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Foreword

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

32.401	Performance Management (PM); Concept and requirements
52.402	Performance Management (PM); Performance measurements - GSM
32.404	Performance Management (PM); Performance measurements - Definitions and template
32.405	Performance Management (PM); Performance measurements Universal Terrestrial Radio Access Network (UTRAN)
32.406	Performance Management (PM); Performance measurements Core Network (CN) Packet Switched (PS) domain
32.407	Performance Management (PM); Performance measurements Core Network (CN) Circuit Switched (CS) domain
32.408	Performance Management (PM); Performance measurements Teleservice
32.409	Performance Management (PM); Performance measurements IP Multimedia Subsystem (IMS)
32.425	Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN)
32.426	**Performance Management (PM); Performance measurements Evolved Packet Core network (EPC)**

The present document is part of a set of specifications, which describe the requirements and information model necessary for the standardised Operation, Administration and Maintenance (OA&M) of a multi-vendor LTE SAE-system.

During the lifetime of a LTE SAE network, its logical and physical configuration will undergo changes of varying degrees and frequencies in order to optimise the utilisation of the network resources. These changes will be executed through network configuration management activities and/or network engineering, see TS 32.600 [2].

Many of the activities involved in the daily operation and future network planning of a LTE SAE network require data on which to base decisions. This data refers to the load carried by the network and the grade of service offered. In order to produce this data performance measurements are executed in the NEs, which comprise the network. The data can then be transferred to an external system, e.g. an Operations System (OS) in TMN terminology, for further evaluation.

The purpose of the present document is to describe the mechanisms involved in the collection of the data and the definition of the data itself.

Annex B of TS 32.404 helps in the definition of new performance measurements that can be submitted to 3GPP for potential adoption and inclusion in the present document. Annex B of TS 32.404 discusses a top-down performance measurement definition methodology that focuses on how the end-user of performance measurements can use the measurements.

1 Scope

The present document describes the measurements for EPC and combined EPC/UMTS/GSM.
TS 32.401 [1] describes Performance Management concepts and requirements.
The present document is valid for all measurement types provided by an implementation of an EPC network and combined EPC/UMTS/GSM network. Only measurement types that are specific to EPC or combined EPC/UMTS/GSM networks are defined within the present documents.

Vendor specific measurement types used in EPC and combined EPC/UMTS/GSM networks are not covered. Instead, these could be applied according to manufacturer's documentation.

Measurements related to "external" technologies (such as IP) as described by "external" standards bodies (e.g. IETF) shall only be referenced within this specification, wherever there is a need identified for the existence of such a reference.

The definition of the standard measurements is intended to result in comparability of measurement data produced in a multi-vendor network, for those measurement types that can be standardised across all vendors' implementations.

The structure of the present document is as follows:

- Header 1: Network Element (e.g. MME related measurements);
- Header 2: Measurement function;
- Header 3: Measurements.

2 References

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

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

[2] 3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[3] 3GPP TS 24.301: " Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[4] 3GPP TS 29.274: "Evolved General Packet Radio Service (GPRS); Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".

[5] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (Release 8)".

[6] 3GPP TS 29.274: " Tunnelling Protocol for Control plane (GTPv2-C)".

[7] 3GPP TS 29.281: "GPRS Tunnelling Protocol User Plane (GTPv1-U)".

[8] 3GPP TS 36.414: "Evolved Universal Terrestrial Access Network (E-UTRAN); S1 data transport".

[9] 3GPP TS 29.272: "Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol".

[10] 3GPP TS 23.203: "Policy and charging control architecture".

[11] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[12] 3GPP TS 36.412: "Evolved Universal Terrestrial Access Network (E-UTRAN); S1 signaling transport".

[13] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[14] IETF RFC 5136: "Defining Network Capacity".

3 Measurement family and abbreviations

3.1 Measurement family

The measurement names defined in the present document are all beginning with a prefix containing the measurement family name. This family name identifies all measurements which relate to a given functionality and it may be used for measurement administration (see TS 32.401 [1]).

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

- EQPT (measurements related to Equipment)
- MM (measurements related to Mobility Management)
- GTP (measurements related to GTP Management)
- IP (measurements related to IP Management)
- IRATHO (measurements related to Inter-Radio Access Technology Handover)
- SM (measurements related to Session Management)
- SUB (measurements related to Subscriber Management)

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

EQPT	Equipment
EPC	Evolved Packet Core
GTP	GPRS Tunnelling Protocol
MME	Mobility Management Entity
UMTS	Universal Mobile Telecommunications System
UTRAN	Universal Terrestrial Radio Access Network
Subscr	Subscriber
Tau	Tracking area update
Rau	Routeing area update

4 Measurements related to the MME

4.1 Mobility Management

4.1.1 EPS attach procedures

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

4.1.1.1 Attempted EPS attach procedures

a) This measurement provides the number of attempted EPS attach procedures initiated within this MME area.

b) CC.

c) Receipt of "ATTACH REQUEST" message with "Attach type" information element indicating "EPS attach" from the MS (TS 24.301 [3]).

Editor notes: Attach type message needs to be changed according to TS24.301.

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

e) MM.EpsAttachAtt.E
Note: E indicates EPS.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.1.2 Successful EPS attach procedures

a) This measurement provides the number of successfully performed EPS attach procedures within this MME area.

b) CC.

c) Transmission of a "ATTACH ACCEPT" message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "EPS attach". If the "ATTACH ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.301 [3]).

Editor notes: Attach type message needs to be changed according to TS24.301.

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

e) MM.EpsAttachSucc.E
Note: E indicates EPS.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.1.3 Failed EPS attach procedures

a) This measurement provides the number of failed EPS attach procedures. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission by the SGSN of the ATTACH REJECT message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "EPS attach", the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.301 [3].
The sum of all supported per cause measurements shall be equal to the total number of failed EPS attach procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

Editor notes: Attach type message needs to be changed according to TS24.301.

d) Each measurement (as defined in e) 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) MM.EpsAttachFail.*Cause*.E
where *Cause* identifies the reject cause, E indicates EPS.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching

h) EPS.

4.1.2 UE-initiated EPS Detach procedure

4.1.2.1 Attempted EPS detach procedures by UE

a) This measurement provides the number of attempted EPS detach procedures initiated by UE within this MME area.

b) CC.

c) Receipt of "DETACH REQUEST" message with "detach type" information element indicating "EPS detach" from the UE (TS 24.301 [3]).

Editor notes: Attach type message needs to be changed according to TS24.301.

d) A single integer value.

e) MM.EpsDetachUeAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS.

4.1.2.2 Successful EPS detach procedures by UE

a) This measurement provides the number of successful EPS detach procedures initiated by UE within this MME area.

b) CC

c) Transmission of "DETACH ACCEPT" message from the MME (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachUeSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.3 MME-initiated EPS Detach procedure

4.1.3.1 Attempted EPS detach procedures by MME

a) This measurement provides the number of attempted EPS detach procedures initiated by MME.

b) CC

c) Transmission of "DETACH REQUEST" message by UE from the MME, not including repeat (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachMMEAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.3.2 Successful EPS detach procedures by MME

a) This measurement provides the number of successful EPS detach procedures initiated by MME.

b) CC

c) Receipt of "DETACH ACCEPT" message by MME from the UE (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachMMESucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.4 HSS-initiated EPS Detach procedure

4.1.4.1 Attempted EPS detach procedures by HSS

a) This measurement provides the number of attempted EPS detach procedures initiated by HSS.

b) CC

c) Receipt of "CANCEL LOCATION" message by MME from HSS with "cancel type" information element indicating 'delete user', not including repeat (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachHssAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.4.2 Successful EPS detach procedures by HSS

a) This measurement provides the number of successful EPS detach procedures initiated by HSS.

b) CC

c) Transmission of "CANCEL LOCATION ACK" message by HSS from the MME (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachHssSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.5 Tracking area update procedure with Serving GW change

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

4.1.5.1 Attempted tracking area update procedure with Serving GW change

a) This measurement provides the number of attempted tracking area update procedures with Serving GW change initiated within this MME area.

b) CC.

c) Receipt of "TRACKING AREA UPDATE REQUEST" message from a MS with "Last visited registered TAI" information element indicating to the MME that it wishes to be served by a new Serving GW (different to the old Serving GW (TS 24.301 [3])).

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

e) MM.TauInterSgwAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.5.2 Successful tracking area update procedure with Serving GW change

a) This measurement provides the number of successfully performed tracking area update procedures with Serving GW change within this MME area.

b) CC.

c) Transmission of a "TRACKING AREA UPDATE ACCEPT" message to the MS, in response to a "TRACKING AREA UPDATE REQUEST" message in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by a new Serving GW (different to the old Serving GW). If the "TRACKING AREA UPDATE ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.301 [3]).

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

e) MM.TauInterSgwSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.5.3 Failed tracking area update procedure with Serving GW change

a) This measurement provides the number of failed tracking area update procedure with Serving GW change. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission of a 'TRACKING AREA UPDATE REJECT' message to the MS, in response to a " TRACKING AREA UPDATE REQUEST" message with in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by a new Serving GW (different to the old Serving GW), the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.301. The sum of all supported per cause measurements shall be equal to the total number of failed Tracking Area Update procedure with Serving GW change. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) 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) MM.TauInterSgwFail.*Cause*
where Cause identifies the reject cause.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching

h) EPS.

4.1.6 Tracking area update procedure without Serving GW change

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

4.1.6.1 Attempted tracking area update procedure without Serving GW change

a) This measurement provides the number of attempted tracking area update procedures without Serving GW change initiated within this MME area.

b) CC.

c) Receipt of "TRACKING AREA UPDATE REQUEST" message from a MS with "Last visited registered TAI" information element indicating to the MME that it wishes to be served by the same Serving GW as the old Serving GW (TS 24.301 [3]).

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

e) MM.TauIntraSgwAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.6.2 Successful tracking area update procedure without Serving GW change

a) This measurement provides the number of successfully performed tracking area update procedures without Serving GW change within this MME area.

b) CC.

c) Transmission of a "TRACKING AREA UPDATE ACCEPT" message to the MS, in response to a "TRACKING AREA UPDATE REQUEST" message in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by the same Serving GW as the old Serving GW. If the "TRACKING AREA UPDATE ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.301 [3]).

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

e) MM.TauIntraSgwSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.6.3 Failed tracking area update procedure without Serving GW change

a) This measurement provides the number of failed tracking area update procedure without Serving GW change. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission of a 'TRACKING AREA UPDATE REJECT' message to the MS, in response to a " TRACKING AREA UPDATE REQUEST" message in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by the same Serving GW as the old Serving GW, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.301. The sum of all supported per cause measurements shall be equal to the total number of failed Tracking Area Update procedure with Serving GW change. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) 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) MM.TauIntraSgwFail.*Cause*
where Cause identifies the reject cause.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching

h) EPS.

4.1.9 EPS paging procedures

The three measurement types defined in clauses 4.1.9.n are subject to the "2 out of 3 approach".

4.1.9.1 Attempted EPS paging procedures

a) This measurement provides the number of attempted PS paging procedures initiated at the MME. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when an EPS paging procedure is started i.e. at the transmission of the first "Paging" message (TS 36.413 [4]) from the MME to the eNodeB, which are counted when paging area is smaller than or equal to one TA.

d) A single integer value.

e) MM.PagingEpsAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.9.2 Successful EPS paging procedures

a) This measurement provides the number of successful PS paging procedures initiated at the MME. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a paging_response is received by the MME from the UE as response to an EPS PS paging procedure (Receipt of "SERVICE REQUEST" message with Service Type = Paging Response from the UE (TS 24.301 [3])) , which are counted when paging area is smaller than or equal to one TA.

d) A single integer value.

e) MM.PagingEpsSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.9.3 Failed EPS paging procedures

a) This measurement provides the number of failed PS paging procedures initiated at the MME, i.e. EPS paging procedures that time out. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when an EPS PS paging procedure times out, which are counted when paging area is smaller than or equal to one TA.

d) A single integer value.

e) MM.PagingEpsFail

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.10 MME control of overload related measurements for EPC

4.1.10.1 Attempted Overload Start procedure

a) This measurement provides the number of attempted Overload Start procedures.

b) CC.

c) Transmission of "OVERLOAD START" message From MME to each eNodeB(TS 23.401[5], TS 36.413 [11]).

d) A single integer value.

e) NM.OverLoadStartAtt.

f) MMEFunction.

g) Valid for packet switching.

h) EPS.

4.1.10.2 Attempted Overload Stop procedure

a) This measurement provides the number of attempted Overload Stop procedures.

b) CC.

c) Transmission of "OVERLOAD STOP" message From MME to each eNodeB(TS 23.401[5], TS 36.413 [11]).

d) A single integer value.

e) NM.OverLoadStopAtt.

f) MMEFunction.

g) Valid for packet switching.

h) EPS.

4.1.11 EMM-Registered subscribers

4.1.11.1 Mean number of EMM-Registered subscribers

a) This measurement provides the mean number of EMM-Registered state subscribers.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of EMM-Registered subscribers in a MME and then taking the arithmetic mean.

d) A single integer value.

e) MM. RegisteredSubNbrMean

f) MMEFunction.

g) Valid for packet switching.

h) EPS

4.1.11.2 Maximum number of EMM-Registered subscribers

a) This measurement provides the maximum number of EMM-Registered state subscribers.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of EMM-Rgistered subscribers in MME and then taking the maximum.

d) A single integer value.

e) MM.RegisteredSubNbrMax

f) MMEFunction.

g) Valid for packet switching.

h) EPS

4.1.12 Handover related measurements

4.1.12.1 Inter RAT handover

4.1.12.1.1 Incoming inter RAT handover

4.1.12.1.1.1 Attempted incoming inter RAT handover

a) This measurement provides the number of attempts incoming inter RAT handover from SGSN to MME. The four measurement types defined in e) are subject to the "3 out of 4 approach".

b) CC

c) Receipt by MME of "Forward Relocation Request" message from SGSN, where the BSSGP Cause or RANAP Cause IE (IE type: F-Cause) indicates handover from GSM or UMTS to EPS respectively (See TS 29.274 [4]), or receipt by MME of "Direct Transfer (S101 Session ID, Attach Request, UE Capabilities, TAI)" message from HRPD access network indicates handover from CDMA2000 to EPS (See TS 32.402 [13])

d) Each measurement is an integer value.

e) IRATHO.IncMMEAtt Combined;
IRATHO.IncMMEAtt.G GSM;
IRATHO.IncMMEAtt.U UMTS;
IRATHO.IncMMEAtt.C CDMA2000.

f) MMEFunction

g) Valid for packet switching.

h) Combined

4.1.12.1.1.2 Successful incoming inter RAT handover

a) This measurement provides the number of successful incoming inter RAT handover from SGSN to MME. The four measurement types defined in e) are subject to the "3 out of 4 approach".

b) CC

c) Transmission by MME of "Forward Relocation Complete Notification" message to SGSN, indicates handover to EPS(See TS 29.274 [4]), or transmission by MME of "Direct Transfer (S101 Session ID, Attach Accept, (and Bearer Setup Request))" to HRPD access network indicates handover from CDMA2000 to EPS (See TS 32.402 [13]).

d) Each measurement is an integer value.

e) IRATHO.IncMMESucc Combined;
IRATHO.IncMMESucc.G GSM;
IRATHO.IncMMESucc.U UMTS
IRATHO.IncMMESucc.C CDMA2000.

f) MMEFunction

g) Valid for packet switching.

h) Combined

4.1.12.1.2 Outgoing inter RAT handover

4.1.12.1.2.1 Attempted outgoing inter RAT handover

a) This measurement provides the number of attempts outgoing inter RAT handover from MME to SGSN. The four measurement types defined in e) are subject to the "3 out of 4 approach".

b) CC

c) Transmission by MME of "Forward Relocation Request" message to SGSN, where the Target Identification IE indicates handover to UMTS or GSM (See TS 29.274 [4]), or transmission by MME of "Direct Transfer Request message (S101 Session ID, SectorID, PDN GW Address(es), GRE key(s) for uplink traffic, APN(s), HRPD message starting HO access)" message to the HRPD access node indicates handover to CDMA2000 (See TS 32.402 [13]).

d) Each measurement is an integer value.

e) IRATHO.OutMMEAtt Combined;
IRATHO.OutMMEAtt.G GSM;
IRATHO.OutMMEAtt.U UMTS;
IRATHO.OutMMEAtt.C CDMA2000.

f) MMEFunction

g) Valid for packet switching.

h) Combined

4.1.12.1.2.2 Successful outgoing inter RAT handover

a) This measurement provides the number of successful outgoing inter RAT handover from MME to SGSN. The four measurement types defined in e) are subject to the "3 out of 4 approach".

b) CC

c) Receipt by MME of "Forward Relocation Complete Notification" message from SGSN, indicates handover to UMTS or GSM (See TS 29.274 [4]), or receipt by MME of "Direct Transfer Request message (S101 Session ID, HRPD message with HO access information, HS-GW Address and GRE key(s) for forwarded traffic, CDMA2000 HO Status)" message from HRPD access network indicates handover to CDMA2000 (See TS 32.402 [13]).

d) Each measurement is an integer value.

e) IRATHO.OutMMESucc Combined;
IRATHO.OutMMESucc.G GSM;
IRATHO.OutMMESucc.U UMTS;
IRATHO.OutMMESucc.C CDMA2000.

f) MMEFunction

g) Valid for packet switching.

h) Combined

4.1.13 Routeing area update with MME interaction

The three measurement types defined in this clause are subject to the "4 out of 5 approach".

4.1.13.1 Attempted routeing area update with MME interaction

f) This measurement provides the number of attempted routeing area update with MME interaction initiated within this MME area.

g) CC

h) Receipt of "Context Request" message from a SGSN (TS 29.274 [6]).

i) A single integer value.

j) MM.RauAtt

i) MMEFunction

j) Valid for packet switching.

k) EPS.

4.1.13.2 Successful routeing area update with MME interaction and without S-GW change

f) This measurement provides the number of successfully performed routeing area update with MME interaction and without S-GW change within this MME area.

g) CC.

h) Transmission of a "Context Response" message to the SGSN, IE Cause value is "Request Accepted", with following receipt of "Context Acknowledge" message, IE Indication flags indicate that SGW is not changed (TS 29.274 [6]).

i) A single integer value.

j) MM.RauIntraSgwSucc

i) MMEFunction

j) Valid for packet switching.

k) EPS.

4.1.13.3 Failed routeing area update with MME interaction and without S-GW change

i) This measurement provides the number of failed routeing area update with MME interaction and without S-GW change. The measurement is split into subcounters per the reject cause.

j) CC

k) Transmission of a "Context Response" message to the SGSN, IE Cause value is except "Request Accepted", with following receipt of "Context Acknowledge" message, IE Indication flags indicate that SGW is not changed. The relevant measurement is incremented according to the failure cause. Possible failure causes are defined within TS 29.274 [6]. The sum of all supported per cause measurements shall be equal to the total number of failed routeing area update with MME interaction and without S-GW change. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

l) 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.

m) MM.RauIntraSgwFail.*Cause*
where Cause identifies the failure cause.

n) MMEFunction

o) Valid for packet switching

p) EPS.

4.1.13.4 Successful routeing area update with MME interaction and with S-GW change

a) This measurement provides the number of successfully performed routeing area update with MME interaction and with S-GW change within this MME area.

b) CC.

c) Transmission of a "Context Response" message to the SGSN, IE Cause value is "Request Accepted", with following receipt of "Context Acknowledge" message, IE Indication flags indicate that SGW is changed (TS 29.274 [6]).

d) A single integer value.

e) MM.RauInterSgwSucc

f) MMEFunction

g) Valid for packet switching.

h) EPS

4.1.13.5 Failed routeing area update with MME interaction and with S-GW change

a) This measurement provides the number of failed routeing area update with MME interaction and with S-GW change. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission of a "Context Response" message to the SGSN, IE Cause value is except "Request Accepted", with following receipt of "Context Acknowledge" message, IE Indication flags indicate that SGW is changed. The relevant measurement is incremented according to the failure cause. Possible failure causes are defined within TS 29.274 [6]. The sum of all supported per cause measurements shall be equal to the total number of failed routeing area update with MME interaction and without S-GW change. In case only a subset of per cause measurements is supported, a sum subcounter 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) MM.RauInterSgwFail.*Cause*
where Cause identifies the failure cause.

f) MMEFunction

g) Valid for packet switching.

h) EPS

4.2 Session Management

4.2.1 Number of dedicated EPS bearers in active mode (Mean)

a) This measurement provides the mean number of dedicated EPS bearers.

b) SI

c) The measurement is obtained by sampling at a pre-defined interval, the number of dedicated EPS bearer established by MME in active mode and then taking the arithmetic mean.

d) A single integer value

e) SM.MeanNbrActDedicatedBearer

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.2 Number of dedicated EPS bearers in active mode (Maximum)

a) This measurement provides the maximum number of dedicated EPS bearers in active mode.

b) SI

c) The measurement is obtained by sampling at a pre-defined interval, the number of dedicated EPS bearer established by MME in active mode and then taking the.maximum

d) A single integer value

e) SM.MaxNbrActDedicatedBearer

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.3 Dedicated bearer set-up time by MME (Mean)

a) The measurement provides the valid time per dedicated bearer set-up procedure by MME, (unit: second).

b) DER (n=1)

c) This measurement is obtained by accumulating the time intervals for every successful dedicated bearer setup by MME between the transmission by the MME of a "ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST" and the corresponding "ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT" message receipt by the MME the over a granularity period using DER. If the dedicated bearer setup procedure is beyond one granularity period, only the set-up time for procedures whose message 'ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT' is received in the granularity period can be accumulated. The end value of this time will then be divided by the number of successful dedicated bearer set-up procedures in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d) A single integer value

e) SM.EstabActDedicatedEpsBearerTimeMean

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.4 MME initiated dedicated bearer activation

4.2.4.1 Attempted dedicated bearer activation procedures by MME

a) The measurement provides the number of attempted dedicated bearer activation procedures by MME.

b) CC

c) Transmission of 'ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST' message by MME (TS 24.301 [3])

d) A single integer value

e) SM.ActDedicatedEpsBearerAtt

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.4.2 Successful dedicated bearer activation procedures by MME

a) The measurement provides the number of successful dedicated bearer activation procedures by MME

b) CC

c) Receipt of 'ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT' message by MME (TS 24.301 [3]).

d) A single integer value

e) SM.ActDedicatedEpsBearerSucc

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.4.3 Failed dedicated bearer activation procedures by MME

a) The measurement provides the number of failed dedicated bearer activation procedures by MME, which is incremented according to the reject cause.

b) CC

c) Receipt of 'ACTIVATE DEDICATED EPS BEARER CONTEXT REJECT' message by MME from UE with 'ESM Cause' indicating the cause of failure. Each measurement type defined in e) is corresponding to a reject cause, possible reject causes are defined within TS 24.301 [3].

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

e) SM.ActDedicatedEpsBearerFail.*Cause*
where *Cause* identifies the reject cause.

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.5 MME initiated dedicated bearer deactivation

4.2.5.1 Attempted dedicated bearer deactivation procedures by MME

a) The measurement provides the number of attempted dedicated bearer deactivation procedures by MME

b) CC

c) Transmission of 'DEACTIVATE EPS BEARER CONTEXT REQUEST' message by MME (TS 24.301 [3])

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

e) SM.DeactEpsDedicatedBearerAtt

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.5.2 Successful dedicated bearer deactivation procedures by MME

a) The measurement provides the number of successful dedicated bearer deactivation procedures by MME.

b) CC

c) Receipt of 'DEACTIVATE EPS BEARER CONTEXT ACCEPT' message by MME (TS 24.301 [3]).

d) A single integer value

e) SM.DeactEpsDedicatedBearerSucc

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.6. MME initiated EPS bearer modification

4.2.6.1 Attempted EPS bearer modification procedures by MME

a) The measurement provides the number of attempted EPS bearer modification procedures by MME

b) CC

c) Transmission of 'MODIFY EPS BEARER CONTEXT REQUEST' message by MME (TS 24.301 [3])

d) A single integer value

e) SM.ModEpsBearerAtt

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.6.2 Successful EPS bearer modification procedures by MME

a) The measurement provides the number of successful EPS bearer modification procedures by MME.

b) CC

c) Receipt of 'MODIFY EPS BEARER CONTEXT ACCEPT' message by MME (TS 24.301 [3]).

d) A single integer value

e) SM.ModEpsBearerSucc

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.6.3 Failed EPS bearer modification procedures by MME

a) The measurement provides the number of failed EPS bearer modification procedures by MME, which is incremented according to the reject cause.

b) CC

c) Receipt of 'MODIFY EPS BEARER CONTEXT REJECT' message by MME from UE with 'ESM Cause' taking the reject cause. (TS 24.301 [3]).

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

e) SM.ModEpsBearerFail.*Cause*
where Cause identifies the reject cause

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.7 Total EPS Service Request

The total service requests include both UE initiated and Network initiated service requests.

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

4.2.7.1 Total Attempted EPS Service Request procedures.

a) This measurement provides the total number of attempted EPS Service Request procedures.

b) CC.

c) Receipt of "SERVICE REQUEST" message from the MS (TS 24.301 [3]).

d) A single integer value.

e) SM.EpsServiceReqAtt

f) MMEFunction

g) Valid for packet switching.

h) EPS

4.2.7.2 Total Successful EPS Service Request procedures.

a) This measurement provides the total number of successful EPS Service Request procedures.

b) CC.

c) Transmission of "INITIAL CONTEXT SETUP REQUEST" message to the eNB as a result of Service Request procedure.

d) A single integer value.

e) SM.EpsServiceReqSucc.

f) MMEFunction

g) Valid for packet switching.

h) EPS

4.2.7.3 Total failed EPS Service Request procedures.

a) This measurement provides the total number of failed EPS Service Request procedures.

b) CC.

c) Transmission of "SERVICE REJECT" message to the eNB as a result of Service Request procedure. Possible reject causes are defined within TS 24.301 [3].
The sum of all supported per cause measurements shall be equal to the total number of failed Service Request procedures. In case only a subset of per cause measurements is supported, a sum subcounter 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) SM.EpsServiceReqFail.*Cause*
where *Cause* identifies the reject cause.

f) MMEFunction

g) Valid for packet switching.

h) EPS

4.3 Subscriber management for MME

4.3.1 Attempted insert subscriber data requests received from a HSS

a) This measurement provides the number of attempted insert subscriber data requests received from a HSS.

b) CC

c) On receipt by the MME of an Insert Subscriber Data Request message from HSS (see TS 29.272 [9]),

d) A single integer value.

e) SUB.InsertSubscrDataHssAtt

f) MMEFunction

g) Valid for packet switched traffic.

h) EPS

4.3.2 Attempted delete subscriber data requests received from a HSS

a) This measurement provides the number of attempted delete subscriber data requests received from a HSS.

b) CC

c) On receipt by the MME of a Delete Subscriber Data Request message from HSS (see TS 29.272 [9]),

d) A single integer value.

e) SUB.DeleteSubscrDataHssAtt

f) MMEFunction

g) Valid for packet switched traffic.

h) EPS

4.4 S1-MME data volume related measurements

4.4.1 Number of incoming IP data packets on the S1-MME interface from eNodeB to MME

a) This measurement provides the number of incoming IP data packets on the S1-MME interface from eNodeB to MME.

b) CC.

c) Reception by the MME of an IP data packet on the S1-MME interface from the eNodeB. See TS 36.412 [12].

d) A single integer value.

e) IP.IncDataPktS1MME

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

4.4.2 Number of outgoing IP data packets on the S1-MME interface from MME to eNodeB

a) This measurement provides the number of outgoing IP data packets on the S1-MME interface from MME to eNodeB.

b) CC.

c) Transmission by the MME of an IP data packet on the S1-MME interface from the MME. See TS 36.412 [12].

d) A single integer value.

e) IP.OutDataPktS1MME

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

4.4.3 Number of octets of incoming IP data packets on the S1-MME interface from eNodeB to MME

a) This measurement provides the number of octets of incoming IP data packets on the S1-MME interface from eNodeB to MME.

b) CC.

c) Reception by the MME of an IP data packet on the S1-MME interface from the eNodeB, the data packet size is extracted from the IP header and added on to the measurement value. See TS 36.412[5].

d) A single integer value.

e) IP.IncDataOctS1MME

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

4.4.4 Number of octets of outgoing IP data packets on the S1-MME interface from MME to eNodeB

a) This measurement provides the number of octets of outgoing IP data packets on the S1-MME interface from MME to eNodeB.

b) CC.

c) Transmission by the MME of an IP data packet on the S1-MME interface from the MME, the data packet size is extracted from the IP header and added on to the measurement value. See TS 36.412[5].

d) A single integer value.

e) IP.OutDataOctS1MME

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

4.5 Equipment resource

4.5.1 MME Processor usage

4.5.1.1 Mean Processor Usage

a) This measurement provides the mean usage of each key processor during the granularity period. Each equipment may have more than one key processor, how to indentify key processor is vendor specific.

b) SI

c) This measurement is obtained by sampling at a pre-defined interval the usage of the processor and then taking the arithmetic mean for each key processor.

d) Each measurement is an integer value (Unit: %).

e) EQPT.MeanProcessorUsage.ProcessorID
where ProcessorID identifies the key processor of this equipment, the format of ProcessorID is vendor specific.

f) ManagedElement

g) Valid for packet switched.

h) EPS

4.5.1.2 Peak processor usage

a) This measurement provides the peak usage of each key processor during the granularity period. Each equipment may have more than one key processor, how to indentify key processor is vendor specific.

b) SI

c) This measurement is obtained by sampling at a pre-defined interval the usage of the processor and then taking the maximum for each key processor.

d) Each measurement is an integer value (Unit: %).

e) EQPT.PeakProcessorUsage.*ProcessorID*
where *ProcessorID* identifies the key processor of this equipment, the format of *ProcessorID* is vendor specific.

f) ManagedElement

g) Valid for packet switched traffic.

h) EPS.

5 Measurements related to the PDN-GW for a GTP based S5/S8

5.1 Session Management

5.1.1 PDN-GW initiated Dedicated Bearer Creation

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

5.1.1.1 Attempted number of PDN-GW initiated Dedicated Bearer Creation

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Creation

b) CC

c) Transmission of "Create Bearer REQUEST" message From PDN-GW, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.CreationPGWInitBearerAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.1.2 Successful number of PDN-GW initiated Dedicated Bearer Creation

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Creation.

b) CC

c) Receipt of 'Create Bearer Response' message by PDN-GW where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.CreatationPGWInitBearerSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.1.3 Failed number of PDN-GW initiated Dedicated Bearer Creation

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Creation. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Create Bearer Response' message by PDN-GW where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

d) Each measurement (as defined in e) 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) SM.CreatationPGWInitBearerFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.2 PDN-GW initiated Dedicated Bearer Deletion

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

5.1.2.1 Attempted number of PDN-GW initiated Dedicated Bearer Deletion

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Deletion

b) CC

c) Transmission of "Delete Bearer REQUEST" message From PDN-GW, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter (TS 29.274 [4], TS 23.401[5]).

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

e) SM.DelPGWInitBearerAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.2.2 Successful number of PDN-GW initiated Dedicated Bearer Deletion

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Deletion.

b) CC

c) Receipt of 'Delete Bearer Response' message by PDN-GW where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter (TS 29.274 [4], TS 23.401[5]).

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

e) SM.DelPGWInitBearerSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.2.3 Failed number of PDN-GW initiated Dedicated Bearer Deletion

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Deletion. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Delete Bearer Response' message by PDN-GW where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

d) Each measurement (as defined in e) 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) SM.DelPGWInitBearerFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.3 PDN-GW initiated Dedicated Bearer Modification with QoS update procedure

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

5.1.3.1 Attempted number of PDN-GW initiated Dedicated Bearer Modification with QoS update

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Modification with QoS update.

b) CC

c) Transmission of "Update Bearer REQUEST" message From PDN-GW with 'Bearer Level QoS' IE, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerQoSUpdateAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.3.2 Successful PDN-GW initiated Dedicated Bearer Modification with QoS update

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Modification with QoS update.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW with 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerQoSUpdateSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.3.3 Failed PDN-GW initiated Dedicated Bearer Modification with QoS update

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Modification with QoS update procedures. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW with 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

d) Each measurement (as defined in e) 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) SM.ModPGWInitBearerQoSUpdateFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.4 PDN-GW initiated Dedicated Bearer Modification without QoS update procedure

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

5.1.4.1 Attempted number of PDN-GW initiated Dedicated Bearer Modification without QoS update

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Modification without QoS update.

b) CC

c) Transmission of "Update Bearer REQUEST" message From PDN-GW without 'Bearer Level QoS' IE, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerNoQoSUpdateAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.4.2 Successful number of PDN-GW initiated Dedicated Bearer Modification without QoS update

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Modification without QoS update.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW without 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerNoQoSUpdateSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.4.3 Failed number of PDN-GW initiated Dedicated Bearer Modification without QoS update

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Modification without QoS update. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW without 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

d) Each measurement (as defined in e) 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) SM.ModPGWInitBearerNoQoSUpdateFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.5 Active EPS Bearers related measurements for EPC

5.1.5.1 Mean Number of Active EPS Bearers

a) This measurement provides the mean number of simultaneous active EPS Bearers.

b) SI.

c) The measurement is obtained by sampling at a pre-defined interval, the number of Active EPS Bearers in PDN GW and then taking the arithmetic mean.

d) The measurement is split into subcounters per QCI, and the possible QCIs are included in TS 23.203[10].

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

f) SM.ActEPSBearNbrMean.*QCI*
where *QCI* identifies the EPS Bearer level quality of service class.

g) PGWFunction

h) Valid for packet switching.

i) EPS.

5.1.5.2 Max Number of Active EPS Bearers

a) This measurement provides the peak number of active EPS Bearers in PDN GW.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number of Active EPS Bearers and then taking the maximum.

d) The measurement is split into subcounters per QCI, and the possible QCIs are included in TS 23.203[10].

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

f) SM.ActEPSBearNbrMax.*QCI*.

g) Where *QCI* identifies the EPS Bearer level quality of service class.

h) PGWFunction

i) Valid for packet switching.

j) EPS.

5.1.6 UE requested bearer resource modification related measurements for EPC

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

5.1.6.1 Attempted UE requested bearer resource modification procedure

f) This measurement provides the number of attempted UE requested bearer resource modification procedures.

g) CC.

h) Receipt of "Bearer Resource Command" message by PDN GW (TS 23.401[5], TS 29.274 [4]).

i) A single integer value.

j) SM.UEReqBearerResModiAtt.

i) PGWFunction.

j) Valid for packet switching.

k) EPS.

5.1.6.2 Successful UE requested bearer resource modification procedure

f) This measurement provides the number of successfully performed UE requested bearer resource modification procedures.

g) CC.

h) Transmission of 'Update Bearer REQUEST', 'Create Bearer REQUEST' or 'Delete Bearer REQUEST' message From PDN-GW, the message shall contain the 'PTI' IE allocated by the UE to correlate to the UE requested bearer resource modification procedure (TS 23.401[5], TS 29.274 [4]).

i) A single integer value.

j) SM.UEReqBearerResModiSucc.

k) PGWFunction.

l) Valid for packet switching.

m) EPS.

5.1.6.3 Failed UE requested bearer resource modification procedure

a) This measurement provides the number of failed UE requested bearer resource modification procedures.

b) CC.

c) Transmission of 'Bearer Resource Failure Indication' From PDN GW which may contain the 'Cause' IE that indicates the failure cause (TS 23.401[5], TS 29.274 [4]).

d) Each measurement (as defined in e) 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) SM.UEReqBearerResModiFail.*Cause*

Where *Cause* identifies the failure cause.

f) PGWFunction.

g) Valid for packet switching.

h) EPS.

5.1.7 PDN Connections related measurements for EPC

5.1.7.1 Mean Number of PDN Connections, per APN

a) This measurement provides the mean number of PDN Connections per APN.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number of PDN Connections in PDN GW and then taking the arithmetic mean.

The measurement is split into subcounters per APN.

d) Each measurement is an integer value.

e) SM.PDNConnNbrMean.*APN*

Where the *APN* identifies the Access Point Name.

f) PGWFunction.

g) Valid for packet switching.

h) EPS.

5.1.7.2 Max Number of PDN Connections, per APN

a) This measurement provides the maximum number of PDN Connections per APN.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number of PDN Connections in PDN GW and then taking the maximum.

The measurement is split into subcounters per APN.

d) Each measurement is an integer value.

e) SM.PDNConnNbrMax.*APN*

Where the *APN* identifies the Access Point Name.

f) PGWFunction.

g) Valid for packet switching.

h) EPS.

5.2 SGi related measurements

5.2.1 SGi incoming link usage

a) This measurement provides the IP-layer incoming link usage of SGi interface.

b) CC

c) See clause 2.3.4. Definition: IP-type-P (broad spectrum of packet types) Link Usage in IETF RFC 5136 [14].

d) Each measurement is an integer value.

e) IP.SGiIncLinkUsage.*SGiRP*
where *SGiRP* identifies the SGi reference point of this PGWFunction, the format of *SGiRP* is vendor specific.

f) PGWFunction

g) Valid for packet switched traffic.

h) EPS

5.2.2 SGi outgoing link usage

a) This measurement provides the IP-layer outgoing link usage of SGi interface.

b) CC

c) See clause 2.3.4. Definition: IP-type-P (broad spectrum of packet types) Link Usage in IETF RFC 5136 [14].

d) Each measurement is an integer value.

e) IP.SGiOutLinkUsage.*SGiRP*
where *SGiRP* identifies the SGi reference point of this PGWFunction, the format of *SGiRP* is vendor specific.

f) PGWFunction

g) Valid for packet switched traffic.

h) EPS

6 Measurements related to the S-GW

6.1 GTP related measurements

6.1.1 GTP S5/S8

6.1.1.1 Number of outgoing GTP data packets on the S5/S8 interface, from S-GW to PDN-GW

i) This measurement provides the number of GTP data PDUs which have been generated by the GTP protocol entity on the S5/S8 interface.

j) CC.

k) Transmission by the S-GW of a GTP data PDU on the S5/S8 interface to the PDN-GW. See TS 29.274 [6] and 29.281 [7].

l) A single integer value.

m) GTP.OutDataPktS5S8SGW

n) EP_RP_EPS

o) Valid for packet switching.

p) EPS

6.1.1.2 Number of incoming GTP data packets on the S5/S8 interface, from PDN-GW to S-GW

i) This measurement provides the number of GTP Data PDUs which have been accepted and processed by the GTP protocol entity on the S5/S8 interface.

j) CC.

k) Reception by the S-GW of a GTP data PDU on the S5/S8 interface from the PDN-GW. See TS 29.274 [6] and 29.281 [7].

l) A single integer value.

m) GTP.IncDataPktS5S8SGW

n) EP_RP_EPS

o) Valid for packet switching.

p) EPS

6.1.1.3 Number of octets of outgoing GTP data packets on the S5/S8 interface, from S-GW to PDN-GW

a) This measurement provides the number of octets of outgoing GTP data packets on the S5/S8 interface.

b) CC.

c) Transmission by the S-GW of a GTP Data PDU (T-PDU) on the S5/S8 interface to the PDN-GW including GTP header. See TS 29.274 [6] and 29.281 [7].

d) A single integer value.

e) GTP.OutDataOctS5S8SGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

6.1.1.4 Number of octets of incoming GTP data packets on the S5/S8 interface, from PDN-GW to S-GW

a) This measurement provides the number of octets of incoming GTP data packets on the S5/S8 interface.

b) CC.

c) Reception by the S-GW of a GTP Data PDU (T-PDU) on the S5/S8 interface from the PDN-GW including GTP header. See TS 29.274 [6] and 29.281 [7].

d) A single integer value.

e) GTP.IncDataOctS5S8SGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

6.1.1.5 Number of outgoing GTP signalling packets on the S5/S8 interface, from S-GW to PDN-GW

a) This measurement provides the number of GTP signalling PDUs which have been generated by the GTP protocol entity on the S5/S8 interface.

b) CC

c) Transmission by the S-GW of a GTP signalling PDU on the S5/S8 interface to the PDN-GW. See TS 29.274 [6].

d) A single integer value.

e) GTP.OutSigPktS5S8SGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

6.1.1.6 Number of incoming GTP signalling packets on the S5/S8 interface, from PDN-GW to S-GW

a) This measurement provides the number of GTP signalling PDUs which have been accepted and processed by the GTP protocol entity on the S5/S8 interface.

b) CC.

c) Reception by the S-GW of a GTP signalling PDU on the S5/S8 interface from the PDN-GW. See TS 29.274 [6].

d) A single integer value.

e) GTP.IncSigPktS5S8SGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

6.1.1.7 Number of octets of outgoing GTP signalling packets on the S5/S8 interface, from S-GW to PDN-GW

a) This measurement provides the number of octets of outgoing GTP signalling packets on the S5/S8 interface.

b) CC.

c) Transmission by the S-GW of a GTP Signalling PDU on the S5/S8 interface to the PDN-GW including GTP header. See TS 29.274 [6].

d) A single integer value.

e) GTP.OutSigOctS5S8SGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

6.1.1.8 Number of octets of incoming GTP signalling packets on the S5/S8 interface, from PDN-GW to S-GW

a) This measurement provides the number of octets of incoming GTP signalling packets on the S5/S8 interface.

b) CC

c) Reception by the S-GW of a GTP Signalling PDU on the S5/S8 interface from the PDN-GW including GTP header. See TS 29.274 [6].

d) A single integer value.

e) GTP.IncSigOctS5S8SGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

7 Measurements related to the SGW

7.1 S1-U data volume related measurements

7.1.1 Number of outgoing GTP data packets on the S1-U interface, from S-GW to eNodeB

a) This measurement provides the number of GTP data PDUs on the S1-U interface which have been generated by the GTP-U protocol entity on the S1-U interface.

b) CC

c) Transmission by the S-GW of a GTP-U data PDU on the S1-U interface to the eNodeB. See TS 36.414 [8].

d) A single integer value.

e) GTP.OutDataPktS1USGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

7.1.1.2 Number of incoming GTP data packets on the S1-U interface, from eNodeB to S-GW

a) This measurement provides the number of GTP Data PDUs which have been accepted and processed by the GTP-U protocol entity on the S1-U interface.

b) CC

c) Reception by the S-GW of a GTP-U data PDU on the S1-U interface from the eNodeB. See TS 36.414 [8].

d) A single integer value.

e) GTP.InDataPktS1USGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

7.1.1.3 Number of octets of outgoing GTP data packets on the S1-U interface, from S-GW to eNodeB

a) This measurement provides the number of octets of outgoing GTP data packets on the S1-U interface which have been generated by the GTP-U protocol entity on the S1-U interface.

b) CC

c) Transmission by the S-GW of a GTP-U Data PDUon the S1-U interface to the eNodeB including GTP-U header. See TS 36.414 [8].

d) A single integer value.

e) GTP.OutDataOctS1USGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

7.1.1.4 Number of octets of incoming GTP data packets on the S1-U interface, from eNodeB to S-GW

a) This measurement provides the number of octets of incoming GTP data packets on the S1-U interface which have been accepted and processed by the GTP-U protocol entity on the S1-U interface.

b) CC

c) Reception by the S-GW of a GTP-U Data PDU on the S1-U interface from the eNodeB including GTP-U header. See TS 36.414[8].

d) A single integer value.

e) GTP.InDataOctS1USGW

f) EP_RP_EPS

g) Valid for packet switching.

h) EPS

Annex A (informative): Use case for measurements

A.1 Use case for mobility management related measurements

A UE/user needs to register with the network to receive services that require registration. This registration is described as Network Attachment. The always-on IP connectivity for UE/users of the EPS is enabled by establishing a default EPS bearer during Network Attachment. The PCC rules applied to the default EPS bearer may be predefined in the PDN GW and activated in the attachment by the PDN GW itself. The Attach procedure may trigger one or multiple Dedicated Bearer Establishment procedures to establish dedicated EPS bearer(s) for that UE. During the attach procedure, the UE may request for an IP address allocation. Terminals utilising only IETF based mechanisms for IP address allocation are also supported.

If user or subscriber cannot attach to the PS network of EPC, they cannot access network, so they may complain about quality of service provided by EPC network. So it is necessary to define attach related measurements to evaluate network attchment performance of EPC network by attchment success rate.

If inter RAT handover fails, it will lead to call drop. So the measurements related to inter RAT handover are useful to identify the problems in core network, sometimes signalling transmitted in core network will be lost or error because of some unknown reasons. Also for incoming inter RAT handover cases, if MME decides not to allow incoming handover, MME will not send related message to eNodeB, so incoming handover failure will not be counted from EUTRAN measurement. Inter RAT handover related measurements based on MME will cover cases handover from eNodeB to RNC or BSC or CDMA2000 and vice versa. So it is necessary to define inter RAT handover related measurements.

A.2 Use case for detach related measurements

The detach procedure is used by the UE to detach only for EPS services or to detach for both EPS services and non-EPS services or only for non-EPS services via a combined detach procedure. Also the detach procedure can be used by the network to inform the UE that it does not have access to the EPS any longer. Three detach procedures are provided when the UE accesses the EPS through E-UTRAN. The first detach procedure is UE-initiated detach procedure and other detach procedures are network-initiated detach procedures, which are MME-initiated detach procedure and HSS-initiated detach procedure respectively.

The detach procedure shall be invoked by the UE if the UE is switched off, the USIM card is removed from the UE or the EPS capability or CS fallback capability of the UE is disabled. The detach procedure shall be invoked by the network if the UE is illegal or GPRS services are not allowed in this PLMN and etc. The UE is detached either explicitly or implicitly. Explicit detach means that the network or the UE explicitly requests detach and signal with each other; implicit detach means that the network detaches the UE without notifying the UE, which is typically the case when the network presumes that it is not able to communicate with the UE, e.g. due to radio conditions.

If the detach procedure is performed, the EPS bearer context(s) for this particular UE are deactivated locally without peer-to-peer signalling between the UE and the MME.

Due to different EMM causes, the detach procedures are invoked by the UE or the network. In order to estimate the relative performance of detach of EPC network, it is necessary to define detach related measurements by detach success rate.

A.3 Use case for tracking and routeing area update related measurements

If a user fails upating the Tracking Area or Routeing Area, it may not be able to attach to the new Tracking Area or Routeing Area, and then the user experience would be very intolerable. Since MME determines to relocate S-GW based

on S-GW service area, which is composed of TAs or RAs, it is assumed that S-GW service area is already known in MMEs. If the MME identifies that the new TA or RA is out of the scope of S-GW service area, it shall perform inter S-GW Tracking or Routeing Area Update procedure, otherwise, it shall perform intra S-GW Tracking or Routeing Area Update procedure.

Thus it is necessary to define Tracking or Routeing Area Update related measurements includes both Inter and Intra S-GW Tracking or Routeing Area Update procedures to evaluate network tracking or Routeing area update performance of EPC network by calculate success rate.

A.4 Use case for session related measurements

The purpose of the dedicated bearer context activation procedure is to establish an EPS bearer context with specific QoS and TFT (Traffic Flow Template) between the UE and the EPC. The dedicated EPS bearer context activation procedure is initiated by the network, but may be requested by the UE by means of the UE requested bearer resource allocation procedure. The dedicated bearer context activation procedure can be part of the attach procedure, and if the attach procedure fails, the UE shall consider that the dedicated bearer activation has implicitly failed.

The purpose of the EPS bearer context modification procedure is to modify an EPS bearer context with a specific QoS and TFT. The EPS bearer context modification procedure is initiated by the network in order to either modify the QoS, the TFT, or both. The EPS bearer context modification procedure is initiated by the network, but it may be initiated as part of the UE requested bearer resource allocation procedure.

The purpose of the EPS bearer context deactivation procedure is to deactivate an EPS bearer context or disconnect from a PDN by deactivating all EPS bearer contexts to the PDN. The EPS bearer context deactivation procedure is initiated by the network, and it may be triggered by the UE by means of the UE requested bearer resource release procedure or UE requested PDN disconnect procedure.

If users or subscribers cannot use the services provided by EPS successfully, the users" subjective feel to the network is influenced. So it is necessary to define session related measurements to evaluate session performance of EPC network.

A.5 Use case for EPS paging procedures

Paging success rate is one of the important performance indicators for network performance analysis. It measures the paging response acceptance rate when the CN believes that the mobile is in the coverage area and pages the mobile to find the terminating mobile party to complete the incoming call. If the paging success rate is too low, network access success rate will be impacted. Paging success rate is calculated by paging related measurements. So it is necessary to define paging related measurements.

A.6 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

As PDN-GW is the element that initiate the dedicated bearer, if PDN-GW can not activate the dedicated bearer, then users or subscribers cannot use the services provided by EPS successfully, which will influence the users" subjective feel to the network. So it is necessary to define PDN-GW initiated Dedicated Bearer Creation related measurements to evaluate session performance of EPC network.

A.7 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

The PDN-GW shall be able to delete the dedicated bearer to release more network resources. If the PDN-GW can not delete the dedicated bearer, then the valid network resource for user will become less and less which may leads to system crash. So it is necessary to define PDN-GW initiated Dedicated Bearer Deletion related measurements to evaluate session performance of EPC network.

A.8 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

The PDN-GW shall be able to update the dedicated bearer to modify an EPS bearer with a specific QoS and TFT, if PDN-GW can not update QoS and TFT, then users or subscribers cannot achieve better network resource and the PDN-GW cannot map the service flow to the appropriate bearer, which will influence the users" subjective feel to the network. So it is necessary to define PDN-GW initiated Dedicated Bearer Modification with QoS Update related measurements to evaluate session performance of EPC network.

A.9 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

The PDN-GW shall be able to update the dedicated bearer to modify an EPS bearer with a specific TFT, if PDN-GW can not update TFT, then the PDN-GW cannot map the service flow to the appropriate bearer, which will influence the users" subjective feel to the network. So it is necessary to define PDN-GW initiated Dedicated Bearer Modification without QoS Update related measurements to evaluate session performance of EPC network.

A.10 Use case of GTP S5/S8 data volume related measurements

GTP S5/S8 related measurements are used to measure data volume on S5/S8 interface including incoming and outgoing of data and signalling packets.

It is useful to analyze transport bandwidth usage of S5/S8 interface. If the transport bandwidth usage is too high, more bandwidth should be deployed. Also from the ratio of signaling to data bandwidth usage, it is useful to analyze network performance, such as if the ratio of them is too high, some abnormal events are possible happened, GTP S5/S8 related measurements should be together with other performance measurements to analysis network performance to find out the abnormal events.

So it is necessary to define GTP S5/S8 related measurements.

A.11 Use case of S1-U data volume related measurements

S1-U related measurements are used to measure data volume on S1-U interface including incoming and outgoing of GTP data packets and octets.

It is useful to analyze transport bandwidth usage of S1-U interface. If the transport bandwidth usage is too high, more bandwidth should be deployed, or load balance should be considered according to core network dimension if there are multiple S-GWs connected to multiple eNodeBs.

So it is necessary to define S1-U related measurements.

A.12 Use case of SGi related measurements for EPC

SGi related measurements are used to measure data volume on SGi interface including incoming and outgoing of IP data packets and octets.

It is useful to analyze transport bandwidth usage of SGi interface. If the transport bandwidth usage is too high, more bandwidth should be deployed.

So it is necessary to define SGi related measurements.

A.13 Use case of subscriber management for MME related measurements

Subscriber management includes Insert Subscriber Data and Delete Subscriber Data related measurements that are useful to monitor network performance. For example, a surge of insert or delete subscriber data messages can occur if there is a failure/recovery of a MME, or an operator controlled modification of a large number of subscriber profiles (e.g. to include a new service). Such an increase could lead to overload of signaling network elements, which would otherwise operate efficiently with the available resources.

So it is necessary to define subscriber management for MME related measurements.

A.14 Use case of S1-MME data volume related measurements

S1-MME related measurements are used to measure data volume on S1-MME interface including incoming and outgoing of IP data packets and octets.

It is useful to analyze transport bandwidth usage of S1-MME interface. If the transport bandwidth usage is too high, more bandwidth should be deployed, or load balance should be considered according to core network dimension if there are multiple MMEs connected to multiple eNodeBs.

So it is necessary to define S1-MME data volume related measurements.

A.15 Use case of Active EPS Bearers related measurements for EPC

Active EPS Bearers related measurements in PDN GW include the mean and maximum number of active EPS Bearers created by PDN GW in QCI level.

The former could reflect the general load condition of PDN GW, which could help the operator for network optimization and load balance. The latter could reflect that whether the capacity of PDN GW should be extended or not, if the maximum number approaches or exceeds the equipment capacity, the operator should consider deploying more capacity or adding new equipment, otherwise it will impact the success rate for user EPS bearer activation.

A.16 Use case of MME control of overload related measurements for EPC

Under unusual circumstances or overload situations, the MME shall restrict the load that its eNodeBs are generating on it using OVERLOAD START message. When the MME has recovered and wishes to increase its load, the MME sends OVERLOAD STOP messages to the eNodeB(s).

The counters should be incremented for each OVERLOAD START message and for each OVERLOAD STOP message sent to an eNodeB respectively, and the severity of the unusual or overload conditions could be reflected by the values of the counters. For Operators, they need to know the probabilities of overload in MME to ensure that the capacity of MME can meet the requirements of subscribers in most cases. So MME control of overload related measurements are very useful for operator and could help operator to monitor unusual or overload conditions, and also estimate the severity of the conditions. Using the measurements, the operator could analyze whether some problems exist in the network or not, and may find out abnormal events leaded to the bad conditions, finally resolve the problems.

A.17 Use case of UE requested bearer resource modification related measurements for EPC

The purpose of UE requested bearer resource modification related measurements for EPC procedure is to request for a modification of bearer resources for one traffic flow aggregate with a specific QoS demand, or for the modification of the packet filters used for an active traffic flow aggregate, without changing QoS.

For example, if the subscribers cannot obtain the QoS resource that they have requested, and the subjective feel of the subscribers to the network may be influenced, but on the other hand, the resource of the network is limited and the subscribers" demand could not be always satisfied. Based on the UE requested bearer resource modification related measurements, operators can get the success rate of UE requested bearer resource modification, which can help opertors find a balance point between the network resource and user experience, and then the operators could optimize the user experience and also network quality. The failure UE requested bearer resource modification can be used also in trouble shooting when necessary.

A.18 Use case for registered subscribers related measurements for EPC

The UE state in the MME enters the EMM-REGISTERED state by a successful TAU procedure for a UE selecting an E-UTRAN cell from GERAN/UTRAN or by an Attach procedure via E-UTRAN. In the EMM-REGISTERED state, the UE can receive services that require registration in the EPS. And the UE location is known in the MME to at least an accuracy of the tracking area list allocated to that UE (excluding some abnormal cases). Operators shall have the knowledge of the number of registered subscribers in MME to evaluate the capacity status of MME.

A.19 Use case of PDN Connections related measurements for EPC

A PDN connection defines the association between a UE represented by one IP address and a PDN represented by a APN.Different kinds of services may be located in different PDN, and the users may access specific service via the specific APN. For example, APN1 is for Internet service accessed by laptop, and then APN2 is for WAP service accessed by mobile phone.

PDN Connections related measurements per APN, including mean and max number of PDN Connections, could provide an approach for the operator to monitor the amount of PDN Connections for specific APN and make the operators know whether the services located in specific PDN are accepted and enjoyed by the subscribers or not.

A.20 Use case of MME processor usage

When network is very busy, for example on important holiday or emergency events happened, the traffic of one MME is very heavy. So MME processor usage measurements are very important to indicate MME processor load capability. If MME processors usage is too high, operator must take action to avoid network paralysis.

A.21 Use case for EPS Service Request related Measurements

Service Request procedure is one of the important NAS procedure which is triggered by the UE when it is idle state and has some data to send or receive(after the paging procedure).

There should be a good success rate of the procedure; failing so, would affect the user experience of not sending / receiving the data.

When the UE is in idle state and has some user data pending to be sent, Service Request procedure is triggered by sending the NAS Service Request message to the MME. When the MME Accepts, it would request radio / S1 bearers to be established.

Similarly When the UE is in idle state and the Network has some user data to be sent, Paging procedure is triggered, which when accepted by UE, would trigger the Service Request procedure. In other words, Paging Success can be considered as Service Request procedure initiated by the Network.

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2008	SP-42	SP-080840			Presentation to SA for information		1.0.0
Mar 2009	SP-43	SP-090064	--	--	Presentation to SA for approval	2.0.0	8.0.0
Jun 2009	SP-44	SP-090290	1	-	Addition of use case of GTP S5/S8 data volume related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	2	-	Addition of GTP S5/S8 data volume related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	3	-	Addition of use case of S1-U data volume related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	4	-	Addition of S1U data volume related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	5	-	Addition of use case of SGi related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	6	-	Addition of use case of subscriber management for MME related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	7	-	Addition of subscriber management for MME related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	8	-	Addition of use case of S1-MME data volume related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	9	-	Addition of Active EPS Bearers related measurements for EPC	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	10	-	Addition of MME control of overload for EPC	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	11	-	Addition of UE requested bearer resource modification related measurements for EPC	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	12	-	Use case for registered subscribers related measurements for EPC	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	13	-	proposal of registered subscriber related measurements for EPC	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	14	-	Addition of PDN Connections related measurements for EPC	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	15	-	Addition of S1-MME data volume related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	16	-	Addition of inter RAT handover related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	17	-	Addition of SGi related measurements	8.0.0	9.0.0
Jun 2009	SP-44	SP-090290	18	-	Addition of MME processor usage related measurements	8.0.0	9.0.0
Sep 2009	SP-45	SP-090627	19	-	Addition of routeing area update with MME interaction related measurements	9.0.0	9.1.0
Sep 2009	SP-45	SP-090627	20	-	Add service request related measurements	9.0.0	9.1.0

History

Document history		
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