Technical Specification Group Services and System Aspects
Meeting #17, Biarritz, France, 9-12 September 2002

TSGS#17(02)0609

Source: **SA5 (Telecom Management)**

Title: **Rel-5 CRs 32.403 (Performance measurements - UMTS and combined UMTS/GSM) - this is the revision of SP-020503**

Document for: **Approval**

Agenda Item: **7.5.3**

Doc-1st-	Spec	CR	Rev	Phase	Subject	Cat	Version-	Doc-2nd-	Workitem
SP-020503	32.403	009	-	Rel-5	**Introduction of Service Based Performance Measurement Definitions**	B	5.0.0	S5-028333	OAM-PM
SP-020503	32.403	010	-	Rel-5	**Add flexibility in the measurement template for the Measured Object Class (MOC)**	C	5.0.0	S5-028335	OAM-PM

3GPP TSG-SA5 (Telecom Management) **S5-028333**
Meeting #30, Tampere, FINLAND, 19 - 23 August 2002

CR-Form-v7

CHANGE REQUEST

⌘ **32.403** **CR** **009** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☒

Title:	⌘	Introduction of Service Based Performance Measurement Definitions
Source:	⌘	S5
Work item code:	⌘	OAM-PM
Date:	⌘	30/08/2002
Category:	⌘	**B**
Release:	⌘	*Rel-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction 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.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	New Measurements required to monitor services from an end-to-end basis.
Summary of change:	⌘	Input to reflect customer experience from an end-to-end perspective.
Consequences if not approved:	⌘	Additional measurements will improve the ability to monitor performance on an end-to-end basis, this is seen as a major issue for many operators of GPRS and UMTS based networks.

Clauses affected:	⌘	3.1, 4, 5.6 and 5.10 (new)

Other specs affected: ⌘

Y	N	
	X	Other core specifications
	X	Test specifications
	X	O&M Specifications

⌘

Other comments: ⌘ Some explanatory text for Radio Access Bearers (RAB) measurements was also added in section 4.1 to provide an overview on the rationale behind RAB measurements.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

"*(n-1)* out of *n*" approach:

- The measurements result values generated by a NE can be obtained in a number of different ways. Therefore, the "*(n-1)* out of *n* approach" has been defined in order to avoid redundancy in the measurements.
- The "*(n-1)* out of *n* approach" allows a vendor to choose any (n-1) out of the n defined counters for implementation but some choices can offer more detailed information than others. The missing n^{th} value can be calculated in post-processing.
- If multiple measurements are included in one template, then the applicability of the "(n-1) out of n" scenario are mentioned in template item A with the following sentence "The *n* measurement types defined in item E are subject to the "*(n-1)* out of *n* approach"". The item D will specify the measurement result per measurement type specified in template item E.
- If the measurements that are applicable to the "*(n-1)* out of *n*" scenario are defined in separate templates, then they will be grouped together into a common clause of the TS, and the applicability of the approach will be mentioned in the supersection that groups the measurements.
- Examples of measurements which are subject to the "*(n-1)* out of *n*" approach are provided in the Annex A.

Measurement family

The measurement names defined in the present document are all beginning with a prefix containing the measurement family name (e.g. RAB.AttEstabCS.Conv, MM.AttGprsAttach). This family name identifies all measurements which relate to a given functionality and it may be used for measurement administration (see 3GPP TS 32.401 [12]).

The list of families currently used in the present document is as follows:

~~- RAB (measurements related to Radio Access Bearer management)~~

~~- SIG (measurements related to Signalling)~~

~~- RRC (measurements related to Radio Resource Control)~~

~~- SHO (measurements related to Soft Handover)~~

~~- HHO (measurements related to Hard Handover)~~

~~- RELOC (measurements related to SRNS Relocation)~~

~~- IRATHO (measurements related to inter-Radio Access Technology Handover)~~

~~- MM (measurements related to Mobility Management)~~

~~- SUB (measurements related to Subscriber Management)~~

~~- SEC (measurements related to Security)~~

~~- SMS (measurements related to Short Message Service)~~

~~- SM (measurements related to Session Management)~~

~~- CAM (measurements related to CAMEL)~~

~~- ISYSC (measurements related to GSM/UMTS Intersystem changes)~~

~~- GTP (measurements related to GTP)~~

CAM (measurements related to CAMEL)

- GTP (measurements related to GTP)

- HHO (measurements related to Hard Handover)

- IRATHO (measurements related to inter-Radio Access Technology Handover)

- ISYSC (measurements related to GSM/UMTS Intersystem changes)

- MM (measurements related to Mobility Management)

- RAB (measurements related to Radio Access Bearer management)

- RELOC (measurements related to SRNS Relocation)

- RLC (measurements related to Radio Link Control)

- RRC (measurements related to Radio Resource Control)

- SEC (measurements related to Security)

- SHO (measurements related to Soft Handover)

- SIG (measurements related to Signalling)

- SM (measurements related to Session Management)

- SMS (measurements related to Short Message Service)

- SUB (measurements related to Subscriber Management)

- UBS (measurements related to UMTS Bearer Service)

4 Measurements related to the RNC

4.1 RAB management~~assignment~~

4.1.1 Overview

4.1.1.1 Measurements are based on the success and failure of procedures

The proposed measurements are not merely based on the counting of a given type of message since a same message may be repeated by an implementation dependent process. The aim here is to provide implementation independent specification.

Proposed measurements are based on the success/failure of procedures identified in the reference documents. The end of a procedure implies a stable state of the communication between the two involved parties. This stable state is normally the object of a common understanding from the two parties. As a consequence, proposed measurements are attached either to the successful or the unsuccessful issue of a procedure.

4.1.1.2 Combination of Traffic Class and Core Network domains

A Radio Access Bearer is characterized by several QOS parameters among them is the Traffic Class. Currently there are not any 3GPP specifications including TS 23.107 [8] in which may be found restrictions related to the possible combinations between Traffic Class and Core Network domain.

Consequently, as a conservative position, this specification should leave open every possible combination between Traffic Class and Core Network domain as specification TS 23.107 [8] does.

4.1.1.3 Considered Radio Access Bearer management procedures

Performance Measurement definitions in this section are based on the TS 25.413 “UTRAN Iu Interface RANAP Signalling” document [5].

The following paragraphs of this document are of interest for our purpose:

RAB Assignment

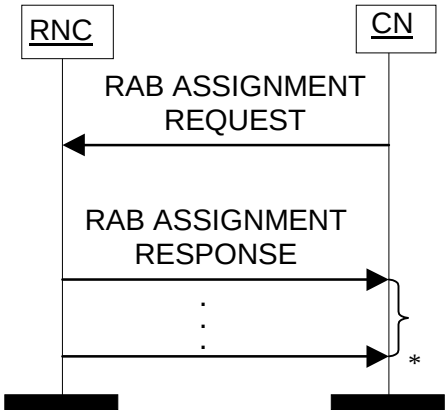
RAB Release Request

RAB ASSIGNMENT REQUEST

RAB ASSIGNMENT RESPONSE

RAB RELEASE REQUEST

These paragraphs show in particular the following diagrams:



* it can be several responses

Figure 1: RAB Assignment procedure. Successful operation.

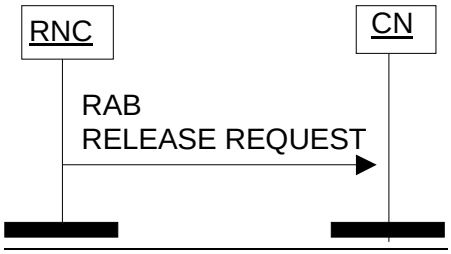


Figure 2: RAB Release Request procedure.

4.1.2 RAB assignment for CS domain

The five measurement types defined in the clause 4.1.2~~n~~ for CS domain ~~(respectively PS domain)~~ are subject to the "4 out of 5 approach".

4.1.2.1 Attempted RAB establishments for CS domain

a) This measurement provides the number of RAB assignment attempts for CS domain. The measurement is pegged by traffic class.

b) CC.

c) On receipt by the RNC of a RANAP RAB ASSIGNMENT REQUEST message for CS domain, each RAB assignment request is added to the relevant measurement according to the traffic class requested. See TS 25.413 and TS 23.107.

d) Four integer values.

e) RAB.AttEstabCS.Conv
RAB.AttEstabCS.Strm
RAB.AttEstabCS.Intact
RAB.AttEstabCS.Bgrd

f) Rnc~~NC~~Function.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.2 Successful RAB establishments without queuing for CS domain

a) This measurement provides the number of successfully established RABs for CS domain in which a queuing process has not been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each successfully established RAB is added to the relevant measurement according to the traffic class requested in the RAB ASSIGNMENT REQUEST message. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabCSNoQueuing.Conv
RAB.SuccEstabCSNoQueuing.Strm
RAB.SuccEstabCSNoQueuing.Intact
RAB.SuccEstabCSNoQueuing.Bgrd

f) Rnc~~NC~~Function.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.3 Failed RAB establishments without queuing for CS domain

a) This measurement provides the number of RAB establishment failures for CS domain in which a queuing process has not been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each RAB failed to establish is added to the relevant measurement according to the failure cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RAB.FailEstabCSNoQueuing.*Cause*
where *Cause* identifies the failure cause.

f) Rnc~~NC~~Function.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.4 Successful RAB establishments with queuing for CS domain

a) This measurement provides the number of successfully established RABs for CS domain in which a queuing process has been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each successfully established RAB is added to the relevant measurement according to the traffic class. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabCSQueuing.Conv
RAB.SuccEstabCSQueuing.Strm
RAB.SuccEstabCSQueuing.Intact
RAB.SuccEstabCSQueuing.Bgrd

f) Rnc~~NC~~Function.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.5 Failed RAB establishments with queuing for CS domain

a) This measurement provides the number of RAB establishment failures for CS domain in which a queuing process has been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each RAB failed to establish is added to the relevant measurement according to the cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

NOTE: The addition is performed with the condition the RAB has been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RAB.FailEstabCSQueuing.*Cause*
where *Cause* identifies the failure cause.

f) Rnc~~NC~~Function.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.3 RAB assignment for PS domain

The five measurement types defined in the clause 4.1.3 for PS domain are subject to the "4 out of 5 approach".

~~4.1.6~~4.1.3.1 Attempted RAB establishments for PS domain

a) This measurement provides the number of RAB assignment attempts for PS domain. The measurement is pegged by traffic class.

b) CC.

c) On receipt by the RNC of a RANAP RAB ASSIGNMENT REQUEST message for PS domain, each RAB assignment request is added to the relevant measurement according to the traffic class requested. See TS 25.413 and TS 23.107.

d) Four integer values.

e) RAB.AttEstabPS.Conv
RAB.AttEstabPS.Strm

RAB.AttEstabPS.Intact
RAB.AttEstabPS.Bgrd

f) Rnc~~NC~~Function.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.7~~4.1.3.2 Successful RAB establishments without queuing for PS domain

a) This measurement provides the number of successfully established RABs for PS domain in which a queuing process has not been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each successfully established RAB is added to the relevant measurement according to the traffic class. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabPSNoQueuing.Conv
RAB.SuccEstabPSNoQueuing.Strm
RAB.SuccEstabPSNoQueuing.Intact
RAB.SuccEstabPSNoQueuing.Bgrd

f) Rnc~~NC~~Function.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.8~~4.1.3.3 Failed RAB establishments without queuing for PS domain

a) This measurement provides the number of RAB establishment failures for PS in which a queuing process has not been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each RAB failed to establish is added to the relevant measurement according to the failure cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RAB.FailEstabPSNoQueuing.*Cause*
where *Cause* identifies the failure cause.

f) Rnc~~NC~~Function.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.9~~4.1.3.4 Successful RAB establishments with queuing for PS domain

a) This measurement provides the number of successfully established RABs for PS domain in which a queuing process has been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each successfully established RAB is added to the relevant measurement according to the traffic class. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabPSQueuing.Conv
RAB.SuccEstabPSQueuing.Strm
RAB.SuccEstabPSQueuing.Intact
RAB.SuccEstabPSQueuing.Bgrd

f) Rnc~~NC~~Function.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.10~~4.1.3.5 Failed RAB establishments with queuing for PS domain

a) This measurement provides the number of RAB establishment failures for PS domain in which a queuing process has been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each RAB failed to establish is added to the relevant measurement according to the cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RAB.FailEstabPSQueuing.*Cause*
where *Cause* identifies the failure cause.

f) Rnc~~NC~~Function.

g) Valid for packet switched traffic.

h) UMTS.

4.1.4 RAB setup time

4.1.4.1 RAB CS connection set-up time (Mean)

a) This measurement provides the mean time during each granularity period for a RNC to establish a RAB CS connection.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful RAB establishment between the receipt by the RNC of a RANAP "RAB ASSIGNMENT REQUEST" message to establish a RAB for CS domain, and the first corresponding (based on RAB ID) transmission by the RNC of a RANAP "RAB

ASSIGNMENT RESPONSE" message for successfully established RABs over a granularity period using DER, see TS 25.413. This end value of the time will then be divided by the number of successfully established RABs 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) RAB.SuccEstabCSSetupTimeMean

f) RncFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.4.2 RAB CS connection set-up time (Maximum)

a) This measurement provides the maximum time during each granularity period for a RNC to establish a RAB CS connection.

b) GAUGE.

c) This measurement is obtained by monitoring the time intervals for each successful RAB establishment between the receipt by the RNC of a RANAP "RAB ASSIGNMENT REQUEST" message to establish a RAB for CS domain, and the first corresponding (based on RAB ID) transmission by the RNC of a RANAP "RAB ASSIGNMENT RESPONSE" message for successfully established RABs see TS 25.413. 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) RAB.SuccEstabCSSetupTimeMax

f) RncFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.4.3 RAB PS connection set-up time (Mean)

a) This measurement provides the mean time during each granularity period for a RNC to establish a RAB PS connection.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful RAB establishment between the receipt by the RNC of a RANAP "RAB ASSIGNMENT REQUEST" message to establish a RAB for PS domain, and the first corresponding (based on RAB ID) transmission by the RNC of a RANAP "RAB ASSIGNMENT RESPONSE" message for successfully established RABs over a granularity period using DER, see TS 25.413. This end value of the time will then be divided by the number of successfully established RABs 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) RAB.SuccEstabPSSetupTimeMean

f) RncFunction.

g) Valid for packet switched traffic.

h) UMTS.

4.1.4.4 RAB PS connection set-up time (Maximum)

a) This measurement provides the maximum time during each granularity period for a RNC to establish a RAB PS connection.

b) GAUGE.

c) This measurement is obtained by monitoring the time intervals for each successful RAB establishment between the receipt by the RNC of a RANAP "RAB ASSIGNMENT REQUEST" message to establish a RAB for PS domain, and the first corresponding (based on RAB ID) transmission by the RNC of a RANAP "RAB ASSIGNMENT RESPONSE" message for successfully established RABs see TS 25.413. 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) RAB.SuccEstabPSSetupTimeMax

f) RncFunction.

g) Valid for packet switched traffic.

h) UMTS.

~~4.2~~4.1.5 RAB release

~~4.2.1~~4.1.5.1 RAB releases for CS domain

a) This measurement provides the number of RAB releases for CS domain pegged by cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB RELEASE REQUEST message for CS domain, each RAB requested to be released is added to the relevant per cause measurement. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Releases for the CS domain. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RAB.RelCS.*Cause*
where *Cause* identifies the release cause.

f) Rnc~~NC~~Function.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.2.2~~4.1.5.2 RAB releases for PS domain

a) This measurement provides the number of RAB releases for PS domain pegged by cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB RELEASE REQUEST message for PS domain, each RAB requested to be released is added to the relevant per cause measurement. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Releases for the PS domain. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RAB.RelPS.*Cause*
where *Cause* identifies the release cause.

f) Rnc~~NC~~Function.

g) Valid for packet switched traffic.

h) UMTS.

4.2 void

4.3 Signalling connection establishment

4.3.1 Attempted signalling connection establishments for CS domain

a) This measurement provides the number of attempts by RNC to establish an Iu control plane connection between the RNC and a CS CN.

NOTE: There is no confirmation in response to this message to indicate that the CN-RNC connection was successfully setup.

b) CC.

c) Transmission of a RANAP Initial UE message by the RNC to the CN. This is sent by the RNC on receipt of an RRC Initial Direct Transfer message from the UE.

d) A single integer value.

e) SIG.AttConnEstabCS.

f) RncFunction.

g) Valid for circuit switching.

h) UMTS.

4.3.2 Attempted signalling connection establishments for PS domain

a) This measurement provides the number of requests by RNC to establish an Iu control plane connection between the RNC and a PS CN.

NOTE: There is no confirmation in response to this message to indicate that the CN-RNC connection was successfully setup.

b) CC.

c) Transmission of a RANAP Initial UE message by the RNC to the CN. This is sent by the RNC on receipt of an RRC Initial Direct Transfer message from the UE.

d) A single integer value.

e) SIG.AttConnEstabPS.

f) RncFunction.

g) Valid for packet switching.

h) UMTS.

4.4 RRC connection establishment

4.4.1 RRC connection establishments

The three measurement types defined in the clause 4.4.1.n are subject to the "2 out of 3 approach".

4.4.1.1 Attempted RRC connection establishments

a) This measurement provides the number of RRC connection establishment attempts for each establishment cause.

b) CC.

c) Receipt of an RRC Connection Request message by the RNC from the UE. Each RRC Connection Request message received is added to the relevant per cause measurement. The possible causes are included in TS 25.331. The sum of all supported per cause measurements shall equal the total number of RRC Connection Establishment attempts. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RRC.AttConnEstab.*Cause*
where *Cause* identifies the Establishment Cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.4.1.2 Failed RRC connection establishments

a) This measurement provides the number of RRC establishment failures for each rejection cause.

b) CC.

c) Transmission of an RRC Connection Reject message by the RNC to the UE or an expected RRC CONNECTION SETUP COMPLETE message not received by the RNC. Each RRC Connection Reject message received is added to the relevant per cause measurement. The possible causes are included in TS 25.331.
Each expected RRC CONNECTION SETUP COMPLETE not received by the RNC is added to the measurement cause 'No Reply' (not specified in TS 25.331).
The sum of all supported per cause measurements shall equal the total number of RRC Connection Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RRC.FailConnEstab.*Cause*
where *Cause* identifies the Rejection Cause.
The cause 'No Reply' is identified by the *.NoReply* suffix.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.4.1.3 Successful RRC connection establishments

a) This measurement provides the number of successful RRC establishments for each establishment cause.

b) CC.

c) Receipt by the RNC of a RRC CONNECTION SETUP COMPLETE message following a RRC establishment attempt. Each RRC Connection Setup Complete message received is added to the relevant per cause measurement. The possible causes are included in TS 25.331. The sum of all supported per cause measurements shall equal the total number of RRC Connection Establishments. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RRC.SuccConnEstab.*Cause*
where *Cause* identifies the Establishment Cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

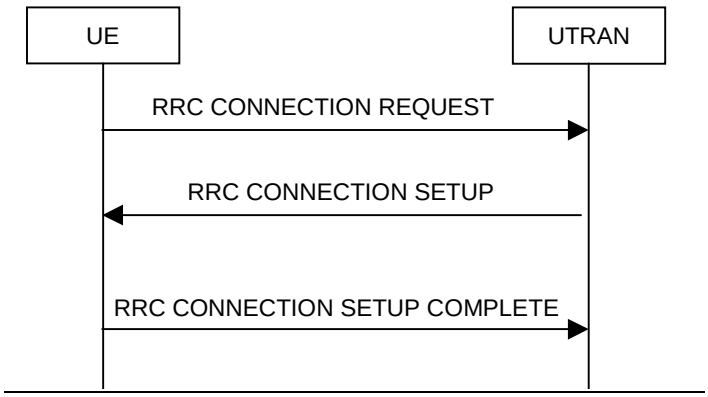
4.4.2 RRC connection establishment setup time

4.4.2.1 RRC connection set-up time (Mean)

a) This measurement provides the mean time per establishment cause it takes for the RNC in order to establish a RRC connection during each granularity period. The measurement is pegged by establishment cause.

b) DER (n=1)

c) This measurement is obtained by accumulating the time intervals for every successful RRC connection establishment per establishment cause between the receipt by the RNC from the UE of a "RRC CONNECTION REQUEST" and the corresponding "RRC CONNECTION SETUP COMPLETE" message over a granularity period using DER. The end value of this time will then be divided by the number of successful RRC connections observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period. The measurement is pegged by establishment cause, see TS 25.331.



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

e) RRC.AttConnEstabTimeMean.*Cause*
where *Cause* identifies the Establishment Cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic

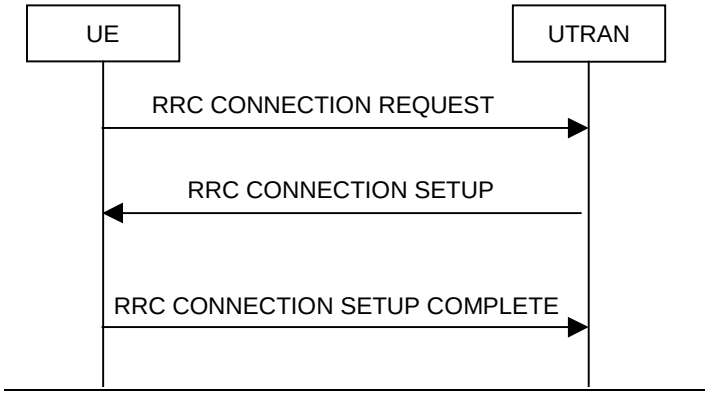
h) UMTS

4.4.2.2 RRC connection set-up time (Max)

a) This measurement provides the maximum time per establishment cause it takes for the RNC in order to establish a RRC connection during each granularity period. The measurement is pegged by establishment cause.

b) GAUGE

c) This measurement is obtained by monitoring the time intervals for each successful RRC connection establishment per establishment cause between the receipt by the RNC from the UE of a "RRC CONNECTION REQUEST" and the corresponding "RRC CONNECTION SETUP COMPLETE" message, see TS 25.331. 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. The measurement is pegged by establishment cause,.



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

e) RRC.AttConnEstabTimeMax.*Cause*
where *Cause* identifies the Establishment Cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic

h) UMTS

4.5 RRC connection re-establishment

The three measurement types defined in the clause 4.5.n are subject to the "2 out of 3 approach".

4.5.1 Attempted RRC re-establishments

a) This measurement provides the number of RRC re-establishments attempts.

b) CC.

c) Receipt by the RNC of a CELL UPDATE message using the Cell Update cause "Radio link failure". See TS 25.331.

d) A single integer value.

e) RRC.AttConnReEstab.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.5.2 Failed RRC re-establishments

a) This measurement provides the number of RRC re-establishment failures.

b) CC.

c) Transmission of an RRC Connection Release message by RNC to the UE or an expected UTRAN Mobility Information Confirm message not received by RNC from the UE. See TS 25.331.
Each RRC Connection Release message received is added to the relevant per cause measurement. The possible causes are included in TS 25.331.
Each expected UTRAN Mobility Information Confirm message not received by the RNC is added to the measurement cause 'No Reply' (not specified in TS 25.331).

The sum of all supported per cause measurements shall equal the total number of RRC re-establishment failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RRC.FailConnReEstab.*Cause*
where *Cause* identifies the Failure Cause.
The cause 'No Reply' is identified by the *.NoReply* suffix.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.5.3 Successful RRC re-establishments

a) This measurement provides the number of successful RRC re-establishments.

b) CC.

c) Receipt by the RNC of a UTRAN MOBILITY INFORMATION CONFIRM in a CELL UPDATE procedure using the value cause "Radio link failure". See TS 25.331.

d) A single integer value.

e) RRC.SuccConnReEstab.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.6 RRC connection release

4.6.1 Attempted RRC connection releases on DCCH

a) This measurement provides the number of RRC connection release attempts per release cause sent from UTRAN to the UE on the DCCH.

b) CC.

c) Transmission of an RRC CONNECTION RELEASE message by the RNC to the UE on DCCH. Each RRC Connection Release message sent on DCCH is added to the relevant per cause measurement. The possible causes are included in TS 25.331. The sum of all supported per cause measurements shall equal the total number of RRC Connection Release attempts on DCCH. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RRC.AttConnRelDCCH.*Cause*
where *Cause* identifies the Release Cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.6.2 Attempted RRC connection releases on CCCH

a) This measurement provides the number of RRC connection release attempts per release cause sent from UTRAN to the UE on the CCCH.

b) CC.

c) Transmission by the RNC of an RRC CONNECTION RELEASE message to the UE on CCCH. Each RRC Connection Release message sent on CCCH is added to the relevant per cause measurement. The possible causes are included in TS 25.331. The sum of all supported per cause measurements shall equal the total number of RRC Connection Release attempts on CCCH. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RRC.AttConnRelCCCH.*Cause*
where *Cause* identifies the Release Cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.7 RLC connection

4.7.1 Number of RLC blocks sent (per Mode)

a) This measurement provides the number of RLC blocks sent by the RNC including retransmitted blocks.

b) CC.

c) Transmission of RLC block, see TS 25.322.

d) RLC.NbrBlocksSent.TM
RLC.NbrBlocksSent.UM
RLC.NbrBlocksSent.AM

e) A single integer value.

f) ~~RNCFunction~~RncFunction, per Mode (Transparent, Unacknowledged and Acknowledged)

g) Valid for packet switching and circuit switching

h) UMTS

4.7.2 Number of RLC blocks Received (per Mode)

a) This measurement provides the number of received RLC blocks by the RNC.

b) CC.

c) Receipt of a RLC blocks from a peer entity and before any error checking, see TS 25.322.

d) RLC.NbrBlocksReceived.TM
RLC.NbrBlocksReceived.UM
RLC.NbrBlocksReceived.AM

e) A single integer value.

f) ~~RNCFunction~~RncFunction per Mode (Transparent, Unacknowledged and Acknowledged)

g) Valid for packet switching and circuit switching

h) UMTS

4.7.3 Discarded RLC blocks by RNC

a) This measurement provides the number of discarded RLC blocksin case of error detection in the RNC (uplink transmission, RNC).

b) CC.

c) Discard of a received block in the RNC, see TS 25.322.

d) RLC.DiscardedBlocksByRNC.

e) A single integer value.

f) RncFunction.

g) Valid for packet switching.

h) UMTS

4.7.4 Number of Retransmitted RLC blocks in Acknowledge Mode

a) This measurement provides the number of retransmitted RLC blocks in RLC acknowledge mode, detected in the UE and signalled to the RNC (downlink transmission, UE).

b) CC.

c) Receipt of a NACK or SACK block from the peer entity (UE) , see TS 25.322.

d) RLC.RetransmittedBlocksToUE.

e) A single integer value.

f) ~~RNCFunction~~RncFunction.

g) Valid for packet switching.

h) UMTS

4.8~~7~~ Soft handover

~~4.7.1~~4.8.1 Radio link additions to active link set (UE side)

The three measurement types defined in the clause 4.8~~7~~.1.n for the radio link additions to active link set (UE side) are subject to the "2 out of 3 approach".

4.8~~7~~.1.1 Attempted radio link additions to active link set (UE side)

a) This measurement provides the number of attempted radio link additions during active link set update procedure (UE side) for each cell. This measurement shall be increased for each attempted radio link addition (UE side). This measurement is only valid for FDD mode.

b) CC.

c) Transmission of an ACTIVE SET UPDATE message (RRC) by the serving RNC to the UE. Within an ACTIVE SET UPDATE message more than one radio link can be added. Each existing radio link addition information element shall be considered separately. See TS 25.331.

d) A single integer value.

e) SHO.AttRLAddUESide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.87.1.2 Successful radio link additions to active link set (UE side)

a) This measurement provides the number of successful radio link additions during active link set update procedure (UE side) for each cell. This measurement shall be increased for each successful radio link addition (UE side). This measurement is only valid for FDD mode.

b) CC.

c) Receipt of an ACTIVE SET UPDATE COMPLETE message (RRC), sent by the UE to the SERVING RNC, in response to an ACTIVE SET UPDATE message with one or more existing radio link addition information element. One ACTIVE SET UPDATE COMPLETE message can be related to more than one added radio link. Each successful added radio link shall be considered separately. See TS 25.331.

d) A single integer value.

e) SHO.SuccRLAddUESide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.87.1.3 Failed radio link additions to active link set (UE side)

a) This measurement provides the number of failed radio link additions during active link set Update procedure (UE side) for each cell per cause. For each failure cause a separate subcounter is defined. Every failed radio link addition (UE side) shall be considered separately. This measurement is only valid for FDD mode.

b) CC.

c) Receipt of an ACTIVE SET UPDATE FAILURE message (RRC) sent by UE to the UTRAN in response to an ACTIVE SET UPDATE message with non-empty radio link addition information element or an expected ACTIVE SET UPDATE COMPLETE message not received by the RNC. Each message can be related to more than one radio link.

- Each failed attempt to add a radio link shall be considered separately and added to the relevant per cause measurement. Failure causes are defined within TS 25.331.

- Each expected ACTIVE SET UPDATE COMPLETE message not received by the RNC is added to the measurement cause 'No Reply' (not specified in TS 25.331).

The sum of all supported per cause measurements shall equal the total number of failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form SHO.FailRLAddUESide.*Cause*
where *Cause* identifies the failure cause.
The cause 'No Reply' is identified by the .*NoReply* suffix.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.8~~7~~.2 Radio link deletions from active link set (UE side)

4.8~~7~~.2.1 Attempted radio link deletions from active link set (UE side)

a) This measurement provides the number of attempted radio link deletions during active link set update procedure (UE side) for each cell. This measurement shall be increased for each attempted radio link deletion (UE side). This measurement is only valid for FDD mode.

b) CC.

c) Transmission of an ACTIVE SET UPDATE message (RRC) by the SERVING RNC to the UE. Within an ACTIVE SET UPDATE message more than one radio link can be removed. Each existing radio link removal information element shall be considered separately. See TS 25.331.

d) A single integer value.

e) SHO.AttRLDelUESide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.8~~7~~.2.2 Successful radio link deletions from active link set (UE side)

a) This measurement provides the number of successful radio link deletions during active link set update procedure (UE side) for each cell. This measurement shall be increased for each successful radio link deletion (UE side). This measurement is only valid for FDD mode.

b) CC.

c) Receipt of an ACTIVE SET UPDATE COMPLETE message (RRC) sent by UE to the Serving RNC in response to an ACTIVE SET UPDATE message with one or more existing radio link removal information element. One ACTIVE SET UPDATE COMPLETE message can be related to more than one deleted radio link. Each successful deleted radio link shall be considered separately. See TS 25.331.

d) A single integer value.

e) SHO.SuccRLDelUESide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.8~~4.9 Radio link addition procedure (UTRAN side)

~~4.8~~4.9.1 Radio link additions (UTRAN side)

The three measurement types defined in the clause ~~4.8~~4.9.1.n for radio link additions (UTRAN side) are subject to the "2 out of 3 approach".

~~4.8~~4.9.1.1 Attempted radio link additions (UTRAN side)

a) This measurement provides the number of attempted radio link additions (UTRAN side) for each cell. This measurement shall be increased for each attempted radio link addition (UTRAN side). This measurement is valid for FDD and TDD mode.

b) CC.

c) This measurement is based on two different events:

- Transmission of a RADIO LINK SETUP REQUEST message (NBAP) by the serving RNC to the NodeB. Within a RADIO LINK SETUP REQUEST message more than one radio link can be added. Each existing radio link information element shall be considered separately. See TS 25.433.

- Transmission of a RADIO LINK ADDITION REQUEST message (RNSAP) by the serving RNC to the drift RNC. Within a RADIO LINK ADDITION REQUEST message more than one radio link can be added. Each existing radio link information element shall be considered separately. See TS 25.423.

d) A single integer value.

e) SHO.AttRLAddUTRANSide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.8~~4.9.1.2 Successful radio link additions (UTRAN side)

a) This measurement provides the number of successful radio link additions (UTRAN side) for each cell. This measurement shall be increased for each successful radio link addition (UTRAN side). This measurement is valid for FDD and TDD mode.

b) CC.

c) This measurement is based on two different events:

- Receipt of a RADIO LINK SETUP RESPONSE message (NBAP) sent by NodeB to the serving RNC in response to a RADIO LINK SETUP REQUEST message with one or more existing radio link information elements. One RADIO LINK SETUP RESPONSE message can be related to more than one added radio link. Each successful added radio link shall be considered separately. See TS 25.433.

- Receipt of a RADIO LINK ADDITION RESPONSE message (RNSAP) sent by drift RNC to the serving RNC in response to a RADIO LINK ADDITION REQUEST message with one or more existing radio link information elements. One RADIO LINK ADDITION RESPONSE message can be related to more than one added radio link. Each successful added radio link shall be considered separately. See TS 25.423.

d) A single integer value.

e) SHO.SuccRLAddUTRANSide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.8~~4.9.1.3 Failed radio link additions (UTRAN side)

a) This measurement provides the number of failed radio link additions (UTRAN side) for each cell. This measurement shall be increased for each failed radio link addition (UTRAN side). For each failure cause a separate measurement is defined. Every failed radio link addition shall be considered separately. This measurement is valid for FDD and TDD mode.

b) CC.

c) This measurement is based on two different events:

- Receipt of a RADIO LINK SETUP FAILURE message (NBAP) sent by NodeB to the serving RNC in response to a RADIO LINK SETUP REQUEST message with one or more existing radio link information elements. One RADIO LINK SETUP FAILURE message can be related to more than one radio link. Each failed attempt to add a radio link shall be considered separately. Failure causes are defined within 3GPP TS 25.443.

- Receipt of a RADIO LINK ADDITION FAILURE message (RNSAP) sent by drift RNC to the serving RNC in response to a RADIO LINK ADDITION REQUEST message with one or more existing radio link information elements. One RADIO LINK ADDITION FAILURE message can be related to more than one radio link. Each failed attempt to add a radio link shall be considered separately. Failure causes are defined within 3GPP TS 25.423.

- The sum of all supported per cause measurements shall equal the total number of Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form SHO.FailRLAddUTRANSide.*Cause*
where *Cause* identifies the failure cause.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.8~~4.9.2 Radio link deletions (UTRAN side)

~~4.8~~4.9.2.1 Attempted radio link deletions (UTRAN side)

a) This measurement provides the number of attempted radio link deletions (UTRAN side) for each cell. This measurement shall be increased for each attempted radio link deletion (UTRAN side). This measurement is valid for FDD and TDD mode.

b) CC.

c) This measurement is based on two different events:

- Transmission of a RADIO LINK DELETION REQUEST message (NBAP) by the serving RNC to the NodeB. Within a RADIO LINK DELETION REQUEST message more than one radio link can be removed. Each existing radio link information element shall be considered separately. See TS 25.433.

- Transmission of a RADIO LINK DELETION REQUEST message (RNSAP) by the serving RNC to the drift RNC. Within a RADIO LINK DELETION REQUEST message more than one radio link can be removed. Each existing radio link information element shall be considered separately. See TS 25.423.

d) A single integer value.

e) SHO.AttRLDelUTRANSide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.8~~4.9.2.2 Successful radio link deletions (UTRAN side)

a) This measurement provides the number of successful radio link deletions (UTRAN side) for each cell. This measurement shall be increased for each successful radio link deletion (UTRAN side). This measurement is valid for FDD and TDD mode.

b) CC.

c) This measurement is based on two different events:

- Receipt of a RADIO LINK DELETION RESPONSE message (NBAP) sent by NodeB to the serving RNC in response to a RADIO LINK DELETION REQUEST message with one or more existing radio link removal information element. One RADIO LINK DELETION RESPONSE message can be related to more than one deleted radio link. Each successful deleted radio link shall be considered separately. See TS 25.433.

- Receipt of a RADIO LINK DELETION RESPONSE message (RNSAP) sent by drift RNC to the serving RNC in response to a RADIO LINK DELETION REQUEST message with one or more existing radio link removal information element. One RADIO LINK DELETION RESPONSE message can be related to more than one deleted radio link. Each successful deleted radio link shall be considered separately. See TS 25.423.

d) A single integer value.

e) SHO.SuccRLDelUTRANSide.

f) UtranCell.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10 Hard handover

~~4.9.1~~4.10.1 Outgoing intra-cell hard handovers

The three measurement types defined in the clause ~~4.9~~4.10.1.n for outgoing intra-cell hard handovers are subject to the "2 out of 3 approach".

~~4.9~~4.10.1.1 Attempted outgoing intra-cell hard handovers

a) This measurement provides the number of attempted outgoing intra-cell hard handovers per neighbour cell relation.

b) CC.

c) Transmission of a RRC message PHYSICAL CHANNEL RECONFIGURATION, RADIO BEARER SETUP, RADIO BEARER RECONFIGURATION, RADIO BEARER RELEASE, or TRANSPORT CHANNEL RECONFIGURATION from the source RNC to the UE, indicating the attempt of an outgoing intra-hell hard handover. See TS 25.331.

d) A single integer value.

e) HHO.AttOutIntraCell.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.1.2 Successful outgoing intra-cell hard handovers

a) This measurement provides the number of successful outgoing intra-cell hard handovers per neighbour cell relation.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION COMPLETE, RADIO BEARER SETUP COMPLETE, RADIO BEARER RECONFIGURATION COMPLETE, RADIO BEARER RELEASE COMPLETE, or TRANSPORT CHANNEL RECONFIGURATION COMPLETE sent from the UE to the source RNC, indicating a successful outgoing intra-cCell hard handover. See TS 25.331.

d) A single integer value.

e) HHO.SuccOutIntraCell.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.1.3 Failed outgoing intra-cell hard handovers

a) This measurement provides the number of failed outgoing intra-cell hard handovers per neighbour cell relation per cause, where the UE returned to the original physical channel configuration.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION FAILURE, RADIO BEARER SETUP FAILURE, RADIO BEARER RECONFIGURATION FAILURE, RADIO BEARER RELEASE FAILURE, or TRANSPORT CHANNEL RECONFIGURATION FAILURE sent from the UE to the source RNC, indicating a failed outgoing intra-cell hard handover. Failure causes are defined within TS 25.331. The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form HHO.FailOutIntraCell.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9.2~~4.10.2Outgoing intra-NodeB hard handovers

The three measurement types defined in the clause ~~4.9~~4.10.2.n for outgoing intra-NodeB hard handovers are subject to the "2 out of 3 approach".

~~4.9~~4.10.2.1 Attempted outgoing intra-NodeB hard handovers

a) This measurement provides the number of attempted outgoing intra-NodeB hard handovers per neighbour cell relation.

b) CC.

c) Transmission of a RRC message PHYSICAL CHANNEL RECONFIGURATION, RADIO BEARER SETUP, RADIO BEARER RECONFIGURATION, RADIO BEARER RELEASE, or TRANSPORT CHANNEL RECONFIGURATION from the source RNC to the UE, indicating the attempt of an outgoing intra-NodeB hard handover. See TS 25.331.

d) A single integer value.

e) HHO.AttOutIntraNodeB.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.2.2 Successful outgoing intra-NodeB hard handovers

a) This measurement provides the number of successful outgoing intra-NodeB hard handovers per neighbour cell relation.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION COMPLETE, RADIO BEARER SETUP COMPLETE, RADIO BEARER RECONFIGURATION COMPLETE, RADIO BEARER RELEASE COMPLETE, or TRANSPORT CHANNEL RECONFIGURATION COMPLETE sent from the UE to the source RNC, indicating a successful outgoing intra-NodeB hard handover. See TS 25.331.

d) A single integer value.

e) HHO.SuccOutIntraNodeB.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.2.3 Failed outgoing intra-NodeB hard handovers

a) This measurement provides the number of failed outgoing intra-NodeB hard handovers per neighbour cell relation per cause, where the UE returned to the original physical channel configuration.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION FAILURE, RADIO BEARER SETUP FAILURE, RADIO BEARER RECONFIGURATION FAILURE, RADIO BEARER RELEASE FAILURE, or TRANSPORT CHANNEL RECONFIGURATION FAILURE sent from the UE to the source RNC, indicating a failed outgoing intra-NodeB hard handover. Failure causes are defined within 3GPP TS25.331.
The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form HHO.FailOutIntraNodeB.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9.3~~4.10.3Outgoing inter-NodeB, intra-RNC hard handovers

The three measurement types defined in the clause ~~4.9~~4.10.3.n for outgoing inter-NodeB, intra-RNC hard handovers are subject to the "2 out of 3 approach".

~~4.9~~4.10.3.1 Attempted outgoing inter-NodeB, intra-RNC hard handovers

a) This measurement provides the number of attempted outgoing inter-NodeB, intra-RNC hard handovers per neighbour cell relation.

b) CC.

c) Transmission of a RRC message PHYSICAL CHANNEL RECONFIGURATION, RADIO BEARER SETUP, RADIO BEARER RECONFIGURATION, RADIO BEARER RELEASE, or TRANSPORT CHANNEL RECONFIGURATION from the source RNC to the UE, indicating the attempt of an outgoing inter-NodeB, intra-RNC hard handover. See TS 25.331.

d) A single integer value.

e) HHO.AttOutInterNodeBIntraRNC.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.3.2 Successful outgoing inter-NodeB, intra-RNC hard handovers

a) This measurement provides the number of successful outgoing inter-NodeB, intra-RNC hard handovers per neighbour cell relation.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION COMPLETE, RADIO BEARER SETUP COMPLETE, RADIO BEARER RECONFIGURATION COMPLETE, RADIO BEARER RELEASE COMPLETE, or TRANSPORT CHANNEL RECONFIGURATION COMPLETE sent from the UE to the source RNC, indicating a successful outgoing inter-NodeB, intra-RNC hard handover. See TS 25.331.

d) A single integer value.

e) HHO.SuccOutInterNodeBIntraRNC.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.3.3 Failed outgoing inter-NodeB, intra-RNC hard handovers

a) This measurement provides the number of failed outgoing inter-NodeB, intra-RNC hard handovers per neighbour cell relation per cause, where the UE returned to the original physical channel configuration.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION FAILURE, RADIO BEARER SETUP FAILURE, RADIO BEARER RECONFIGURATION FAILURE, RADIO BEARER RELEASE FAILURE, or TRANSPORT CHANNEL RECONFIGURATION FAILURE sent from the UE to the source RNC, indicating a failed outgoing inter-NodeB, intra-RNC hard handover. Failure causes are defined within TS 25.331.
The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .*sum* suffix.

e) The measurement name has the form HHO.FailOutInterNodeBIntraRNC.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9.4~~4.10.4 Outgoing inter-RNC hard handovers via Iur

The three measurement types defined in the clause ~~4.9~~4.10.4.n for outgoing inter-RNC hard handovers are subject to the "2 out of 3 approach".

~~4.9~~4.10.4.1 Attempted outgoing inter-RNC hard handovers via Iur

a) This measurement provides the number of attempted outgoing inter-RNC hard handovers via Iur per neighbour cell relation.

b) CC.

c) Transmission of a RRC message PHYSICAL CHANNEL RECONFIGURATION, RADIO BEARER SETUP, RADIO BEARER RECONFIGURATION, RADIO BEARER RELEASE, or TRANSPORT CHANNEL RECONFIGURATION from the source RNC to the UE, indicating the attempt of an outgoing inter-RNC hard handover via Iur. See TS 25.331.

d) A single integer value.

e) HHO.AttOutInterRNCIur.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.4.2 Successful outgoing inter-RNC hard handovers via Iur

a) This measurement provides the number of successful outgoing inter-RNC hard handovers via Iur per neighbour cell relation.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION COMPLETE, RADIO BEARER SETUP COMPLETE, RADIO BEARER RECONFIGURATION COMPLETE, RADIO BEARER RELEASE COMPLETE, or TRANSPORT CHANNEL RECONFIGURATION COMPLETE sent from the UE to the source RNC, indicating a successful outgoing inter-RNC hard handover via Iur. See TS 25.331.

d) A single integer value.

e) HHO.SuccOutInterRNCIur.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.4.3 Failed outgoing inter-RNC hard handovers via Iur

a) This measurement provides the number of failed outgoing inter-RNC hard handovers via Iur per neighbour cell relation per cause, where the UE returned to the original physical channel configuration.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION FAILURE, RADIO BEARER SETUP FAILURE, RADIO BEARER RECONFIGURATION FAILURE, RADIO BEARER RELEASE FAILURE, or TRANSPORT CHANNEL RECONFIGURATION FAILURE sent from the UE to the source RNC, indicating a failed outgoing inter-RNC hard handover via Iur. Failure causes are defined within TS 25.331. The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .*sum* suffix.

e) The measurement name has the form HHO.FailOutInterRNCIur.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

~~4.9~~4.10.5 Relocation preparation for outgoing inter-RNC hard handovers switching in the CN

The three measurement types defined in the clause ~~4.9~~4.10.5.n for relocation preparation for outgoing inter-RNC hard handovers switching in the CN are subject to the "2 out of 3 approach".

~~4.9~~4.10.5.1 Attempted relocation preparation for outgoing inter-RNC hard handovers switching in the CN

a) This measurement provides the number of attempted relocation preparation for outgoing inter-RNC hard handovers switching in the CN per neighbour cell relation.

b) CC.

c) Transmission of a RANAP message RELOCATION REQUIRED from the source RNC to the CN (Source side), indicating an attempted relocation preparation of a outgoing inter-RNC hard handover switching in the CN. See TS 25.413.

d) A single integer value.

e) HHO.AttRelocPrepOutInterRNCCN.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.5.2 Successful relocation preparation for outgoing inter-RNC hard handovers switching in the CN

a) This measurement provides the number of successful relocation for outgoing inter-RNC hard handovers switching in the CN per neighbour cell relation.

b) CC.

c) Receipt of a RANAP message RELOCATION COMMAND sent from the CN (Source side) to the source RNC, indicating a successful relocation preparation of a outgoing inter-RNC hard handover switching in the CN. See TS 25.413.

d) A single integer value.

e) HHO.SuccAttRelocPrepOutInterRNCCN.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.5.3 Failed relocation preparation for outgoing inter-RNC hard handovers switching in the CN

a) This measurement provides number of failed relocation for outgoing inter-RNC hard handovers switching in the CN per neighbour cell relation per cause.

b) CC.

c) Receipt of a RANAP message RELOCATION PREPARATION FAILURE sent from the CN (Source side) to the source RNC, indicating a failed relocation preparation for outgoing inter-RNC hard handover switching in the CN. Failure causes are defined within TS 25.413. The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form HHO.FailRelocPrepOutInterRNCCN.*Cause*
where *Cause* identifies the name of the failure cause.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9.6~~4.10.6Outgoing inter-RNC hard handovers switching in the CN

The three measurement types defined in the clause ~~4.9~~4.10.6.n for outgoing inter-RNC hard handovers switching in the CN are subject to the "2 out of 3 approach".

~~4.9~~4.10.6.1 Attempted outgoing inter-RNC hard handovers switching in the CN

a) This measurement provides the number of attempted outgoing -nter-RNC hard handovers switching in the CN per neighbour cell relation related to Ues.

b) CC.

c) Transmission of a RRC message PHYSICAL CHANNEL RECONFIGURATION, RADIO BEARER SETUP, RADIO BEARER RECONFIGURATION, RADIO BEARER RELEASE, or TRANSPORT CHANNEL RECONFIGURATION from the source RNC to the UE, indicating the attempt of an inter-RNC hard handover switching in the CN. See TS 25.331.

d) A single integer value.

e) HHO.AttOutInterRNCCN.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.6.2 Successful outgoing inter-RNC hard handovers switching in the CN

a) This measurement provides the number of successful outgoing inter-RNC hard handovers switching in the CN per neighbour cell relation related to Ues.

b) CC.

c) Receipt of a RANAP message Iu RELEASE COMMAND sent from the CN (Source side) to the source RNC, indicating a successful inter-RNC hard handover switching in the CN. See TS 25.413.

d) A single integer value.

e) HHO.SuccOutInterRNCCN.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.9~~4.10.6.3 Failed outgoing inter-RNC hard handovers switching in the CN

a) This measurement provides the number of failed outgoing inter-RNC hard handovers switching in the CN per neighbour cell relation related to Ues, where the UE returned to the original physical channel configuration.

b) CC.

c) Receipt of a RRC message PHYSICAL CHANNEL RECONFIGURATION FAILURE, RADIO BEARER SETUP FAILURE, RADIO BEARER RECONFIGURATION FAILURE, RADIO BEARER RELEASE FAILURE, or TRANSPORT CHANNEL RECONFIGURATION FAILURE sent from the UE to the source RNC, indicating a failed inter-RNC hard handover switching in the CN. Failure causes are defined within 3GPP TS25.331.
The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form HHO.FailOutInterRNCCN.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.11 ~~4.10~~ Relocation

~~4.10.1~~4.11.1 Relocations preparations

The three measurement types defined in the clause 4.~~10~~11.1.n for relocations preparations are subject to the "2 out of 3 approach".

4.11.1.1 ~~4.10.1.1~~ Attempted relocations preparations

a) This measurement provides the number of attempted relocation preparations ('UE involved' and 'UE non involved' Relocations).

b) CC.

c) Transmission of a RANAP message RELOCATION REQUIRED from the source RNC to the CN (Source side), indicating an attempted relocation preparation. See TS 25.413.

d) A single integer value.

e) RELOC.AttPrep.

f) RncFunction.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.11.1.2 ~~4.10.1.2~~ Successful relocation preparations

a) This measurement provides the number of successful relocation preparations ('UE involved' and 'UE non involved' Relocations).

b) CC.

c) Receipt of a RANAP message RELOCATION COMMAND sent from the CN (Source side) to the source RNC, indicating a successful relocation preparation. See TS 25.413.

d) A single integer value.

e) RELOC.SuccPrep.

f) RncFunction.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.11.1.3 ~~4.10.1.3~~ Failed relocation preparations

a) This measurement provides number of failed relocation preparations per cause ('UE involved' and 'UE non involved' Relocations).

b) CC.

c) Receipt of a RANAP message RELOCATION PREPARATION FAILURE sent from the CN (Source side) to the source RNC, indicating a failed relocation preparation. Failure causes are defined within TS 25.413.
The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form RELOC.FailPrep.*Cause*
where *Cause* identifies the failure cause.

f) RncFunction.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

4.11.2 ~~4.10.2~~ Relocations

4.11.2.1 ~~4.10.2.1~~ Successful relocations

a) This measurement provides the number of successful relocations ('UE involved' and 'UE non involved' Relocations).

b) CC.

c) Receipt of a RANAP message Iu RELEASE COMMAND sent from the CN (Source side) to the source RNC in response to a RELOCATION REQUIRED message, indicating a successful relocation. See TS 25.413.

d) A single integer value.

e) RELOC.Succ.

f) RncFunction.

g) Valid for circuit switched and packet switched traffic.

h) UMTS.

~~4.11~~4.12 Circuit switched inter-RAT handover

~~4.11.1~~4.12.1 Relocation preparation for outgoing circuit switched inter-RAT handovers

The three measurement types defined in the clause ~~4.11~~4.12.1.n for relocation preparation for outgoing circuit switched inter-RAT handovers are subject to the "2 out of 3 approach".

~~4.11~~4.12.1.1 Attempted relocation preparation for outgoing circuit switched inter-RAT handovers

a) This measurement provides the number of attempted relocation preparations for outgoing circuit switched inter-RAT handovers per neighbour cell.

b) CC.

c) Transmission of a RANAP message RELOCATION REQUIRED from the serving RNC to the CN, indicating an attempted relocation preparation of an outgoing inter-RAT handover. See TS 25.413.

d) A single integer value.

e) IRATHO.AttRelocPrepOutCS.

f) UtranRelation.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11~~4.12.1.2 Successful relocation preparation for outgoing circuit switched inter-RAT handovers

a) This measurement provides the number of successful relocation preparations for outgoing circuit switched inter-RAT handovers per neighbour cell.

b) CC.

c) Receipt of a RANAP message RELOCATION COMMAND sent from the CN to the serving RNC, indicating a successful relocation preparation of an inter-RAT handover. See TS 25.413.

d) A single integer value.

e) IRATHO.SuccRelocPrepOutCS.

f) UtranRelation.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11~~4.12.1.3 Failed relocation preparation for outgoing circuit switched inter-RAT handovers

a) This measurement provides number of failed relocation preparations for outgoing circuit switched inter-RAT handovers per neighbour cell per cause.

b) CC.

c) Receipt of a RANAP message RELOCATION PREPARATION FAILURE sent from the CN to the serving RNC, indicating a failed relocation preparation for outgoing inter-RAT handovers. Failure causes are defined within TS 25.413.
The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form IRATHO.FailRelocPrepOutCS.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11.2~~4.12.2 Outgoing circuit switched inter-RAT handovers

The three measurement types defined in the clause ~~4.11~~4.12.2.n for outgoing circuit switched inter-RAT handovers are subject to the "2 out of 3 approach".

~~4.11~~4.12.2.1 Attempted outgoing circuit switched inter-RAT handovers

a) This measurement provides the number of attempted outgoing circuit switched inter-RAT handovers per neighbour cell from Ues point of view.

b) CC.

c) Transmission of a RRC-message INTER RADIO ACCESS TECHNOLOGY HANDOVER COMMAND from serving RNC to the UE, indicating an attempted outgoing inter-RAT handover. See TS 25.331.

d) A single integer value.

e) IRATHO.AttOutCS.

f) UtranRelation.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11~~4.12.2.2 Successful outgoing circuit switched inter-RAT handovers

a) This measurement provides the number of successful outgoing circuit switched inter-RAT handovers per neighbour cell from Ues point of view.

b) CC.

c) Receipt of a RANAP message Iu RELEASE COMMAND sent from the CN to the serving RNC, indicating a successful inter-RAT handover. See TS 25.413.

d) A single integer value.

e) IRATHO.SuccOutCS.

f) UtranRelation.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11~~4.12.2.3 Failed outgoing circuit switched inter-RAT handovers

a) This measurement provides the number of failed outgoing circuit switched inter-RAT handovers per neighbour cell per cause from Ues point of view, where the UE returned to the original physical channel configuration.

b) CC.

c) Receipt of a RRC message INTER RADIO ACCESS TECHNOLOGY HANDOVER FAILURE sent from the UE to the serving RNC, indicating a failed inter-RAT handover. Failure causes are defined within TS 25.331. The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form IRATHO.FailOutCS.*Cause*
where *Cause* identifies the failure cause.

f) UtranRelation.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11.3~~4.12.3 Incoming circuit switched inter-RAT handovers

The three measurement types defined in the clause ~~4.11~~4.12.3.n for incoming circuit switched inter-RAT handovers are subject to the "2 out of 3 approach".

~~4.11~~4.12.3.1 Attempted incoming circuit switched inter-RAT handovers

a) This measurement provides the number of attempted incoming circuit switched inter-RAT handovers for each cell.

b) CC.

c) Receipt of a RANAP RELOCATION REQUEST message sent from the CN to the target RNC, indicating the attempt of an inter-RAT handover. See TS 25.413.

d) A single integer value.

e) IRATHO.AttIncCS.

f) UtranCell.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11~~4.12.3.2 Successful incoming circuit switched inter-RAT handovers

a) This measurement provides the number of successful incoming circuit switched interRAT handovers for each cell.

b) CC.

c) Receipt of a RRC HANDOVER TO UTRAN COMPLETE message sent from the UE to the target RNC, indicating a successful interRAT handover. See TS 25.331.

d) A single integer value.

e) IRATHO.SuccIncCS.

f) UtranCell.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.11~~4.12.3.3 Failed incoming circuit switched inter-RAT handovers

a) This measurement provides the number of failed incoming circuit switched interRAT handovers per cell per cause.

b) CC.

c) Receipt of a RANAP message RELOCATION FAILURE sent from the CN to the target RNC, indicating a failed relocation preparation for incoming inter-RAT handovers. Failure causes are defined within TS 25.413. The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form IRATHO.FailIncCS.*Cause*
where *Cause* identifies the failure cause.

f) UtranCell.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.12~~4.13 Packet switched inter-RAT handover

~~4.12.1~~4.13.1 Outgoing packet switched inter-RAT handovers, UTRAN controlled

The three measurement types defined in the clause ~~4.12~~4.13.1.n for outgoing packet switched inter-RAT handovers, UTRAN controlled are subject to the "2 out of 3 approach".

~~4.12~~4.13.1.1 Attempted outgoing packet switched inter-RAT handovers, UTRAN controlled

a) This measurement provides the number of attempted outgoing, UTRAN controlled, Packet Switched interRAT handovers per cell.

b) CC.

c) Transmission of a RRC-message, CELL CHANGE ORDER FROM UTRAN, from source RNC to the UE, indicating a attempted outgoing Packet Switched inter-RAT handover. See TS 25.331.

d) A single integer value.

e) IRATHO.AttOutPSUTRAN.

f) UtranCell.

g) Valid for packet switched traffic.

h) UMTS.

~~4.12~~4.13.1.2 Successful outgoing packet switched inter-RAT handovers, UTRAN controlled

a) This measurement provides the number of successful outgoing, UTRAN controlled, Packet Switched interRAT handovers per cell.

b) CC.

c) Transmission of a RANAP message, Iu RELEASE COMMAND, from the PS CN to the source RNC, indicating a successful outgoing Packet Switched inter-RAT handover. See TS 25.413.

d) A single integer value.

e) IRATHO.SuccOutPSUTRAN.

f) UtranCell.

g) Valid for packet switched traffic.

h) UMTS.

~~4.12~~4.13.1.3 Failed outgoing packet switched inter-RAT handovers UTRAN controlled

a) This measurement provides the number of failed outgoing, UTRAN controlled, Packet Switched interRAT handovers per cause, where the UE resumes the connection to UTRAN using the same resources used before receiving the cell change order. This is measured per cell.

b) CC.

c) Receipt of an RRC message, CELL CHANGE FAILURE FROM UTRAN, sent from the UE to the source RNC, indicating a failed inter-RAT handover. Failure causes are defined within TS 25.331.
The sum of all supported per cause measurements shall equal the total number of failed events. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form IRATHO.FailOutPSUTRAN.*Cause*
where *Cause* identifies the failure cause.

f) UtranCell.

g) Valid for packet switched traffic.

h) UMTS.

~~4.12~~4.13.2 Outgoing packet switched inter-RAT handovers, UE controlled

~~4.12~~4.13.2.1 Successful outgoing packet switched inter-RAT handovers, UE controlled

a) This measurement provides the number of successful outgoing, UE controlled, Packet Switched inter-RAT handovers per cell.

b) CC.

c) Receipt of an RANAP message, SRNS CONTEXT REQUEST, sent from the PS CN to the serving RNC, indicating a successful outgoing UE controlled Packet Switched inter-RAT handover. See TS 25.413.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported.

e) IRATHO.SuccOutPSUE.

f) UtranCell.

g) Valid for packet switched traffic.

h) UMTS.

5.6 Session Management

5.6.1 Attempted PDP context activation procedures initiated by MS

a) This measurement provides the number of attempted PDP context activation procedures. These include the static as well as the dynamic PDP addresses.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Activate PDP Context Request" message from the MS (TS 24.008).

d) A single integer value.

e) SM.AttActPdpContext:

SM.AttActPdpContext	Combined (don't care)
SM.AttActPdpContext.G	GSM
SM.AttActPdpContext.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.2 Attempted dynamic PDP context activation procedures initiated by MS

a) This measurement provides the number of attempted PDP context activation requests where a dynamic PDP address is required to be used.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Activate PDP Context Request" message from the MS with an empty PDP address (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.AttActPdpContextDyn:

SM.AttActPdpContextDyn	Combined (don't care)
SM.AttActPdpContextDyn.G	GSM
SM.AttActPdpContextDyn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.3 Successful PDP context activation procedures initiated by MS

a) This measurement provides the number of successfully completed PDP context activations. For these context activations, the GGSN is updated successfully.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Activate PDP Context Accept" message to the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.SuccActPdpContext:

SM.SuccActPdpContext	Combined (don't care)
SM.SuccActPdpContext.G	GSM
SM.SuccActPdpContext.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.4 Successful dynamic PDP context activation procedures initiated by MS

a) This measurement provides the number of successfully completed PDP context activations where a dynamic PDP address is used.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Activate PDP Context Accept" message to the MS (TS 24.008), the PDP address has been dynamically assigned.

d) A single integer value per measurement type defined in e).

e) SM.SuccActPdpContextDyn:

SM.SuccActPdpContextDyn	Combined (don't care)
SM.SuccActPdpContextDyn.G	GSM
SM.SuccActPdpContextDyn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.5 mean number of activated PDP contexts

a) Mean number of activated PDP contexts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number activated PDP contexts, and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) SM.MeanActPDPContext:

SM.MeanActPDPContext	Combined (don't care)
SM.MeanActPDPContext.G	GSM
SM.MeanActPDPContext.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.6 Attempted PDP context deactivation procedures initiated by the MS

a) This measurement provides the number of PDP context deactivation procedures initiated by the MS.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Deactivate PDP Context Request" message from the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.AttDeactPdpContextMs:

SM.AttDeactPdpContextMs	Combined (don't care)
SM.AttDeactPdpContextMs.G	GSM
SM.AttDeactPdpContextMs.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.7 Successful PDP context deactivation procedures initiated by the MS

a) This measurement provides the number of successfully completed PDP context deactivations. For these context deactivations, the GGSN is updated successfully (i.e. deletion of the PDP context).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Deactivate PDP Context Accept" message to the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.SuccDeactPdpContextMs:

SM.SuccDeactPdpContextMs	Combined (don't care)
SM.SuccDeactPdpContextMs.G	GSM
SM.SuccDeactPdpContextMs.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.8 Number of active PDP context

a) This measurement provides the number of active PDP context.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) The gauge will be incremented when a PDP context is created and will be decremented when a PDP context is deleted.

d) A single integer value per measurement type defined in e).

e) SM.NbrActPdpContext:

SM.NbrActPdpContext	Combined (don't care)
SM.NbrActPdpContext.G	GSM
SM.NbrActPdpContext.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.9 Number of mobile subscribers with activated PDP context (i.e. subscribers that can send/receive GPRS packet data)

a) This measurement provides the number of mobile subscribers with activated PDP context (i.e. subscribers that can send/receive GPRS packet data).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) Addition of first PDP context or removal of last PDP context in SGSN location register for a particular subscriber.

d) A single integer value per measurement type defined in e).

e) SM.NbrActivePdpPerSgsn:

SM.NbrActivePdpPerSgsn	Combined (don't care)
SM.NbrActivePdpPerSgsn.G	GSM
SM.NbrActivePdpPerSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.10 Mean number of subscribers that have an activated PDP context (i.e. subscribers that can send/receive GPRS packet data)

a) This measurement provides the arithmetic mean number value of subscribers that have an activated PDP context (i.e. subscribers that can send/receive GPRS packet data).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number of subscribers with activated PDP context in SGSN, and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) SM.MeanActivePdpPerSgsn:

SM.MeanActivePdpPerSgsn	Combined (don't care)
SM.MeanActivePdpPerSgsn.G	GSM
SM.MeanActivePdpPerSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.11 Attempted PDP context deactivation procedures initiated by the GGSN

a) This measurement provides the number of PDP context deactivation procedures initiated by the GGSN. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Delete PDP Context Request" message from the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.AttDeactPdpContextGgsn:

SM.AttDeactPdpContextGgsn	Combined (don't care)
SM.AttDeactPdpContextGgsn.G	GSM
SM.AttDeactPdpContextGgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.12 Successful PDP context deactivation procedures initiated by the GGSN

a) This measurement provides the number of successfully handled PDP context deactivations initiated by the GGSN. For these context deactivations, the MS has accepted the PDP context deactivation.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Delete PDP Context Response" message to the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.SuccDeactPdpContextGgsn:

SM.SsuccDeactPdpContextGgsn	Combined (don't care)
SM.SsuccDeactPdpContextGgsn.G	GSM
SM.SsuccDeactPdpContextGgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.13 Attempted PDP context deactivation procedures initiated by the SGSN

a) This measurement provides the number of PDP context deactivation procedures initiated by the SGSN. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmision of a "Delete PDP Context Request" message to the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.AttDeactPdpContextSgsn:

SM.AttDeactPdpContextSgsn	Combined (don't care)
SM.AttDeactPdpContextSgsn.G	GSM
SM.AttDeactPdpContextSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.14 Successful PDP context deactivations initiated by the SGSN

a) This measurement provides the number of successfully handled PDP context deactivations initiated by the SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "deactivate PDP Context Accept" message from the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.SuccDeactPdpContextSgsn:

SM.SuccDeactPdpContextSgsn	Combined (don't care)
SM.SuccDeactPdpContextSgsn.G	GSM
SM.SuccDeactPdpContextSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.15 Attempted SGSN-Initiated PDP context update procedures

a) This measurement provides the number of attempted SGSN-Initiated PDP context update procedures. An Update PDP Context Request message shall be sent from a SGSN to a GGSN as part of the GPRS Inter SGSN Routeing Update procedure or the PDP Context Modification procedure or to redistribute contexts due to load sharing. It shall be used to change the QoS and the path. The message shall be sent by the new SGSN at the Inter SGSN Routeing Update procedure.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmision of an "Update PDP Context Request" message to the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.AttUpdPdpContextSgsn:

SM.AttUpdPdpContextSgsn	Combined (don't care)
SM.AttUpdPdpContextSgsn.G	GSM
SM.AttUpdPdpContextSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.16 Successful SGSN-Initiated PDP context update procedures

a) This measurement provides the number of successfully handled SGSN-Initiated PDP context update procedures. These updates are performed successfully when a positive update PDP context response is received from the GGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Update PDP Context Response" message from the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.SsuccUpdPdpContextSgsn:

SM.SsuccUpdPdpContextSgsn	Combined (don't care)
SM.SsuccUpdPdpContextSgsn.G	GSM
SM.SsuccUpdPdpContextSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.17 Attempted GGSN-Initiated PDP context update procedures

a) This measurement provides the number of attempted GGSN-Initiated PDP context update procedures. An Update PDP Context Request may also be sent from a GGSN to a SGSN to re-negotiate the QoS of a PDP context. This GGSN-initiated Update PDP Context Request can also be used to provide a PDP address to the SGSN (and MS). The latter shall be used by GGSN when it acts as a DHCP Relay Agent or Mobil IP Foreign Agent.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Update PDP Context Request" message from the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.AttUpdPdpContextGgsn:

SM.AttUpdPdpContextGgsn	Combined (don't care)
SM.AttUpdPdpContextGgsn.G	GSM
SM.AttUpdPdpContextGgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.18 Successful GGSN-Initiated PDP context update procedures

a) This measurement provides the number of successfully handled GGSN-Initiated PDP context update procedures. These updates are performed successfully when a positive update PDP context response is received from the SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Update PDP Context Response" message to the GGSN (TS 29.060).

d) A single integer value per measurement type defined in e).

e) SM.SuccUpdPdpContextGgsn:

SM.SuccUpdPdpContextGgsn	Combined (don't care)
SM.SuccUpdPdpContextGgsn.G	GSM
SM.SuccUpdPdpContextGgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.19 Attempted SGSN-Initiated PDP context modifications procedures.

a) This measurement provides the number of attempted SGSN-Initiated PDP context modifications procedures. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Modify PDP Context Request" message to the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.AttModPdpContextSgsn:

SM.AttModPdpContextSgsn	Combined (don't care)
SM.AttModPdpContextSgsn.G	GSM
SM.AttModPdpContextSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.20 Successfully SGSN-Initiated PDP context modifications procedures

a) This measurement provides the number of successfully handled SGSN-Initiated PDP context modifications procedures. These modifications are performed successfully when a positive Modify PDP Context Accept is received from the MS.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Modify PDP Context Accept" message from the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.SuccModPdpContextSgsn:

SM.SuccModPdpContextSgsn	Combined (don't care)
SM.SuccModPdpContextSgsn.G	GSM
SM.SuccModPdpContextSgsn.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.21 Attempted MS-Initiated PDP context modifications procedures.

a) This measurement provides the number of attempted MS-Initiated PDP context modifications procedures. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Modify PDP Context Request" message from the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.AttModPdpContextMs:

SM.AttModPdpContextMs	Combined (don't care)
SM.AttModPdpContextMs.G	GSM
SM.AttModPdpContextMs.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.22 Successfully MS-Initiated PDP context modifications procedures

a) This measurement provides the number of successfully handled MS-Initiated PDP context modifications procedures. These modifications are performed successfully when a positive Modify PDP Context Accept is received from the MS.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Modify PDP Context Accept" message to the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.SsuccModPdpContextMs:

SM.SsuccModPdpContextMs	Combined (don't care)
SM.SsuccModPdpContextMs.G	GSM
SM.SsuccModPdpContextMs.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.23 Attempted Secondary PDP context activation procedures.

a) This measurement provides the number of attempted Secondary PDP context activation procedures. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Activate Secondary PDP Context Request" message from the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.AttActSecondPdpContext:

SM.AttActSecondPdpContext	Combined (don't care)
SM.AttActSecondPdpContext.G	GSM

SM.AttActSecondPdpContext.U UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.24 Successful Secondary PDP context activations.

a) This measurement provides the number of successfully completed Secondary PDP context activations. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Activate Secondary PDP Context Accept" message to the MS (TS 24.008).

d) A single integer value per measurement type defined in e).

e) SM.SuccActSecondPdpContext:

SM.SuccActSecondPdpContext	Combined (don't care)
SM.SuccActSecondPdpContext.G	GSM
SM.SuccActSecondPdpContext.U	UMTS

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.25 Failed PDP context activation procedures initiated by MS

a) This measurement provides the number of Failed PDP context activation procedures. These include the static as well as the dynamic PDP addresses. This measurement is pegged by failure cause.

b) CC.

c) Transmission by the SGSN of a ACTIVATE PDP CONTEXT REJECT message indicating a PDP context activation failure, the measurement is incremented according to the failure cause. Possible causes are included in TS 24.008. The sum of all supported per cause measurements should equal the total number of PDP context activation failures.

d) A single integer value.

e) The measurement name has the form SM.FailActPdpCtxtMs.Cause
where Cause identifies the failure cause.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.26 Failed PDP context activation procedures initiated by Network

~~i)~~a) This measurement provides the number of Failed PDP context activation procedures. These include the static as well as the dynamic PDP addresses. This measurement is pegged by failure cause.

~~j)~~b) CC.

~~k)~~c) Receipt of a " REQUEST PDP CONTEXT ACTIVATION REJECT " message from the MS (TS 24.008) message indicating a PDP context activation failure, the measurement is incremented according to the failure cause. Possible causes are included in TS 24.008. The sum of all supported per cause measurements should equal the total number of PDP context activation failures.

~~l)~~d) A single integer value.

~~m)~~e) The measurement name has the form SM.FailActPdpCtxtNtwk.Cause
where Cause identifies the failure cause.

~~n)~~f) SgsnFunction.

~~o)~~g) Valid for packet switching.

~~p)~~h) GSM/UMTS.

5.6.27~~6~~ Abnormal PDP context Deactivation procedures

a) This measurement provides the number of PDP context deactivation procedures initiated by the SGSN. This measurement is pegged by cause.

b) CC.

c) Transmission of a "Delete PDP Context Request" message to the GGSN (TS 29.060). the measurement is incremented according to the deletion cause. Possible causes are included in TS 24.008. The sum of all supported per cause measurements should equal the total number of PDP context activation failures.

d) A single integer value.

e) SM.AttDeactPdpContextSgsn.cause

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

5.6.28 PDP Context set-up time, initiated by MS (Mean)

a) This measurement provides the mean time it takes for the SGSN in order to established a PDP context during each collection interval. The measurement is pegged by traffic class per APN (see TS 23.003 for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful mobile originated PDP context activation between the receipt by the SGSN of an " ACTIVATE PDP CONTEXT REQUEST" from the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060, TS 24.008 and TS 23.107 for service class definitions. This end value of the time will then be divided by the number of successful mobile originated PDP context activations 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) SM. SuccActPdpContextAPNTimeMOMean.Conv
SM. SuccActPdpContextAPNTimeMOMean.Strm
SM. SuccActPdpContextAPNTimeMOMean.Intact
SM. SuccActPdpContextAPNTimeMOMean.Bgrd

f) SgsnFunction, per APN.

g) Valid for packet switched traffic.

h) GSM/UMTS

5.6.29 PDP Context set-up time, initiated by MS (Max)

a) This measurement provides the maximum time it takes for the SGSN in order to established a PDP context during each collection interval. The measurement is pegged by traffic class per APN (see TS 23.003 for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

b) GAUGE

c) This measurement is obtained by monitoring the time intervals for each successful mobile originated PDP context activation between the receipt by the SGSN of an " ACTIVATE PDP CONTEXT REQUEST" from the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060, TS 24.008 and TS 23.107 for service class definitions. 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) SM. SuccActPdpContextAPNTimeMOMax.Conv
SM. SuccActPdpContextAPNTimeMOMax.Strm
SM. SuccActPdpContextAPNTimeMOMax.Intact
SM. SuccActPdpContextAPNTimeMOMax.Bgrd

f) SgsnFunction, per APN.

g) Valid for packet switched traffic.

h) GSM/UMTS

5.6.30 PDP Context set-up time, initiated by Network (Mean)

a) This measurement provides the mean time it takes for the SGSN in order to established a PDP context initiated by the network during each collection interval. The measurement is pegged by traffic class per APN (see TS 23.003 for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful mobile terminated PDP context activation between the transmission by the SGSN of a “REQUEST PDP CONTEXT ACTIVATION" for the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060, TS 24.008 and TS 23.107 for service class definitions. This end value of the time will then be divided by the number of successful mobile originated PDP context activations 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) SM. SuccActPdpContextAPNTimeMTMean.Conv
SM. SuccActPdpContextAPNTimeMTMean.Strm
SM. SuccActPdpContextAPNTimeMTMean.Intact
SM. SuccActPdpContextAPNTimeMTMean.Bgrd

f) SgsnFunction, per APN.

g) Valid for packet switched traffic.

h) GSM/UMTS

5.6.31 PDP Context set-up time, initiated by Network (Max)

a) This measurement provides the maximum time it takes for the SGSN in order to established a PDP context initiated by the network during each collection interval. The measurement is pegged by traffic class per APN (see TS 23.003 for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

b) GAUGE

c) This measurement is obtained by monitoring the time intervals for each successful mobile terminated PDP context activation between the transmission by the SGSN of a “REQUEST PDP CONTEXT ACTIVATION" for the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060, TS 24.008 and TS 23.107 for service class definitions. 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) SM. SuccActPdpContextAPNTimeMTMax.Conv
SM. SuccActPdpContextAPNTimeMTMax.Strm
SM. SuccActPdpContextAPNTimeMTMax.Intact
SM. SuccActPdpContextAPNTimeMTMax.Bgrd

f) SgsnFunction, per APN.

g) Valid for packet switched traffic.

h) GSM/UMTS

5.10 UMTS Bearer Service

5.10.1 UMTS Bearer Service CS time to register (Mean)

a) This measurement provides the mean time it takes for the subscribers to register with the network for circuit switched (CS) services during each granularity period.

b) DER (n=1)

c) This measurement is obtained by accumulating the time intervals for each successful attach between the receipt by the VLR of an "ATTACH REQUEST" from the MS and the corresponding receipt by the VLR of an "ATTACH COMPLETE" message over a granularity period using DER, see TS 24.008. This end value of the time will then be divided by the number of successful attach requests for CS domain 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) UBS.TimeToRegisterCSMean

f) VlrFunction

g) Valid for circuit switched traffic.

h) UMTS.

5.10.2 UMTS Bearer Service CS time to register (Max)

a) This measurement provides the maximum time it takes for the subscribers to register with the network for circuit switched (CS) services during each granularity period.

b) GAUGE

c) This measurement is obtained by monitoring the time intervals for each successful attach between the receipt by the VLR of an "ATTACH REQUEST" from the MS and the corresponding receipt by the VLR of an "ATTACH COMPLETE" message over a granularity period, see TS 24.008. 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) UBS.TimeToRegisterCSMax

f) VlrFunction

g) Valid for circuit switched traffic.

h) UMTS.

5.10.3 UMTS Bearer Service PS time to register (Mean)

a) This measurement provides the mean time it takes for the subscribers to register with the network for packet switched (PS) services during each granularity period.

b) DER (n=1)

c) This measurement is obtained by accumulating the time intervals for each successful attach between the receipt by the SGSN of an "ATTACH REQUEST" from the MS and the corresponding receipt by the SGSN of an "ATTACH COMPLETE" message over a granularity period using DER, see TS 24.008. This end value of the time will then be divided by the number of successful attach requests for PS domain observed in the granularity period to give the arithmetic mean.

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

e) UBS.TimeToRegisterPSMean

f) SgsnFunction

g) Valid for packet switched traffic.

h) UMTS.

5.10.4 UMTS Bearer Service PS time to register (Max)

a) This measurement provides the maximum time it takes for the subscribers to register with the network for packet switched (PS) services during each granularity period.

b) GAUGE

c) This measurement is obtained by monitoring the time intervals for each successful attach between the receipt by the SGSN of an "ATTACH REQUEST" from the MS and the corresponding receipt by the SGSN of an "ATTACH COMPLETE" message over a granularity period using DER, see TS 24.008. 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) UBS.TimeToRegisterPSMax

f) SgsnFunction

g) Valid for packet switched traffic.

h) UMTS.

5.10.5 UMTS Bearer Service time to establish Communications Management (CM) radio access connectivity (Mean)

a) This measurement provides the mean time it takes for the radio access network to establish a service connection (for circuit switched connection establishment, supplementary services activation, short message transfer, location services) during each granularity period.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful service request between the receipt by the MSC of a "CM SERVICE REQUEST" from the MS and the corresponding receipt by the MSC of an "CM SERVICE ACCEPT" message over a granularity period using DER, see TS 24.008. This end value of the time will then be divided by the number of successful service requests 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) UBS.TimeForCMConnectRANMean

f) MscFunction.

g) Valid for circuit switched traffic.

h) UMTS.

5.10.6 UMTS Bearer Service time to establish Communications Management (CM) radio access connectivity (Max)

a) This measurement provides the maximum time it takes for the radio access network to establish a service connection (for circuit switched connection establishment, supplementary services activation, short message transfer, location services) during each granularity period.

b) GAUGE.

c) This measurement is obtained by monitoring the time intervals for each successful service request between the receipt by the MSC of a "CM SERVICE REQUEST" from the MS and the corresponding receipt by the MSC of an "CM SERVICE ACCEPT" message over a granularity period, see TS 24.008. 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) UBS.TimeForCMConnectRANMax

f) MscFunction.

g) Valid for circuit switched traffic.

h) UMTS.

3GPP TSG-SA5 (Telecom Management) **S5-028335**
Meeting #30, Tampere, FINLAND, 19 - 23 August 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.403** **CR** **010** ⌘ **rev** **-** ⌘ Current version: **5.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☒ Core Network ☒

Title:	⌘	Add flexibility in the measurement template for the Measured Object Class (MOC)
Source:	⌘	S5
Work item code:	⌘	OAM-PM
Date:	⌘	23/08/2002
Category:	⌘	**C**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction 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.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	It should be possible to use the same measurement name for a standardized measurement type implemented at a different object class level than the one defined in the Standard. The measurement file format defined in TS 32.401 clearly associates the measurement values with an object instance, thus allowing the non-ambiguous reuse of a measurement name at different object class levels.
Summary of change:	⌘	Extension of the usage of the measurement type definition for other object classes than the one specified in the field f). Additional clarifications have been made with regard to the structure of the measurement name and the usage of VS prefix for vendor-specific measurements.
Consequences if not approved:	⌘	Introduction of unnecessary vendor-specific measurements which are in fact similar to 3GPP standardized measurements.

Clauses affected:	⌘	3.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

3.3 Measurement definition template

Following is the template used to describe the measurements contained in this clause.

C.x.y. Measurement Name (clause header)

This is a descriptive name of the measurement type that is specified as clause C.x.y of the present document.

The measurement name shall be written in lower-case characters except abbreviations (e.g. RNC).

A measurement name can apply to one or more measurements. If the measurement name applies to several measurements then all fields of the template will take this into account.

a) Description

This clause contains an explanation of the measurement operation.

b) Collection Method

This n contains the form in which this measurement data is obtained:

- **CC** (Cumulative Counter);
- **GAUGE** (dynamic variable), used when data being measured can vary up or down during the period of measurement;
- **DER** (Discrete Event Registration), when data related to a particular event are captured every n^{th} event is registered, where n can be 1 or larger;
- **SI** (Status Inspection).

c) Condition

This clause contains the condition which causes the measurement result data to be updated;
This will be defined by identifying protocol related trigger events for starting and stopping measurement processes, or updating the current measurement result value. Where it is not possible to give a precise condition, then the conditional circumstances leading to the update are stated.

If a measurement is not available for FDD or TDD, then the measurement description shall contain a statement.

d) Measurement Result (measured value(s), Units)

This clause contains a description of expected result value(s) (e.g. a single integer value).

The definition applies for each measurement result.

e) Measurement Type

This clause contains a short form of the measurement name specified in the header, which is used to identify the measurement type in the result files.

The measurement names are dotted sequences of items. The sequence of elements identifying a measurement is organised from the general to the particular.

- The first item identifies the measurement family (e.g. HHO, RAB, SMS). Note that this family may also be used for measurement administration purpose.
- The second item identifies the name of the measurement itself.
- Depending on the measurement type, additional items may be present to specify sub-counters (failure causes, traffic classes, min, max, avg, G, U ...). In case of multiple additional items, they are also represented as a dotted sequence of items. When available, the template will describe to which standard it is referring to for these additional items (e.g. cause, traffic class). Otherwise, the additional item semantics must be described in details in the present document. Standardised causes will be a number. (e.g. RRC.ConnEstab.1) but non standardised causes should be a string (e.g. RRC.ConnEstab.NoReply).

It is to be noted that the set of values issued for a measurement does not depend on the associated collection method (CC, SI, Gauge, DER). For instance, a gauge collected counter does not necessarily provide min, max, average values.

The vendor-specific UMTS and combined GSM/UMTS measurement names will all begin with the VS prefix.

In addition, it is recommended that a prefix is added for non-UMTS measurements:

~~- VS for vendor specific measurements;~~

- Q3 for Q3 measurements;
- MIB for IETF measurements (ATM, IP);
- OS for other standards measurements.

NOTE: The 3GPP standardised measurements name must not commence with the above prefixes.

Examples of valid measurement names are:

- VS.HO.InterSGSNReject.NoResource;
- HHO.SuccOutIntraCell;
- MM.AttachedSubs.Max;
- RAB.EstabAttCS.Conversational;
- RRC.ConnEstab.*Cause*
  where *Cause* identifies the failure cause.

Abbreviations to be used within measurement types can be found in clause 3.2 of the present document.

f) Measurement Object Class

This clause describes the measured object class (e.g. UtranCell, RncFunction, SgsnFunction). The object class used for this purpose shall be in accordance with the Network Resource Model defined in 3GPP TSs 32.622 [9], 32.632 [10], 32.642 [11].

For object classes currently not defined in CM, the present document defines its own nomenclature (e.g. RA, LAC).

NOTE: It is possible to use the same measurement name for a standardized measurement type implemented at a different object class level than the one defined in the Standard. The same measurement type can apply to one or more measurements for which all fields of the measurement template are the same except the clause f) "Measurement Object Class". For instance, a measurement which uses the same template as a given measurement type but relates to another object class (e.g. UtranCell instead of UtranRelation) shall have the same name.

g) Switching Technology

This clause contains the Switching domain(s) this measurement is applicable to i.e. Circuit Switched and/or Packet Switched.

h) Generation

The generation determines if it concerns a GSM, UMTS, or combined (GSM+UMTS) measurement.

- **GSM**: pure GSM measurement; it only counts GSM events. In a combined (GSM+UMTS) NE the count would be exactly the same as in a pure GSM NE. In a pure UMTS NE this counter does not exist;
- **UMTS**: pure UMTS measurement; it only counts UMTS events. In a combined (GSM+UMTS) NE the count would be exactly the same as in a pure UMTS NE. In a pure GSM NE this counter does not exist;

- **GSM/UMTS**: measurement applicable to both GSM and UMTS systems; in a combined (GSM+UMTS) NE separate subcounts for GSM and/or UMTS events can be obtained;

- **Combined**: measurement applicable to combined GSM and UMTS systems, but regardless of whether the measured event occurred on the GSM or UMTS part of the system. This means that in a combined NE only one total (i.e. GSM+UMTS) count is obtained for the measured event.

The above aspects are also reflected in the measurement type name in template item E by adding a "G" to the GSM measurements and "U" to the UMTS measurements.

NOTE: The 2G component of a combined 2G/3G equipment may actually choose to implement GSM measurements according to the present document or GSM12.04/TS52.402, based on GSM standards.