38.423 [13]) by the source NR cell CU from the target NR cell CU, for informing that the preparation of resources at the target NR cell CU has failed. Each received HANDOVER PREPARATION FAILURE message increments the relevant subcounter per failure cause by 1. There are separate subcounters for HO and for CHO. In case of CHO, the counter may be incremented by more than one message from target nodes.

d) Each subcounter is an integer value.

e) MM.HoPrepInterFail.*cause.*MM.HoPrepInterFail.*cause.*HOMM.HoPrepInterFail.*cause.*CHO

 Where *cause* identifies the failure cause of the handover preparations.

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

5.1.1.6.1.4 Number of requested handover resource allocations

a) This measurement provides the number of handover resource allocation requests received by the target NR cell CU.

b) 1CC

c) On receipt of HANDOVER REQUEST message (see 3GPP TS 38.413 [1]) by the NR cell CU from the AMF, or receipt of HANDOVER REQUEST message (see 3GPP TS 38.423 [13]) by the target NR cell CU from the source NR cell CU, for requesting the preparation of resources for handover. There are separate subcounters for HO and for CHO.

d) A single integer value for each subcounter.

e) MM.HoResAlloInterReq.
MM.HoResAlloInterReq.HO
MM.HoResAlloInterReq.CHO

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

5.1.1.6.1.5 Number of successful handover resource allocations

a) This measurement provides the number of successful handover resource allocations at the target NR cell CU for the handover.

b) CC.

c) On transmission of HANDOVER REQUEST ACKNOWLEDGE message (see 3GPP TS 38.413 [11]) by the NR cell CU to the AMF, or transmission of HANDOVER REQUEST ACKNOWLEDGE message (see 3GPP TS 38.423 [13]) by the target NR cell CU to the source NR cell CU, for informing that the resources for the handover have been prepared. There are separate subcounters for HO and for CHO.

d) A single integer value for each subcounter.

e) MM.HoResAlloInterSucc
MM.HoResAlloInterSucc.HO
MM.HoResAlloInterSucc.CHO

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

5.1.1.6.1.6 Number of failed handover resource allocations

a) This measurement provides the number of failed handover resource allocations at the target NR cell CU for the handover. This measurement is split into subcounters per failure cause.

b) CC

c) On transmission of HANDOVER FAILURE message (see 3GPP TS 38.413 [11]) by the NR cell CU to the AMF, or transmission of HANDOVER PREPARATION FAILURE message (see 3GPP TS 38.423 [13]) by the target NR cell CU to the source NR cell CU, for informing that the preparation of resources has failed. Each transmitted HANDOVER FAILURE message or HANDOVER PREPARATION FAILURE message increments the relevant subcounter per failure cause by 1.

d) Each subcounter is an integer value.

e) MM.HoResAlloInterFail.*cause*MM.HoResAlloInterFail.*cause.*HOMM.HoResAlloInterFail.*cause.*CHO

 Where *cause* identifies the failure cause of the handover resource allocations.

f) NRCellCU

g) Valid for packet switched traffic.

h) 5GS

i) One usage of this performance measurements is for performance assurance.

5.1.1.6.1.7 Number of requested handover executions

a) This inter gNB handover measurement provides the number of outgoing handover executions requested by the source gNB.

b) CC.

c) On transmission of *RRC ConnectionReconfiguration* message to the UE triggering the inter gNB handover from the source NRCellCU to the target NRCellCU, indicating the attempt of an outgoing inter-gNB handover (see TS 38.331 [20]), the counter is stepped by 1. There are separate subcounters for HO and for CHO. In case of CHO, the counter shall only be incremented once for each UE, even if several *RRC ConnectionReconfiguration* messages are sent to UE.

d) A single integer value for each subcounter.

e) MM.HoExeInterReq
MM.HoExeInterReq.HO
MM.HoExeInterReq.CHO

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

5.1.1.6.1.8 Number of successful handover executions

a) This inter gNB handover measurement provides the number of successful handover executions received by the source gNB.

b) CC

c) On receipt at the source gNB of UE CONTEXT RELEASE [13] over Xn from the target gNB following a successful handover, or, if handover is performed via NG, on receipt of UE CONTEXT RELEASE COMMAND [11] from AMF following a successful inter gNB handover, the counter is stepped by 1. There are separate subcounters for HO and for CHO.

d) A single integer value for each subcounter.

e) MM.HoExeInterSucc
MM.HoExeInterSucc.HO
MM.HoExeInterSucc.CHO

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

5.1.1.6.1.9 Number of failed handover executions

a) This inter gNB handover measurement provides the number of failed handover executions received by the source gNB. This measurement is split into subcounters per failure cause.

b) CC.

c) On receipt at the source gNB of UE CONTEXT RELEASE [13] over Xn from the target gNB indicating an unsuccessful inter gNB handover, or, if handover is performed via NG, on receipt of UE CONTEXT RELEASE COMMAND [11] from AMF indicating an unsuccessful inter gNB handover.

The failure causes are listed for the UE CONTEXT RELEASE in [13] and for UE CONTEXT RELEASE COMMAND in [11]. Each received message increments the relevant subcounter per failure cause by 1.

There are separate subcounters for HO and for CHO.

d) Each subcounter is an integer value.

e) MM.HoExeInterFail.*cause*MM.HoExeInterFail.*cause.HO*MM.HoExeInterFail.*cause.CHO*

Where *cause* identifies the failure cause of the UE CONTEXT RELEASE or UE CONTEXT RELEASE COMMAND message.

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

5.1.1.6.1.10 Mean Time of requested handover executions

a) This measurement provides the mean time of Inter-gNB handover executions during each granularity period. The measurement is split into subcounters per S-NSSAI.

b) DER(n=1)

c) This measurement is obtained by accumulating the time interval for every successful Inter-gNB handover executions procedure per S-NSSAI between the receipt by the Source NG-RAN from the Target NG-RAN of a " Release Resource" and the sending of a " N2 Path Switch Request " message from Source NG-RAN to the Target NG-RAN over a granularity period using DER. The end value of this time will then be divided by the number of Inter-gNB handovers observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value (in milliseconds.)

e) MM.HoExeInterReq.TimeMean.*SNSSAI*

f) NRCellCU.

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the mean time of Inter-gNB handovers during the granularity period.

5.1.1.6.1.11 Max Time of requested handover executions

a) This measurement provides the max time of Inter-gNB handover executions during each granularity period. The measurement is split into subcounters per S-NSSAI.

b) DER(n=1)

c) This measurement is obtained by measuring the time interval for every successful Inter-gNB handover executions procedure per S-NSSAI between the receipt by the Source NG-RAN from the Target NG-RAN of a “Release Resource" and the sending of a " N2 Path Switch Request " message from Source NG-RAN to the Target NG-RAN over a granularity period using DER. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value (in milliseconds.)

e) MM.HoExeInterReq.TimeMax.*SNSSAI*

f) NRCellCU.

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the mean time of Inter-gNB handovers during the granularity period.

5.1.1.6.2 Intra-gNB handovers

5.1.1.6.2.1 Number of requested handover executions

a) This measurement provides the number of outgoing intra-gNB handover executions requested by the source NRCellCU.

b) CC.

c) On transmission of *RRC ConnectionReconfiguration* message to the UE triggering the handover from the source NRCellCU to the target NRCellCU, indicating the attempt of an outgoing intra-gNB handover (see 3GPP TS 38.331 [20]), the counter is stepped by 1. There are separate subcounters for HO and for CHO. In case of CHO, the counter shall only be incremented once for each UE, even if several *RRC ConnectionReconfiguration* messages are sent to UE.

d) A single integer value for each subcounter.

e) MM.HoExeIntraReq
MM.HoExeIntraReq.HO
MM.HoExeIntraReq.CHO

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

5.1.1.6.2.2 Number of successful handover executions

a) This measurement provides the number of successful intra-gNB handover executions received by the source NRCellCU.

b) CC.

c) On reception of *RRC ConnectionReconfigurationComplete* message from the UE to the target NRCellCU indicating a successful intra-gNB handover (see 3GPP TS 38.331 [20]), the counter is stepped by 1. There are separate subcounters for HO and for CHO.

d) A single integer value for each subcounter.

e) MM.HoExeIntraSucc
MM.HoExeIntraSucc.HO
MM.HoExeIntraSucc.CHO

f) NRCellCU,
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

**Next change**

##### 5.1.3.7 Handovers measurements

##### 5.1.3.7.1 Intra-gNB handovers

###### 5.1.3.7.1.1 Number of requested handover preparations

a) This measurement provides the number of outgoing intra-gNB handover preparations requested by the source NRCellCU for split gNB deployment.

b) CC.

c) For split gNB deployment the measurement is triggered and stepped by 1 when gNB-CUCP is sending UE CONTEXT MODIFY REQUEST message (see 3GPP TS 38.473 [6]) to gNB-DU to initiate an intra-gNB handover. There are separate subcounters for HO and for CHO. In case of CHO, the counter shall only be incremented once for each UE even if CHO is configured to multiple target cells.

d) A single integer value for each subcounter.

e) MM.HoPrepIntraReq
MM.HoPrepIntraReq.HO
MM.HoPrepIntraReq.CHO

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

###### 5.1.3.7.1.2 Number of successful handover preparations

a) This measurement provides the number of successful intra-gNB handover preparations received by the source NRCellCU, for split gNB deployment.

b) CC

c) For split gNB deployment the measurement is triggered and stepped by 1 when gNB-CUCP receives UE CONTEXT MODIFY RESPONSE message (see 3GPP TS 38.473 [6]) from gNB-DU to initiate a successful intra-gNB handover. There are separate subcounters for HO and for CHO. In case of CHO, the counter shall only be incremented once for each UE even if CHO is configured to multiple target cells.

d) A single integer value for each subcounter.

e) MM.HoPrepIntraSucc
MM.HoPrepIntraSucc.HO
MM.HoPrepIntraSucc.CHO

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

#### 5.1.3.8 Void

#### 5.1.3.9 Void

**End of changes**