Source: **SA5 (Telecom Management)**

Title: **5 Rel-4/5/6 CR 32.401/3 Performance Management; Concept and requirements / Performance measurements - UMTS and combined UMTS/GSM**

Document for: **Approval**

Agenda Item: **7.5.3**

Doc1stevel	Specific a	CR	R	Phase	Subject	Ca	VersCu	Doc2ndLev	WorkitemsI D
SP-040783	32.401	021	--	Rel-6	Removal of annexes from Performance Management Concepts and Requirements	D	6.3.0	S5-049031	OAM-PM
SP-040783	32.401	022	--	Rel-6	Add requirements for Threshold Management	B	6.3.0	S5-049034	OAM-PM
SP-040783	32.403	054	--	Rel-4	Correct measurements about GPRS Update Locations sent to the HLR	F	4.8.0	S5-049037	OAM-PM
SP-040783	32.403	055	--	Rel-5	Correct measurements about GPRS Update Locations sent to the HLR	A	5.8.0	S5-049038	OAM-PM
SP-040783	32.403	056	--	Rel-6	Correct measurements about GPRS Update Locations sent to the HLR	A	6.5.0	S5-049039	OAM-PM

CR-Form-v7

CHANGE REQUEST

⌘	32.401	CR	021	⌘	rev	-	⌘	Current version:	6.3.0	⌘

*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 X Core Network X

Title:	⌘	Removal of annexes from Performance Management Concepts and Requirements
Source:	⌘	**SA5** (lidan@nortelnetworks.com)
Work item code:	⌘	OAM-PM
Date:	⌘	19/11/2004
Category:	⌘	**D**
Release:	⌘	Rel-6

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:	⌘	The annexes are not at the same level with the rest of 32.401 which should be focused on PM Concepts and Requirements. The annexes are related to the technical definition of Itf-N for Performance Measurement result collection.
Summary of change:	⌘	Move each part of the annexes to a new set of specification on Performance Measurement File Format Definition and modify the related text. Additionally, FTIRP is introduced as a way to transfer PM files in order to be consistent with PMIRP(TS 32.412) and FTIRP(TS 32.342).
Consequences if not approved:	⌘	

Clauses affected:	⌘	1, 2, 4.3.2, 5.2, 5.4.1.1, 5.4.1.5, 5.5.1, 5.5.2, Annex A, Annex B, Annex C

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

Change in Clause 1

1 Scope

The present document describes the requirements for the management of performance measurements and the collection of performance measurement result data across GSM and UMTS networks. It defines the administration of measurement schedules by the Network Element Manager (EM), the generation of measurement results in the Network Elements (NEs) and the transfer of these results to one or more Operations Systems, i.e. EM(s) and/or Network Manager(s) (NM(s)).

The basic Performance Management concept that the present document is built upon is described in clause 4. The requirements how an EM administers the performance measurements and how the results can be collected are defined in detail in clause 5. ~~Annex A specifies the file format for the bulk transfer of performance measurement results to the NM, while annex B discusses the file transfer procedure utilised on that interface.~~ A set of measurements available for collection by NEs are described in TS 52.402 for GSM and in TS 32.403 for UMTS and combined UMTS/GSM systems, effort has been made to ensure consistency in the definition of measurements between different NEs and generations. The performance measurement result is described in Performance Measurement File Format Definition ([29]).

…

End of Change in Clause 1

Change in Clause 2

2 References

…

[25] W3C REC-xml-20001006: "Extensible Markup Language (XML) 1.0 (Second Edition)".

[26] W3C REC-xmlschema-0-20010502: "XML Schema Part 0: Primer".

[27] W3C REC-xmlschema-1-20010502: "XML Schema Part 1: Structures".

[28] W3C REC-xmlschema-2-20010502: "XML Schema Part 2: Datatypes".

[29] 3GPP TS 32.432: "Telecommunication management; Performance Measurement File Format Definition".

[30] 3GPP TS 32.342: "Telecommunication management; File Transfer (FT) Integration Reference Point (IRP): Information Service (IS)".

End of Change in Clause 2

Change in Clause 4.3.2

4.3.2 Perceived accuracy

The accuracy of measurements can be seen in three ways:

- whether the result produced represents all occurrences of the defined event;
- whether related measurements produced for the same period refer to the same events; or
- whether a measurement result refers to the whole or part of a granularity period.

Representation of all occurrences: the definition of a measurement needs to accurately reflect which types of events are to be included in the collection of the data. If a general event or procedure description can be characterised by several sub-types then the measurement definition will have to be precise as to which sub-types are included or specifically excluded from that measurement. Depending on the measurement definition, it may prove more acceptable to count the event or procedure by causes, e.g. successful termination, unsuccessful termination for all reasons. If the definition of a measurement refers to specific failure causes then care shall be taken to assess whether all causes are included - the sum of which can provide the total number of failures - or whether a count of the total is defined as well as for the specific causes. This is particularly important if not all of the causes are supported by an implementation, or if not all of the causes are requested in the measurement job definition.

Same period for the same two events: consider two events being counted which refer to the same resource allocation procedure, falling on either side of a granularity period boundary. I.e. the attempt is counted in one period while the termination is counted in the subsequent period. This will lead to discrepancies appearing in the actual figures when trying to compare attempt and termination counts for the same period. In order to avoid this discrepancy, implementations shall ensure that the termination of a procedure started within a given granularity period shall be captured within the measurement results for that same period, even if the termination of the procedure falls within the next granularity period.

Measurement collection periods: a typical measurement collection period can be interrupted by system events.

These interruptions can be one or more of the following:

a) failure of the measured network resource;

b) failure of the measurement procedure;

c) the measured network resource only becomes available after the measurement period has commenced;

d) the measurement procedure only becomes available after the measurement period has commenced.

e) system error (e.g. disk failure/lack of memory);

f) communication error (e.g. link failure between the network manager and the measured network resource)

Any such interruption implies that the affected measurement result is incomplete, and in extreme circumstances, no result reports at all can be generated. In these cases the measurement result shall highlight such interruptions to indicate that the result is suspect (see also setting of suspectFlag in ~~Annex A~~ Performance Measurement File Format Definition [29]). Any actions to be taken subsequently with regards to the usefulness of the data will depend on the circumstances and the requirements of individual Operators.

End of Change in Clause 4.3.2

Change in Clause 5.2

5.2 Basic functions

…

The basic requirement from an NE for measurements is to collect data according to the definition of the measurement jobs and to provide results to at least one OS (EM and/or NM). The data collected in the NE shall be made available for collection by or transfer to the OS(s) according to the schedule defined by the measurement job parameters. The NE shall be able to supply the result data at least to the NM if the Itf-N is implemented in the NEs, result provision from the

NE to the EM is optional in this case. The NE shall be able to provide the result data to the EM if the Itf-N is implemented in the EM.

The EM shall be able to administer the measurements, e.g. create/delete measurement jobs and define their schedules. If the measurement results are transferred from the NEs to the EM, then the EM can control:

- the immediate ("real time") transfer of scheduled reports from the NE to the EM;
- the storage of scheduled reports in the NE; and
- deferred retrieval by the EM of scheduled reports stored in the NE.

In GSM, the optional Q3 interface specified in 3GPP TS 52.402 [22] can be used to perform these functions, while in UMTS, they are executed through a proprietary interface. Depending on the implementation option chosen for the Itf-N, the EM and/or NM may be involved in the control of the measurement result transfer to the NM.

The basic functions of the NM are beyond the scope of the present document. However, any NM that supports the network functions as described here must provide the NM side of the Itf-N, and the ability to handle the measurement result data that it receives, according to the file format(s) specified in the ~~present document~~ Performance Measurement File Format Definition [29]. The measurement result data may then be used in its original form or post-processed according to the system operator requirements. It is further anticipated that NM systems will have sophisticated functions for the management, preparation and presentation of the measurement result data in various forms.

The following clause summarises the measurement administration functions required in GSM and UMTS networks. They are then specified in more detail in clauses 5.x below.

(Performance) measurement administration functions allow the system operator, using functions of the EM, to determine measurement data collection in the network and forwarding of the results to one or more OS(s).

(Performance) measurement administration functions cover:

1) measurement data collection requirements:
   - **measurement types.** Corresponds to the measurements as defined in 3GPP TS 52.402 [22] and 3GPP TS 32.403 [23], respectively, or defined by other standards bodies, or manufacturer defined measurement types;
   - **measured network resources.** The resource(s) to which the measurement types shall be applied have to be specified, e.g. one or more NodeB(s);
   - **measurement recording**, consisting of periods of time at which the NE is collecting (that is, making available in the NE) measurement data.
2) measurement reporting requirements:
   - this allows the system operator to specify the measurement related information to be reported, if required (e.g. omitting zero valued counts).. The frequency at which scheduled result reports shall be generated also has to be defined, if it may deviate from the granularity period. Particular functions, which exceed the requirements set out in the present document, are provided if the optional Q3 interface specified in 3GPP TS 52.402 [22] is implemented for GSM.
3) measurement result transfer requirements:
   - The result transfer requirements in the present document are limited to the file based Itf-N, used to forward the measurement results to the NM. If ItF-N is implemented in the EM, then measurement results can be transferred from the NE to the EM, and/or they are stored locally in the NE and can be retrieved when required. If Itf-N is implemented in the NEs, then the PM result files are sent directly from the NE to the NM, involving control by the EM as required, The EM shall support all administration functions necessary to fulfil the above result transfer requirement.;
   - measurement results can be stored in the network (NEs or EM, depending on implementation option chosen for Itf-N) for retrieval by the NM when required.

A (performance) measurement job, covers the measurement data collection as described in point 1 above. If the Q3 interface for GSM is implemented, it also covers the measurement reporting requirements, as described in point 2 above. In UMTS, the reporting requirements may be covered by the measurement job, or they may be administered per NE, per management domain, or per EM, as chosen by the vendor. It is up to the implementation whether requirements

for the result transfer or the local storage of results are specified within the measurement job, particularly since the use of standard protocols, such as FTP, is foreseen.

A measurement job can be created, modified, displayed or deleted by the EM. In addition, measurement job activities in the NE can be suspended and resumed on request of the EM.

The system operator shall specify the required measurement parameters upon initiation of a measurement job. These parameters consist of, among others, recording schedule, granularity, and measurement type(s), as listed above.

A standard set of measurements that generate the required data is defined in 3GPP TS 52.402 [22] for GSM and 3GPP TS 32.403 [23] for UMTS and combined GSM/UMTS systems. However, a significant number of additional measurements is expected from real implementations. These will mainly consist of measurements for the underlying technologies, which are not 3G specific, such as ATM or IP, but is also due to specific vendor implementations. While the NM interface (Itf-N) for result transfer of both standard and non-standard measurements is fully standardised ~~in annexes A and B of the present document~~ Performance Measurement File Format Definition [29], the interface between EM and NE is only standardised in functional terms. In UMTS, implementation details of this interface are vendor specific. In GSM, it may be implementation specific or implemented in compliance with the OSI interface specified in 3GPP TS 52.402.

End of Change in Clause 5.2

Change in Clause 5.4.1.1

5.4.1.1 Measurement types

Every measurement job consists of one or more measurement types (as defined in ~~annex C~~ Performance Measurement File Format Definition [29]), for which it collects measurement data. The measurement type(s) contained in a job may apply to one or more network resources of the same type, e.g. a measurement job may be related to one or several NodeB(s). A measurement job will only produce results for the measurement type(s) it contains.

End of Change in Clause 5.4.1.1

Change in Clause 5.4.1.5

5.4.1.5 Measurement reporting

Each measurement job running on an NE produces scheduled measurement reports at the end of each granularity period, and contains the information as requested by the system operator. This information consists of:

- an identification of the measurement job that generated the report;
- an identification of the involved measurement type(s) and the measured network resource(s) (e.g. NodeB);
- a time stamp, referring to the end of the granularity period;
- for each measurement type, the result value(s) and an indication of the validity of the result value(s);
- an indication if the scan is not complete, and the reason why the scan could not be completed.

The exact layout of the measurement result reports generated by the NEs may be vendor specific. For the result file transfer to the NM via Itf-N, however, ~~annex A of the present document~~ Performance Measurement File Format Definition [29] defines in detail which information of the report is included in the result files, as well as the file format. Clause 5.5~~4~~.2 specifies how these reports can be transferred to the destination EM and/or NM.

End of Change in Clause 5.4.1.5

Change in Clause 5.5.1

5.5.1 Measurement result characteristics

During its specified recording intervals, each measurement job produces a result at the end of the granularity period if it is not suspended. ~~Annex C~~ Performance Measurement File Format Definition [29] provides for each measurement type that is specified within the present document a description of the expected measurement result.

Measurement results for all measurements of a particular measurement job are gathered in a single report at the end of the granularity period. The report may contain - in addition to the specific measurement results - fixed information, which is global for all measurement results associated with that measurement job, such as an identification of the involved network resources and a time stamp referring to the time at which the NE started collecting the measurement results. If measurement results are sent to the EM then the exact format may be vendor specific. For details about the standard file format for the transfer of measurement results to the NM via Itf-N ~~see annex A of the present document~~ Performance Measurement File Format Definition [29].

Once the result reports have been generated, they shall be stored locally within the NE if so requested by the EM/system operator. The storage capacity and duration as well as the method how the data may be deleted from the NE will be implementation dependent.

If some or all of the requested measurement data cannot be collected by a measurement job (administrative state = locked, operational state = disabled, see clause 5.2.2), this shall be indicated in the measurement report, cf. clause 5.2.1.4. In extreme cases, no report at all can be generated by the measurement job. This means that the destination of the result report (EM and/or NM) shall be capable of coping with missing or incomplete measurement reports.

End of Change in Clause 5.5.1

Change in Clause 5.5.2

5.5.2 Transfer of measurement results

During the recording intervals specified for a measurement job, scheduled measurement reports are generated at the end of each granularity period if the measurement job is not suspended. These reports can be transferred to the EM in either of two ways:

1) immediate notifications:
   - the reports are automatically forwarded to the EM at the end of the granularity period.
2) deferred retrieval:
   - the reports are stored locally in the NE, where they can be retrieved when required.

For each individual report, the transfer of measurement results in either one or both ways is to be established by the system operator, i.e. under the control of the EM. The actual control of the result transfer and the mechanisms applied may be implementation specific.

Each implementation shall support a file transfer facility to an external OS (i.e. not supplied by the NE vendor), such as an NM. This facility shall be implemented using either the FTAM ISO 8751 [7] ~~or~~, (T)FTP protocol or FTIRP([30]). This interface may be located either in the NEs or the EM, as chosen by the vendor. As a result, it may not at all be necessary to transfer measurement result reports to the EM, if:

- the NM interface is implemented in the NEs, and
- the Operator chooses to post-process measurement results only in the NM.

Details of the file format to be used on the NM interface can be found in ~~annex A of the present document~~ Performance Measurement File Format Definition [29]. The measurement report file conventions and transfer procedure are also specified in ~~annex B~~ Performance Measurement File Format Definition [29].

The results of the measurement job can be forwarded to the EM in either of two standard ways:

1) the scheduled result reports generated by the NE (notifications) can be sent to the EM as soon as they are available;

2) the reports can be stored in the NE (files) and transferred to or retrieved by the EM when required.

It shall be possible for the EM to specify the details for its result retrieval as a part of the measurement administration.

Measurement results can be forwarded to the NM via a bulk transfer interface. It is an implementation option whether this interface resides in the EM or the NEs. Depending on the implementation, the control of the bulk transfer of measurement results to the NM may involve the EM and/or the NM. See ~~annex B~~ Performance Measurement File Format Definition [29] for details.

In a network with more than one OS (e.g. EM and NM) the data produced may be required by several OSs. It is therefore necessary to support the possibility for multiple destinations for transfer of data.

All scenarios for the result transfer, as far as they are relevant for standardisation of 3G systems, are defined above. It should be noted that, depending on an Operator's needs, measurement results may have to be transferred to the EM only, the NM only, or both. Depending on a vendor's implementation, measurement results may be transferred to the NM directly from the NE or via the EM. This implies that not all of the result transfer options described above shall be implemented in all cases, however, those procedures that are implemented shall comply with the present document. A detailed specification of the measurement result transfer to the NM can be found in ~~annex B of the present document~~ Performance Measurement File Format Definition [29].

End of Change in Clause 5.5.2

Change in Annex

Annex A (normative):
~~Measurement Report File Format~~Void

~~This annex describes the format of measurement result files that can be transferred from the network (NEs or EM) to the NM. Two alternative format definitions are specified, one using ASN.1 with binary encoding (BER), the other one applying XML (see [25]), which is ASCII based. The XML file format definition is based on XML schema (see [26], [27] and [28]). Each 3G system implementation complying with the present document shall support at least one of these alternatives.~~

~~Both the ASN.1 and XML file format definitions implement the measurement result structure and parameters defined in clauses 5.2 and 5.3 of the present document. The three defined file format definitions correspond to each other (except with some minor XML specific optimisations). This implies that the value ranges and size constraints defined in the ASN.1 definition shall also be valid for implementations of the XML format definition. From that perspective, the three format definitions can be regarded as three different instances of the same single format.~~

~~The following conditions have been considered in defining this file format:~~

- ~~Since the files are transferred via a machine-machine interface, the files applying the format definitions should be machine-readable using standard tools.~~
- ~~The file format should be independent of the data transfer protocol used to carry the file from one system to another.~~
- ~~The file format should be generic across 3G systems.~~
- ~~The file format should be flexible enough to include all possible measurement types, i.e. those specified within annex C as well as measurements defined within other standards bodies, or vendor specific measurement types.~~
- ~~The file format should not impose any dependency between granularity periods for the generation of measurement results and file upload cycles for the file transfer from the network to the NM.~~
- ~~The file format should be flexible enough to support both the NE-based and the EM-based approaches, as discussed in annex B, clause B.1.1 of the present document.~~
- ~~The file format should be usable for other interfaces than Itf-N if required. The measurement file header could be augmented to indicate this other usage, however this would be a non-standard extension. In the ASN.1 file~~

format definition this is accommodated by the use of the ellipsis notation. XML schema allows such additions through insertion of extra schema elements through the provider of the non-standard extension.

A.1 Parameter description and mapping table

Table A.1 maps the tags defined in the ASN.1 file format definition to those used in the XML schema based file format definitions. It also provides an explanation of the individual parameters. XML tag attributes are useful where data values bind tightly to its parent element. They have been used where appropriate.

Table A.1 Mapping of ASN.1 Measurement Report File Format tags to XML tags

ASN.1 Tag		XML schema based XML tag	Description
MeasDataCollection		measCollecFile	This is the top-level tag, which identifies the file as a collection of measurement data. The file content is made up of a header ("measFileHeader"), the collection of measurement result items ("measData"), and a measurement file footer ("measFileFooter").
MeasFileHeader		fileHeader	This is the measurement result file header to be inserted in each file. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp ("collectionBeginTime").
MeasData		measData	The "measData" construct represents the sequence of zero or more measurement result items contained in the file. It can be empty in case no measurement data can be provided. The individual "measData" elements can appear in any order. Each "measData" element contains the name of the NE ("nEId") and the list of measurement results pertaining to that NE ("measInfo").
MeasFileFooter		fileFooter	The measurement result file footer to be inserted in each file. It includes a time stamp, which refers to the end of the overall measurement collection interval that is covered by the collected measurement results being stored in this file.
FileFormatVersion		fileHeader fileFormatVersion	This parameter identifies the file format version applied by the sender. The format version defined in the present document shall be the abridged number and version of this 3GPP document (see below) for the XML format and the ASN.1 format alike. The abridged number and version of a 3GPP document is constructed from its version specific full reference "3GPP […] (yyyy-mm)" by: - removing the leading "3GPP TS" - removing everything including and after the version third digit, representing editorial only changes, together with its preceding dot character - from the resulting string, removing leading and trailing white space, replacing every multi character white space by a single space character and changing the case of all characters to uppercase.
SenderName		fileHeader dnPrefix and fileSender localDn	The senderName uniquely identifies the NE or EM that assembled this measurement file by its Distinguished Name (DN), according to the definitions in 3GPP TS 32.300 [10]. In the case of the NE-based approach, it is identical to the sender's "nEDistinguishedName". For ASN.1 the string may be empty (i.e. string size =0) in case the DN is not configured in the sender. For the XML schema based XML format, the DN is split into the DN prefix and the Local DN (LDN) (see 3GPP TS 32.300 [10]).The XML attribute specification "dnPrefix" may be absent in case the DN prefix is not configured in the sender. The XML attribute specification "localDn" may be absent in case the LDN is not configured in the sender.

ASN.1 Tag		XML schema based XML tag	Description
SenderType		fileSender elementType	This is a user configurable identifier of the type of network node that generated the file, e.g. NodeB, EM, SGSN. The string may be empty (i.e. string size =0) in case the "senderType" is not configured in the sender. For the XML schema based XML format, XML attribute specification "elementType" may be absent in case the "senderType" is not configured in the sender.
VendorName		fileHeader vendorName	The "vendorName" identifies the vendor of the equipment that provided the measurement file. The string may be empty (i.e. string size =0) if the "vendorName" is not configured in the sender. For the XML schema based XML format, XML attribute specification "vendorName" may be absent in case the "vendorName" is not configured in the sender.
CollectionBeginTime		measColleс beginTime	The "collectionBeginTime" is a time stamp that refers to the start of the first measurement collection interval (granularity period) that is covered by the collected measurement results that are stored in this file.
NEId		managedElement	The unique identification of the NE in the system. It includes the user name ("nEUserName"), the distinguished name ("nEDistinguishedName") and the software version ("nESoftwareVersion") of the NE.
NEUserName		managedElement userLabel	This is the user definable name ("userLabel") defined for the NE in 3GPP TS 32.622 [24]. The string may be empty (i.e. string size =0) if the "nEUserName" is not configured in the CM applications. For the XML schema based XML format, XML attribute specification "userLabel" may be absent in case the "nEUserName" is not configured in the CM applications.
NEDistinguishedName		fileHeader dnPrefix and managedElement localDn	This is the Distinguished Name (DN) defined for the NE in 3GPP TS 32.300 [10]. It is unique across an operator's 3G network. The string may be empty (i.e. string size =0) if the "nEDistinguishedName" is not configured in the CM applications. For the XML schema based XML format, the DN is split into the DN prefix and the Local DN (LDN) (see 3GPP TS 32.300 [10]). XML attribute specification "localDn" may be absent in case the LDN is not configured in the CM applications.
NESoftwareVersion		managedElement swVersion	This is the software version ("swVersion") defined for the NE in 3GPP TS 32.622 [24]. This is an optional parameter which allows post-processing systems to take care of vendor specific measurements modified between software versions. For the XML schema based XML format, XML attribute specification "swVersion" may be absent in case the "nESoftwareVersion" is not configured in the CM applications.
MeasInfo		measInfo	The sequence of measurements, values and related information. It includes a list of measurement types ("measTypes") and the corresponding results ("measValues"), together with the time stamp ("measTimeStamp") and granularity period ("granularityPeriod") pertaining to these measurements.
MeasTimeStamp		granPeriod endTime	Time stamp referring to the end of the granularity period.
JobId		job jobId	The "jobId" represents the job with which measurement result contained in the file is associated. The "jobId" is mandatory when PMIRP is supported.
GranularityPeriod		granPeriod duration	Granularity period of the measurement(s) in seconds. For the XML schema based XML format, the value of XML attribute specification "duration" shall use the truncated representation "PT*n*S" (see [28]).
ReportingPeriod		repPeriod duration	Reporting period of the measurement(s) in seconds. For the XML schema based XML format, the value of XML attribute specification "duration" shall use the truncated representation "PT*n*S" (see [28]). The "reportingPeriod" is mandatory when PMIRP is supported.

ASN.1 Tag		XML schema based XML tag	Description
MeasTypes		measTypes or measType	This is the list of measurement types for which the following, analogous list of measurement values ("measValues") pertains. The GSM only measurement types are defined in TS 52.402 [22]. The measurement types for UMTS and combined UMTS/GSM implementations are specified in TS 32.403 [23]. For the XML schema based XML format, depending on sender's choice for optional positioning presence, either XML element "measTypes" or XML elements "measType" will be used.
MeasValues		measValue	This parameter contains the list of measurement results for the resource being measured, e.g. trunk, cell. It includes an identifier of the resource ("measObjInstId"), the list of measurement result values ("measResults") and a flag that indicates whether the data is reliable ("suspectFlag").
MeasObjInstId		measValue measObjLdn	The "measObjInstId" field contains the local distinguished name (LDN) of the measured object within the scope defined by the "nEDistinguishedName" (see 3GPP TS 32.300 [10]). The concatenation of the "nEDistinguishedName" and the "measObjInstId" yields the DN of the measured object. The "measObjInstId" is therefore empty if the "nEDistinguishedName" already specifies completely the DN of the measured object, which is the case for all measurements specified on NE level. For example, if the measured object is a "ManagedElement" representing RNC "RNC-Gbg-1", then the "nEDistinguishedName" will be for instance "DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1", and the "measObjInstId" will be empty. On the other hand, if the measured object is a "UtranCell" representing cell "Gbg-997" managed by that RNC, then the "nEDistinguishedName" will be for instance the same as above, i.e. "DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1", and the "measObjInstId" will be for instance "RncFunction=RF-1,UtranCell=Gbg-997". The class of the "measObjInstId" is defined in item F of each measurement definition template.
MeasResults		measResults or r	This parameter contains the sequence of result values for the observed measurement types. The "measResults" sequence shall have the same number of elements, which follow the same order as the measTypes sequence. Normal values are INTEGERs and REALs. The NULL value is reserved to indicate that the measurement item is not applicable or could not be retrieved for the object instance. For the XML schema based XML format, depending on sender's choice for optional positioning presence, either XML element "measResults" or XML elements "r" will be used.
SuspectFlag		suspect	Used as an indication of quality of the scanned data. FALSE in the case of reliable data, TRUE if not reliable. The default value is "FALSE", in case the suspect flag has its default value it may be omitted.
TimeStamp		measCollec endTime	ASN.1 GeneralizedTime format. The minimum required information within timestamp is year, month, day, hour, minute, and second.
Not Required		measType p	An optional positioning XML attribute specification of XML element "measType" (XML schema based), used to identify a measurement type for the purpose of correlation to a result. The value of this XML attribute specification is expected to be a non-zero, non-negative integer value that is unique for each instance of XML element "measType" that is contained within the measurement data collection file.
Not Required		r p	An optional positioning XML attribute specification of XML element "r", used to correlate a result to a measurement type. The value of this XML attribute specification should match the value of XML attribute specification "p" of the corresponding XML element "measType" (XML schema based).

A.2 ASN.1 file format definition

For ASN.1 formatted files, BER encoding rules shall apply. Embedded comments are integral parts of the standard format; i.e. any implementation claiming conformance to this annex shall also conform to the comments.

```
PM-File-Description
DEFINITIONS AUTOMATIC TAGS::= BEGIN

MeasDataCollection::= SEQUENCE
  {
  measFileHeader   MeasFileHeader,
  measData         SEQUENCE OF MeasData,
  measFileFooter   MeasFileFooter
  }

MeasFileHeader::= SEQUENCE
  {
  fileFormatVersion       PrintableString (SIZE (0..15)),
  senderName              PrintableString (SIZE (0..400)),
  senderType              SenderType,
  vendorName              PrintableString (SIZE (0..32)),
  collectionBeginTime     TimeStamp,
  ...
  }
-- The sole purpose of the ellipsis notation used in the file header is to
facilitate inter-release compatibility, vendor specific additions are not
allowed in implementations claiming conformance to the TS. However, it is
acknowledged that this feature does enable the use of non-standard extensions to
the file header without loosing compatibility to the file format specified in
the present document.

SenderType::= PrintableString (SIZE (0..8))

TimeStamp::= GeneralizedTime

MeasData::= SEQUENCE
  {
  nEId         NEId,
  measInfo     SEQUENCE OF MeasInfo
  }

NEId::= SEQUENCE
  {
  nEUserName              PrintableString (SIZE (0..64)),
  nEDistinguishedName     PrintableString (SIZE (0..400)),
  nESoftwareVersion       PrintableString (SIZE (0..64)) OPTIONAL
  }

MeasInfo::= SEQUENCE
  {
  measTimeStamp           TimeStamp,
  jobId                [1] INTEGER OPTIONAL,
  granularityPeriod    [2] INTEGER,
  reportingPeriod      [3] INTEGER OPTIONAL,
  measTypes            [4] SEQUENCE OF MeasType,
  measValues               SEQUENCE OF MeasValue
  }

MeasType::= PrintableString (SIZE (1..64))

MeasValue::= SEQUENCE
  {
```

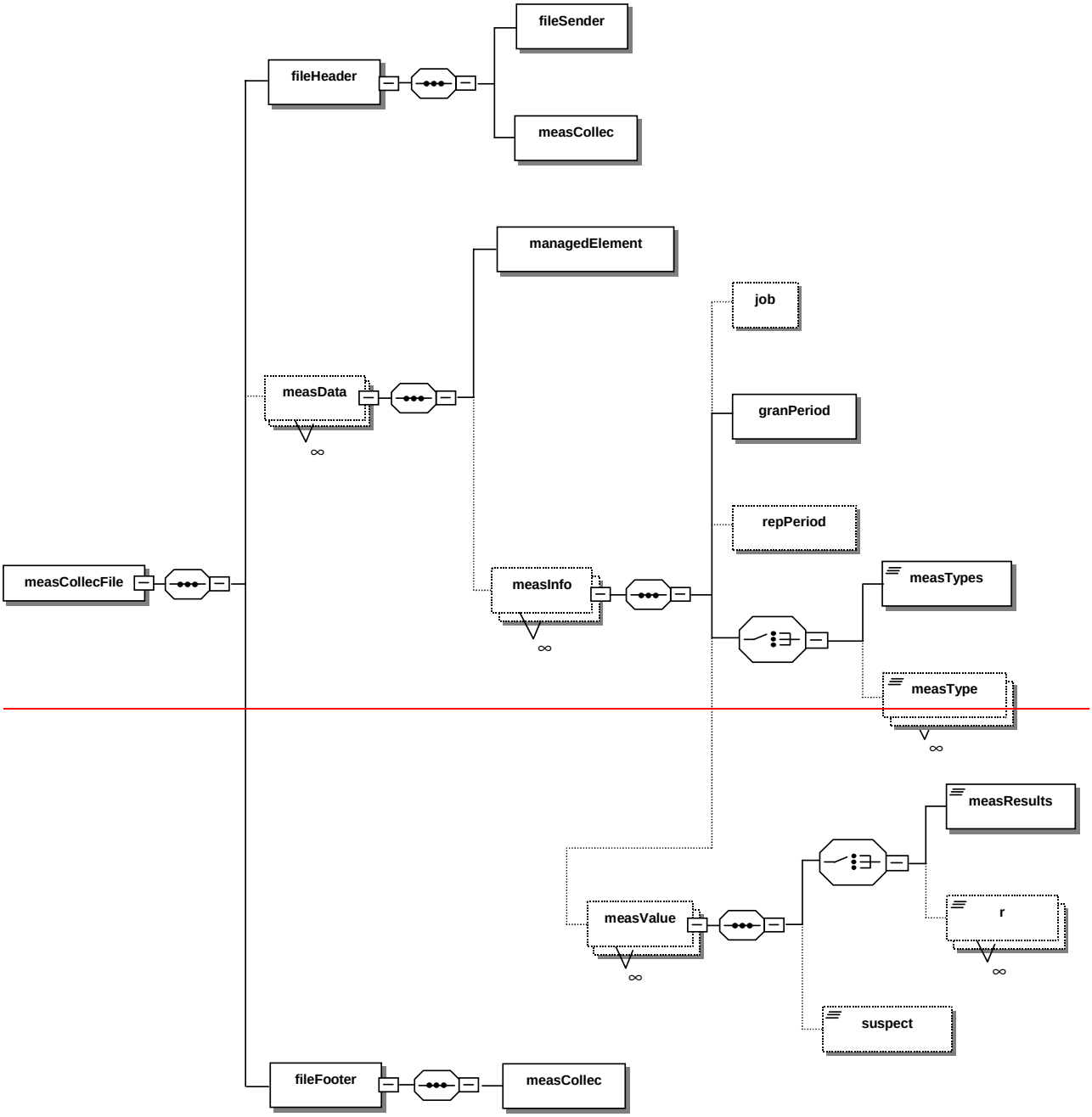
```
  measObjInstId    MeasObjInstId,
  measResults      SEQUENCE OF MeasResult,
  suspectFlag      BOOLEAN DEFAULT FALSE
  }

MeasObjInstId::= PrintableString (SIZE (0..400))

-- The size of the concatenated measObjInstId and neDistinguishedName must not
exceed 400.

MeasResult::= CHOICE
  {
    iValue INTEGER,
    rValue REAL,
    noValueNULL,
    ...
  }

-- Normal values are INTEGERs and REALs. The NULL value is reserved to indicate
that the measurement item is not applicable or could not be retrieved for the
object instance. The sole purpose of the ellipsis notation used in the
MeasResult choice is to facilitate inter-release compatibility in case the
choice needs to be extended in future releases.

MeasFileFooter::= TimeStamp

END
```

A.3 Void

A.4 XML schema based XML file format definition

A.4.1 Measurement collection data file XML diagram

Figure A.1 describes the XML element structure of the measurement collection data file.



~~Figure A.1: XML diagram of the measurement collection data file~~

~~A.4.2 Measurement collection data file XML schema~~

~~The following XML schema `measCollec.xsd` is the schema for measurement collection data XML files:~~

```
<?xml version="1.0" encoding="UTF-8"?>

<!--
  3GPP TS 32.401 PM Concept and Requirements
  Measurement collection data file XML schema
  measCollec.xsd
-->

<schema
  targetNamespace=
"http://www.3gpp.org/ftp/specs/latest/rel-6/32_series/32401-630.zip#measCollec"
  elementFormDefault="qualified"
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:mc=
"http://www.3gpp.org/ftp/specs/latest/rel-6/32_series/32401-630.zip#measCollec"
>

  <!-- Measurement collection data file root XML element -->

  <element name="measCollecFile">
    <complexType>
      <sequence>
        <element name="fileHeader">
          <complexType>
            <sequence>
              <element name="fileSender">
                <complexType>
                  <attribute name="localDn" type="string" use="optional"/>
                  <attribute name="elementType" type="string" use="optional"/>
                </complexType>
              </element>
              <element name="measCollec">
                <complexType>
                  <attribute name="beginTime" type="dateTime" use="required"/>
                </complexType>
              </element>
            </sequence>
            <attribute name="fileFormatVersion" type="string" use="required"/>
            <attribute name="vendorName" type="string" use="optional"/>
            <attribute name="dnPrefix" type="string" use="optional"/>
          </complexType>
        </element>
        <element name="measData" minOccurs="0" maxOccurs="unbounded">
          <complexType>
            <sequence>
              <element name="managedElement">
                <complexType>
                  <attribute name="localDn" type="string" use="optional"/>
                  <attribute name="userLabel" type="string" use="optional"/>
                  <attribute name="swVersion" type="string" use="optional"/>
                </complexType>
              </element>
              <element name="measInfo" minOccurs="0" maxOccurs="unbounded">
                <complexType>
                  <sequence>
                    <element name="job" minOccurs="0">
                      <complexType>
                        <attribute name="jobId" type="string" use="required"/>
                      </complexType>
                    </element>
                    <element name="granPeriod">
                      <complexType>
                        <attribute
```

```
                        name="duration"
                        type="duration"
                        use="required"
                      />
                      <attribute
                        name="endTime"
                        type="dateTime"
                        use="required"
                      />
                    </complexType>
                  </element>
                  <element name="repPeriod" minOccurs="0">
                    <complexType>
                      <attribute name="duration"
                                 type="duration" use="required"/>
                    </complexType>
                  </element>
                  <choice>
                    <element name="measTypes">
                      <simpleType>
                        <list itemType="Name"/>
                      </simpleType>
                    </element>
                    <element name="measType"
                             minOccurs="0" maxOccurs="unbounded">
                      <complexType>
                        <simpleContent>
                          <extension base="Name">
                            <attribute name="p"
                                       type="positiveInteger" use="required"/>
                          </extension>
                        </simpleContent>
                      </complexType>
                    </element>
                  </choice>
                  <element name="measValue"
                           minOccurs="0" maxOccurs="unbounded">
                    <complexType>
                      <sequence>
                        <choice>
                          <element name="measResults">
                            <simpleType>
                              <list itemType="mc:measResultType"/>
                            </simpleType>
                          </element>
                          <element name="r"
                                   minOccurs="0" maxOccurs="unbounded">
                            <complexType>
                              <simpleContent>
                                <extension base="mc:measResultType">
                                  <attribute name="p" type="positiveInteger"
                                             use="required"/>
                                </extension>
                              </simpleContent>
                            </complexType>
                          </element>
                        </choice>
                        <element name="suspect" type="boolean" minOccurs="0"/>
                      </sequence>
                      <attribute name="measObjLdn"
                                 type="string" use="required"/>
                    </complexType>
                  </element>
```

```
                    </sequence>
                  </complexType>
                </element>
              </sequence>
            </complexType>
          </element>
          <element name="fileFooter">
            <complexType>
              <sequence>
                <element name="measCollec">
                  <complexType>
                    <attribute name="endTime" type="dateTime" use="required"/>
                  </complexType>
                </element>
              </sequence>
            </complexType>
          </element>
        </sequence>
      </complexType>
    </element>

    <simpleType name="measResultType">
      <union memberTypes="decimal">
        <simpleType>
          <restriction base="string">
            <enumeration value="NIL"/>
          </restriction>
        </simpleType>
      </union>
    </simpleType>

</schema>
```

A.4.3 Measurement collection data file XML header

The following header shall be used in actual XML measurement result files (cf. annex D for examples):

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="MeasDataCollection.xsl"?>
<measCollecFile
 xmlns=
"http://www.3gpp.org/ftp/specs/latest/rel-6/32_series/32401-630.zip#measCollec"
>
```

Annex B (normative):
~~Measurement Report File Conventions and Transfer Procedure~~Void

~~This annex describes the conventions how files containing performance measurement results are generated in the network (EM or NEs) and the procedure to transfer these files from the network to the NM.~~

~~B.1 Conventions~~

~~The following clauses define conventions for the generation and the naming of measurement result files.~~

~~B.1.1 File generation~~

~~Since vendors may choose to implement the NM interface either in the NEs or the EM, the measurement result files for collection by the NM (push or pull transfer mechanism) may be provided by the NEs or the EM. Note that within one 3G network both possibilities may occur, since NEs of different types may use either one of the two possible approaches (NE based or EM based). This is particularly true in a multi-vendor network.~~

~~The procedures for the transfer of the files to the NM from either the NE or the EM are described in clause B.2.~~

~~B.1.1.1 NE based approach~~

~~The NE shall generate one file immediately at the end of each granularity period. This file shall contain all measurement results produced by the NE within that granularity period. For example, if a NodeB runs 10 measurements with a granularity period of 15 minutes and 5 measurements with a granularity period of 5 minutes, then it shall generate one file containing 10 results every 15 minutes, and one file containing 5 measurement results every 5 minutes.~~

~~In the event of two or more granularity periods coming to an end at the same time, the NE shall generate one file per granularity period. Hence in the above example, the NodeB shall generate 2 files – one containing 10 results (15min granularity period) and the other containing 5 measurement results (5min granularity period), when the end time of the granularity periods coincide.~~

~~The NE and the granularity period shall be identified both in the file name and the file contents. NE identifiers (names) used for the files shall be in accordance with the NE naming conventions defined in 3GPP TS 32.300 [10]. The file shall be available for transfer to or collection by the NM as soon as all applicable results have been assembled.~~

~~Each NE is responsible for the generation and maintenance of the files pertaining to its own measurements (i.e. the measurements it executes). In particular, this implies that the RNC is not involved in the generation, provision or transfer of measurement result files of its controlled NodeBs, i.e. for the measurements defined for the NodeB in the present document, no results will be sent via the Iub interface. (Note that NodeB measurement results may be routed across the same physical interface as Iub, see 3GPP TS 25.442 [4] for details).~~

~~B.1.1.2 EM based approach~~

~~This approach requires that measurement results be forwarded to the EM according to the mechanisms described in clause 4.2.4 of the present document. The EM may choose to provide measurement result files as described above for the NEs, however, additional flexibility may be offered. For example, measurement results from several granularity periods and/ or several NEs could be written into one single file. These NEs may be determined based on network hierarchy (e.g. all NodeBs controlled by the same RNC, all NEs controlled by the same EM), or management domains configured by the system operator (e.g. NodeBs belonging to a certain (management or geographical) area). In case such rules are applied by the EM for the routing of measurement results to specific files then they shall be operator configurable. If results from more than one NE are contained in a file, the NE identifier used for the file shall be the EM name as defined in 3GPP TS 32.300 [10], or a domain name configured by the system operator. If results from more than one granularity period are contained in the file then the beginning of the first and the end of the last granularity period shall be indicated in the file name.~~

The file shall be made available for transfer to or collection by the NM as soon as all applicable results have been assembled.

B.1.2 File naming

The following convention shall be applied for measurement result file naming:

<Type><Startdate>.<Starttime>-[<Enddate>.]<Endtime>[_<jobId>][_<UniqueId>][_<RC>]

1) The Type field indicates if the file contains measurement results for single or multiple NEs and/or granularity periods, where:

   - "A" means single NE, single granularity period;
   - "B" indicates multiple NEs, single granularity period;
   - "C" signifies single NE, multiple granularity periods;
   - "D" stands for multiple NEs, multiple granularity periods.

Note that files generated by the NEs will always have the Type field set to "A".

2) The Startdate field indicates the date when the granularity period began if the Type field is set to A or B. If the Type field is either "C" or "D" then Startdate contains the date when the first granularity period of the measurement results contained in the file started. The Startdate field is of the form YYYYMMDD, where:

   - YYYY is the year in four digit notation;
   - MM is the month in two digit notation (01 - 12);
   - DD is the day in two digit notation (01 - 31).

3) The Starttime field indicates the time when the granularity period began if the Type field is set to A or B. If the Type field is either "C" or "D" then Starttime contains the time when the first granularity period of the measurement results contained in the file began. The Starttime field is of the form HHMMshhmm, where:

   - HH is the two digit hour of the day (local time), based on 24 hour clock (00 - 23);
   - MM is the two digit minute of the hour (local time), possible values are 00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, and 55;
   - s is the sign of the local time differential from UTC (+ or -), in case the time differential to UTC is 0 then the sign may be arbitrarily set to "+" or "-";
   - hh is the two digit number of hours of the local time differential from UTC (00-23);
   - mm is the two digit number of minutes of the local time differential from UTC (00-59).

4) The Enddate field shall only be included if the Type field is set to "C" or "D", i.e. measurement results for multiple granularity periods are contained in the file. It identifies the date when the last granularity period of these measurements ended, and its structure corresponds to the Startdate field.

5) The Endtime field indicates the time when the granularity period ended if the Type field is set to A or B. If the Type field is either "C" or "D" then Endtime contains the time when the last granularity period of the measurement results contained in the file ended. Its structure corresponds to the Starttime field, however, the allowed values for the minute of the hour are 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 00.

6) UniqueId. This is the name of the NE, EM or domain, as defined in clauses B.1.1.1 and B.1.1.2 (e.g. a distinguishedName). The field may be omitted only if the distinguishedName is not available from the CM applications.

7) The RC parameter is a running count, starting with the value of "1", and shall be appended only if the filename is otherwise not unanimous, i.e. more than one file is generated and all other parameters of the file name are identical. Therefore it may only be used by the EM, since the described situation cannot occur with NE

generated files. Note that the delimiter for this field, _ _, is an underscore character (_), followed by a minus character (-), followed by an underscore character (_).

8) jobId. When PMIRP is supported, the jobId shall be indicated in the performance measurement file name.

Some examples describing file naming convention:

1) file name: A20000626.2315+0200-2330+0200_NodeBId,
meaning: file produced by NodeB <NodeBId> on June 26, 2000, granularity period 15 minutes from 23:15 local to 23:30 local, with a time differential of +2 hours against UTC.

2) file name: B20021224.1700-1130-1705-1130_ job10_EMId,
meaning: file containing results for multiple NEs, generated for measurement job job10, produced by EM <EMId> on December 24, 2002, granularity period 5 minutes from 17:00 local to 17:05 local, with a time differential of -11:30 hours against UTC.

3) file name: D20050907.1030+0000-20050909.1500+0000_DomainId_ _2,
meaning: file containing results for NEs belonging to domain <DomainId>, start of first granularity period 07 September 2005, 10:30 local, end of last granularity period 09 September 2005, 15:00 local, with a time differential of 0 against UTC. This file is produced by the EM managing the domain, and it is the second file for this domain/granularity period combination.

B.2. File transfer procedure

Both push (i.e. triggered by the NE) and pull (triggered by the OS) transfer modes shall be supported on the NM interface. Implementation specific means may be employed for the administration and control of the file transfer, concerning:

- the time of the transfer (in push mode);
- the routing of the transfer to one or more OS(s) (in push mode);
- the storage/deletion of the files in the NE, particularly when the EM based approach is chosen (cf. clause B.1.1.1).

Measurement result files shall be retained by the file generator (i.e. NE or EM) at least until they have been successfully transferred to or collected by the NM. The storage capacity and the duration for which the data can be retained at the NE or the EM will be Operator and implementation dependent.

The file transfer procedure implemented in the system (NE or EM) shall ensure that no data can get lost under normal operating conditions. The procedure shall also ensure that the files will be deleted after successful transfer to the NM. Depending on the exact implementation of the procedure, the NM may be responsible for deleting those files, or older files will be eventually overwritten by new ones by the file generator in a round robin fashion.

Each implementation shall support all primitives of the selected protocol (e.g. put file, get file, inspect directory contents, delete file) which are needed by the NM. These primitives depend on the details of the procedure, as defined by the manufacturer.

Annex C (informative):
The table oriented file format structureVoid

Measurement Items (counters) are typically grouped according functionality (cf. GSM 12.04 [8] Measurement Function). The term "measured object class" is used to identify such a group. The file format is based on the fact that the measurements are always collected in sets of one functional group.

The measInfo contains the sequence of measurements, values and related information, in a table oriented structure. It includes a list of measurement types ("measTypes") and the corresponding values ("measValues"), together with the time stamp ("measTimeStamp"), granularity period ("granularityPeriod") and reporting period ("reportingPeriod") pertaining to these measurements. Whenever one of these 4 elements changes, then a new measInfo sequence is started. If the "measTypes" change, then also the "measValues" change, because these elements are connected in the following way: the "measTypes" correspond to a specific measurement object (NE, trunk, cell, …), of which one or more instances can exist inside the NE.

Hence for one set of "measTypes", there can be one or more sets of "measValues", according to the "measObjInstId".

The above is best explained with an example: consider the CELL measurement function (GSM 12.04 [8]). Then the measured object class is Cell. The measInfo contains a "header" line defining which measurements related to Cell are collected (measTypes), and in which order. The subsequent "data" lines will then contain the values of the measurements for each specific cell, which is measured, one data line per cell (measValues).

This format will generate a kind of table with as column headings the measurement names, and in the rows the corresponding measurement values per measured instance.

C.1 Graphical representation of the table structure

For clarity, the table in the example below only contains the measTypes and measValues (and suspectFlag), not the granularityPeriod, reportingPeriod and the measTimeStamp.

	attTCHSeizures	succTCHSeizures	attImmediateAssignProcs	succImmediateAssignProcs	
cell=997	234	345	567	789	false
cell=998	890	901	123	234	false
cell=999	456	567	678	789	false

C.2 Example of ASN.1 Measurement Report File

For readability, a kind of pseudo ASN.1 was used instead of the BER encoding.

```
MeasDataCollection ::= {
  measFileHeader {
    fileFormatVersion ::= "32.401 V6.0",
    senderName ::=
"DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-
Gbg-1,ManagedElement=RNC-Gbg-1",
    senderType ::= "RNC",
    vendorName ::= "Company NN",
    collectionBeginTime ::= 20000301140000
  },
  measData {
    nEId {
      nEUserName ::= "RNC Telecomville",
      nEDistinguishedName ::=
"DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-
Gbg-1,ManagedElement=RNC-Gbg-1",
      nESoftwareVersion ::= "2.1"
    },
```

```
    measInfo {
      measTimeStamp ::= 20000301141430,
      jobId ::= "1231",
      granularityPeriod ::= 900,
      reportingPeriod ::= 1800,
      measTypes {
        "attTCHSeizures",
        "succTCHSeizures",
        "attImmediateAssignProcs",
        "succImmediateAssignProcs"
      },
      measValues {
        {
          measObjInstId ::= "RncFunction=RF-1,UtranCell=Gbg-997",
          measResults {
            iValue ::= 234,
            iValue ::= 345,
            iValue ::= 567,
            iValue ::= 789
          },
          suspectFlag ::= FALSE
        },
        {
          measObjInstId ::= "RncFunction=RF-1,UtranCell=Gbg-998",
          measResults {
            iValue ::= 890,
            iValue ::= 901,
            iValue ::= 123,
            iValue ::= 234
          },
          suspectFlag ::= FALSE
        },
        {
          measObjInstId ::= "RncFunction=RF-1,UtranCell=Gbg-999",
          measResults {
            iValue ::= 456,
            iValue ::= 567,
            iValue ::= 678,
            iValue ::= 789
          },
          suspectFlag ::= TRUE
        }
      }
    }
  },
  measFileFooter ::= 20000301141500
}
```

C.3 Void

C.4 Example of XML schema based XML Measurement Report File

The following is an example of a XML schema based XML measurement report file without use of optional positioning attributes on measurement types and results:

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="MeasDataCollection.xsl"?>
<measCollecFile
  xmlns=
"http://www.3gpp.org/ftp/specs/latest/rel-6/32_series/32401-630.zip#measCollec"
>
  <fileHeader fileFormatVersion="32.401 V6.0"
              vendorName="Company NN"
              dnPrefix="DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1">
    <fileSender
      localDn=
        "SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1"
      elementType="RNC"/>
    <measCollec beginTime="2000-03-01T14:00:00+02:00"/>
  </fileHeader>
  <measData>
    <managedElement
      localDn=
        "SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1"
      userLabel="RNC Telecomville"/>
    <measInfo>
      <job jobId="1231"/>
      <granPeriod duration="PT900S" endTime="2000-03-01T14:14:30+02:00"/>
      <repPeriod duration="PT1800S"/>
      <measTypes>attTCHSeizures succTCHSeizures attImmediateAssignProcs
        succImmediateAssignProcs</measTypes>
      <measValue measObjLdn="RncFunction=RF-1,UtranCell=Gbg-997">
        <measResults>234 345 567 789</measResults>
      </measValue>
      <measValue measObjLdn="RncFunction=RF-1,UtranCell=Gbg-998">
        <measResults>890 901 123 234</measResults>
      </measValue>
      <measValue measObjLdn="RncFunction=RF-1,UtranCell=Gbg-999">
        <measResults>456 567 678 789</measResults>
        <suspect>true</suspect>
      </measValue>
    </measInfo>
  </measData>
  <fileFooter>
    <measCollec endTime="2000-03-01T14:15:00+02:00"/>
  </fileFooter>
</measCollecFile>
```

The following is an example of a XML schema based XML measurement report file with use of optional positioning attributes on measurement types and results:

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="MeasDataCollection.xsl"?>
<measCollecFile
  xmlns=
"http://www.3gpp.org/ftp/specs/latest/rel-6/32_series/32401-630.zip#measCollec"
```

```
>
  <fileHeader fileFormatVersion="32.401 V6.0"
              vendorName="Company NN"
              dnPrefix="DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1">
    <fileSender
      localDn=
        "SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1"
      elementType="RNC"/>
    <measCollec beginTime="2000-03-01T14:00:00+02:00"/>
  </fileHeader>
  <measData>
    <managedElement
      localDn=
        "SubNetwork=CountryNN,MeContext=MEC-Gbg-1,ManagedElement=RNC-Gbg-1"
      userLabel="RNC Telecomville"/>
    <measInfo>
      <job jobId="1231"/>
      <granPeriod duration="PT900S" endTime="2000-03-01T14:14:30+02:00"/>
      <repPeriod duration="PT1800S"/>
      <measType p="1">attTCHSeizures</measType>
      <measType p="2">succTCHSeizures</measType>
      <measType p="3">attImmediateAssignProcs</measType>
      <measType p="4">succImmediateAssignProcs</measType>
      <measValue measObjLdn="RncFunction=RF-1,UtranCell=Gbg-997">
        <r p="1">234</r>
        <r p="2">345</r>
        <r p="3">567</r>
        <r p="4">789</r>
      </measValue>
      <measValue measObjLdn="RncFunction=RF-1,UtranCell=Gbg-998">
        <r p="1">890</r>
        <r p="2">901</r>
        <r p="3">123</r>
        <r p="4">234</r>
      </measValue>
      <measValue measObjLdn="RncFunction=RF-1,UtranCell=Gbg-999">
        <r p="1">456</r>
        <r p="2">567</r>
        <r p="3">678</r>
        <r p="4">789</r>
        <suspect>true</suspect>
      </measValue>
    </measInfo>
  </measData>
  <fileFooter>
    <measCollec endTime="2000-03-01T14:15:00+02:00"/>
  </fileFooter>
</measCollecFile>
```

End of Change in Annex
End of Document

CR-Form-v7

CHANGE REQUEST

⌘	32.401	CR	022	⌘	rev	-	⌘	Current version:	6.3.0	⌘

*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 X Core Network X

Title:	⌘	Add requirements for Threshold Management
Source:	⌘	**SA5** (lidan@nortelnetworks.com)
Work item code:	⌘	OAM-PM
Date:	⌘	19/11/2004
Category:	⌘	**B**
Release:	⌘	Rel-6

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:	⌘	Performance Threshold Management requirements are missing in 32.401
Summary of change:	⌘	Update of clause 5.6; Addition of requirements in new clause 5.7
Consequences if not approved:	⌘	
Clauses affected:	⌘	5.6, 5.7

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

Change in Clause 5.6

5.6 Usage of Alarm IRP for performance alarms

Performance alarms allow Network Operators to be quickly informed of significant PM-related events. Authorized users can (a) set the measurement thresholds and (b) define the characteristics of related performance alarm notifications (e.g. perceivedSeverity). (a) Crossing or (b) reaching of thresholds shall result in the emission of a performance alarm notification. ~~The configuration and management of thresholds and alarm notification are outside the scope of this document.~~

Performance alarms may be defined against any managed object supporting measurement definitions, e.g. UtranCell, SgsnFunction. The source object of the performance alarm shall be the source object instance of the measurement that caused the alarm. Upon threshold (a) crossing or (b) reaching, the subscribed users (i.e. Notification IRP Managers) shall be notified via the Alarm IRP and Notification IRP. The Alarm IRP and Notification IRP are described in TS 32.111-2 [21] and TS 32.302 [11].

All parameters of the alarm notification as described in TS 32.111-2 [21] can be used for performance alarms. This information shall be provided by the PM application as the user of the Alarm IRP, with respect to at least the event type, probable cause, perceived severity, and thresholdinfo, plus all other user supplied mandatory parameters of the alarm notification. The parameter thresholdinfo shall be present for all performance alarm notifications and shall contain information pertinent to the context in which the performance alarm was triggered.

The thresholdinfo parameter shall provide the following information:

- The identifier of the measurement which (a) crossed or (b) reached the threshold
- The value of the measurement
- The threshold (a) crossing or (b) reaching direction (up or down)
- The threshold value (if hysteresis thresholds are supported, both raise and clear trigger values are provided)

Once a performance alarm has been raised, it ~~can~~ shall be managed as other kinds of alarms, e.g., acknowledged, unacknowledged or annotated. Performance alarms may not be cleared manually (i.e., via the ADMC [automatic detection and manual clearing], see 3GPP TS 32.111-1" [12]). Performance alarms shall be cleared when the threshold is (a) crossed or (b) reached in the opposite direction to the one that triggers the alarm.

End of Change in Clause 5.6

Change in Clause 5.7

5.7 Threshold Management

To be able to monitor the overall health of the network, authorized users will have to set the thresholds used for generating Performance Alarms (see section 5.6). It is the Operator's responsibility to ensure that threshold values are defined appropriately in order to detect performance degradations before they become service affecting.

An alarm threshold may be defined for one or more instances of a managed object class supporting measurements. The threshold will be monitored based on a monitor granularity period, where the monitor granularity period is a multiple of measurements collection granularity period. Following threshold creation, it shall be possible to query the threshold information defined for an object instance.

The threshold definition shall allow the user to assign up to four different severity levels (critical, major, minor, warning) based on different threshold values. The threshold direction should also be defined as increasing or decreasing, according to which direction raises the Performance Alarm. More generally, any Performance Management specific parameters of the triggered alarm notification as described in TS 32.111-2[21] will be specified within the threshold configuration information.

All performance measurement types are available for threshold management. When defining thresholds, the user shall be able to select from any of the performance measurement types relevant for the object instance to which the threshold applies.

Thresholds are evaluated as performance data become available. For each measurement type, the current value is checked against the defined alarm threshold(s). Depending upon the previous value for this measurement type, a new alarm, a changed alarm or a clear alarm may be raised upon the (a) crossing or (b) ~~/~~reaching of this threshold.

The behaviour of performance alarms shall be the same as that of the AlarmIRP ([21]).

The threshold value for cumulative counters should be a rate of variation defined in an independent way of the monitor granularity period. ~~(E~~ e.g. an alarm could be triggered when PDP context activation requests are received at a rate exceeding 20 requests/s~~)~~.

The following figure describes examples of threshold crossing for a Cumulative Counter measurement type in the context the changed alarm is supported:

- At T1, a new alarm notification A1 (minor) is generated when Level 1 is crossed
- At T2, a changed alarm notification A1 (critical) is generated when Level 2 and 3 are crossed
- At T3, a changed alarm notification A1 (minor) is generated when Level 3 and 2 are crossed
- At T4, a cleared alarm notification A1 is generated when Level 1 is crossed

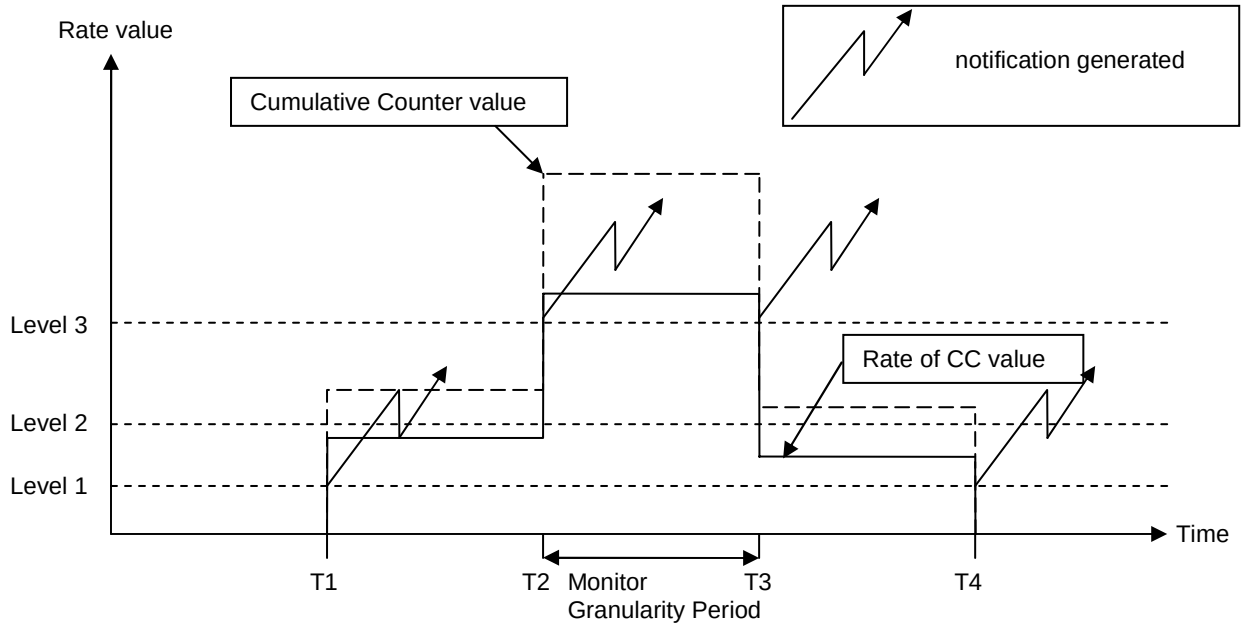


Figure ~~1~~3: Examples of rate-based threshold crossings for a CC measurement type

For **gauge** measurements, the observed value of a gauge at the end of the monitor granularity period is compared to the threshold value.

The following figure describes examples of threshold crossing for a Gauge measurement type in the context the changed alarm is supported:

- At T1, a new alarm notification A1 (minor) is generated when Level 1 is crossed
- At T2, a changed alarm notification A1 (major) is generated when Level 2 is crossed
- At T3, a cleared alarm notification A1 is generated when Level 2 and 1 are crossed

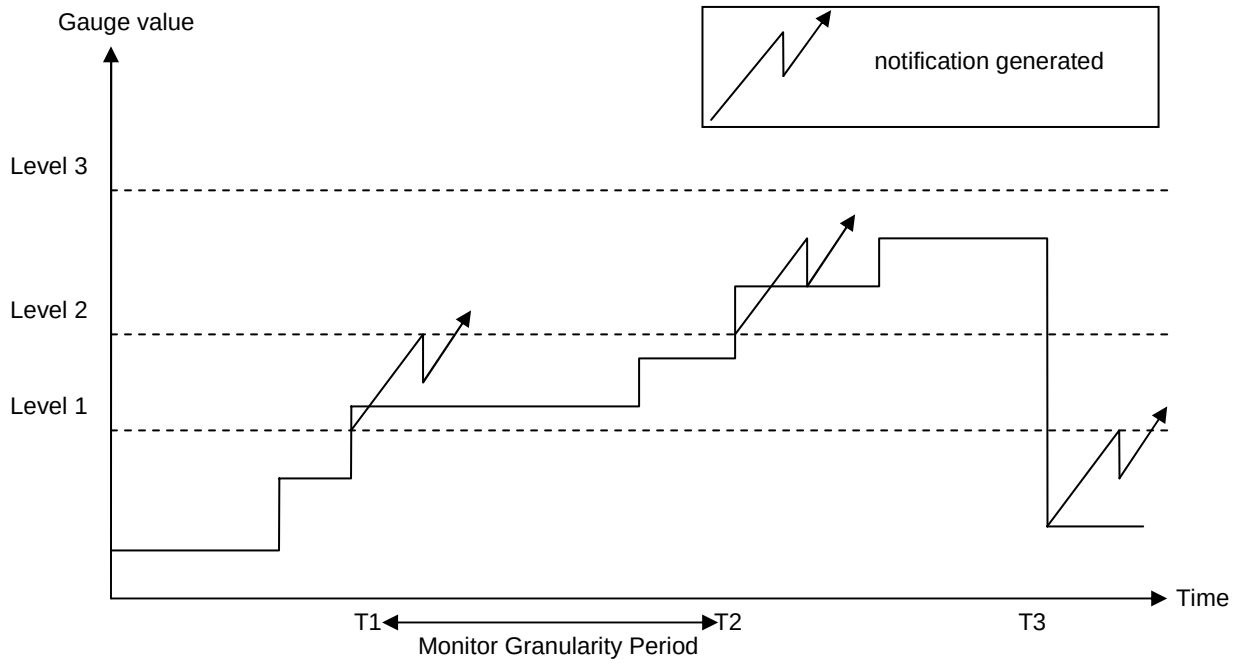


Figure 24: Examples of threshold crossing for a Gauge measurement type

In order to avoid repeatedly triggering Performance Alarms around a particular threshold level, an hysteresis mechanism may also be provided by defining threshold levels in pairs (high levels and low levels). In that case, the high level value shall be greater than or equal to the low level value.

For each pair of high and low threshold levels, one of them shall generate an alarm notification, and the other shall generate an alarm clear notification. If the direction of the threshold is increasing, a new alarm will not be generated before the measurement value has (a) crossed or (b) reached the high level threshold value. Furthermore, the alarm will not be cleared before the measurement value has reached the low level threshold value. For decreasing thresholds, the opposite is applied. The alarm notification shall always be generated before the alarm clear notification.The hysteresis mechanism can be used for both Gauges and Cumulative Counters thresholds.

The following figure describes examples of threshold crossings with hysteresis for a Gauge measurement type in the context the changed alarm is supported:

- At T1, a new alarm notification A1 (e.g. minor) is generated when notifyHigh1 is reached
- At T2, a changed alarm notification A1 (e.g. major) is generated when notifyHigh2 is reached
- At T3, a changed alarm notification A1(e.g. minor) is generated when notifyLow2 is reached
- At T4, a cleared alarm notification A1 is generated when notifyLow1 is reached
- At T5, a new alarm notification A2 is generated when notifyHigh1 is reached

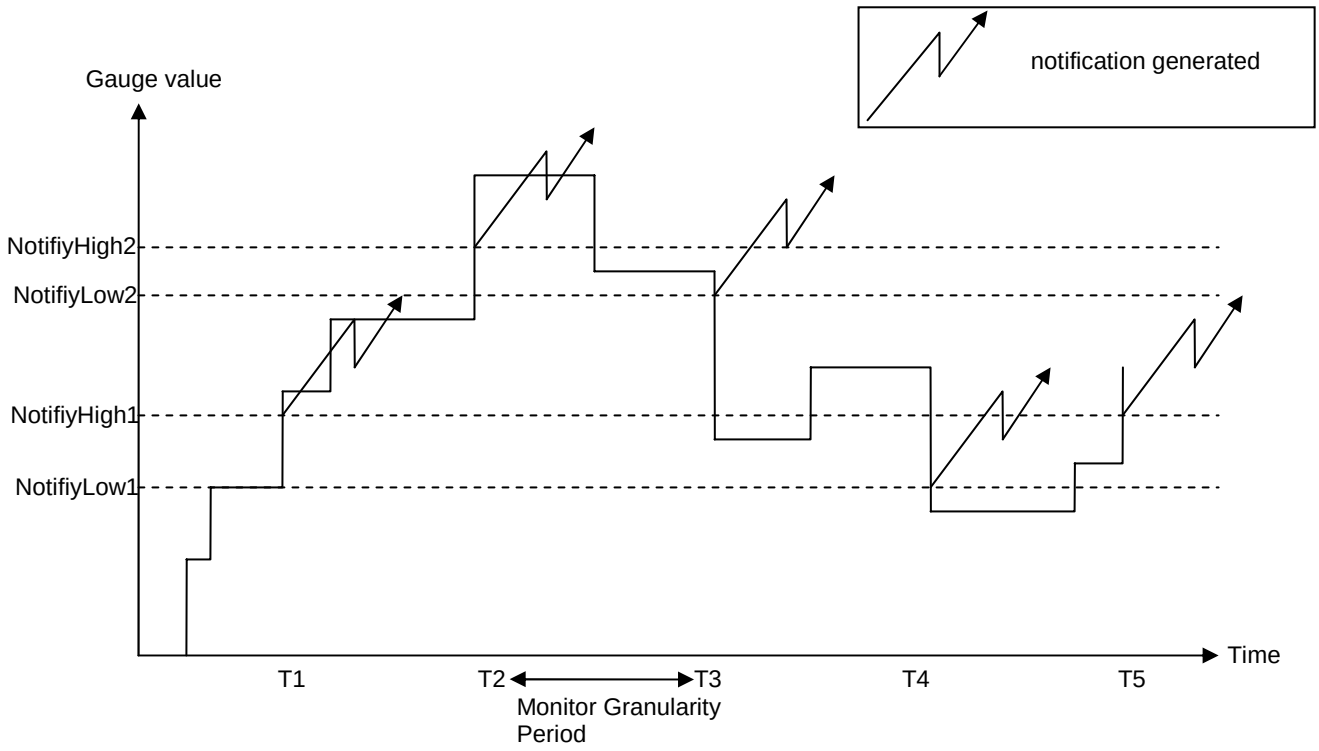


Figure ~~3~~5: Examples of threshold crossings with hysteresis for a Gauge measurement type

For a threshold crossing with hysteresis example of Cumulative Counter measurement type, the monitored value for the alarms generation would be the derivative of the CC value, i.e. its rate of variation.

For DER and SI, the value of the counter will be calculated over the complete monitor granularity period. For **SI,** the counter will be sampled at regular time intervals and the mean value over the monitor granularity period will be calculated and compared with the threshold. For **DER** type, the threshold is compared with the mean value of all observations collected during the monitor granularity period. For a DER type, if no observations are made during the monitor granularity period then the DER will have a value of NULL. No valid comparison with a threshold can be made in this case. If an alarm has previously been detected it will remain outstanding.

The following figure describes examples of threshold crossings for a DER measurement type in the context the changed alarm is supported:

- At T1, a new alarm notification A1 (minor) is generated when Level 1 is crossed
- At T2, a changed alarm notification A1 (major) is generated when Level 2 is crossed
- At T3, a cleared alarm notification A1 is generated when Level 1 is crossed

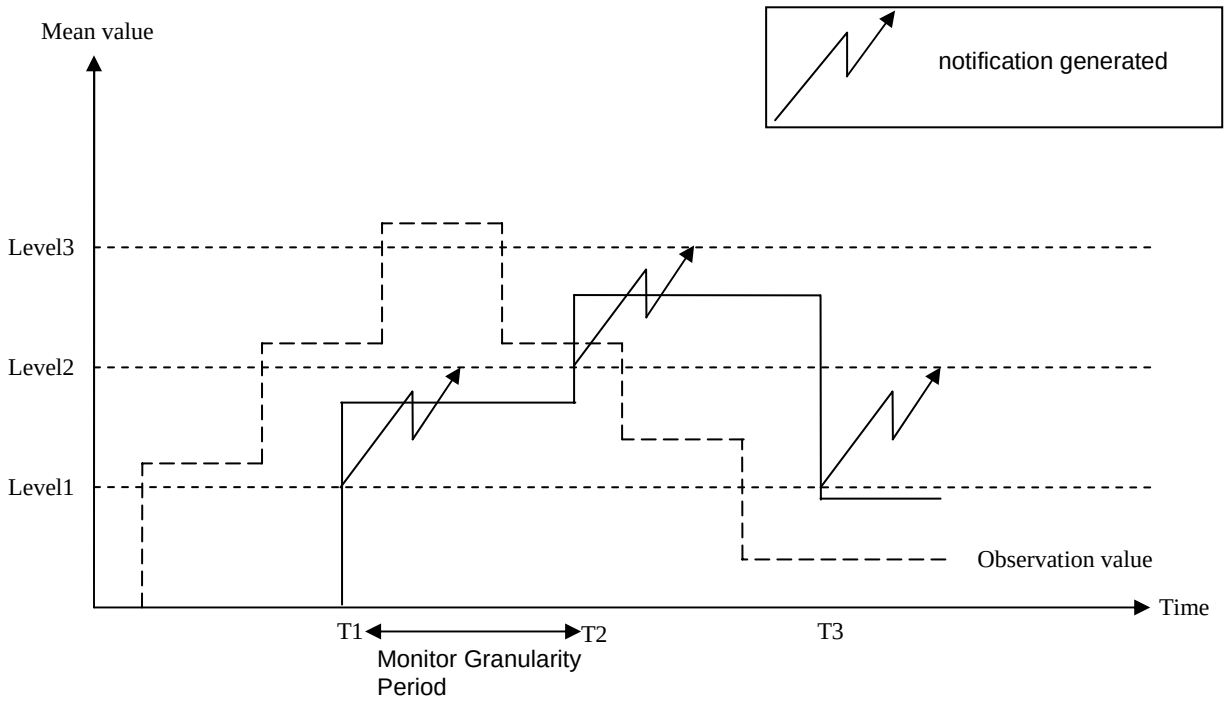


Figure 46: Examples of threshold crossings for a DER measurement type

End of Change in Clause 5.7
End of Document

CR-Form-v7

CHANGE REQUEST

⌘ 32.403 CR 054 ⌘rev - ⌘ Current version: 4.8.0 ⌘

*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 X

Title:	⌘	Correct measurements about GPRS Update Locations sent to the HLR
Source:	⌘	**SA5** (yzyao126@126.com, liyewen@chinamobile.com)
Work item code:	⌘	OAM-PM
Date:	⌘	19/11/2004
Category:	⌘	**F**
Release:	⌘	Rel-4

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:	⌘	1) For measurements about "GPRS Update Locations sent to the HLR", the condition for successful case is incorrect. Currently, the conditions for successful case and attempted case are the same. 2) Subclause name for these two measurements is not appropriate.
Summary of change:	⌘	Correct the condition for "Successful GPRS Update Locations sent to the HLR" and change the subclause name.
Consequences if not approved:	⌘	Wrong condition for "successful GPRS Update Locations sent to the HLR" which will lead to an incorrect measurement report.

Clauses affected:	⌘	5.1.44

		Y	N			
Other specs affected:	⌘		X	Other core specifications	⌘	
			X	Test specifications		
		X		O&M Specifications		Rel-5/6/ 32.403

Other comments:	⌘	Rel-5/6/ Mirror CRs 32.403 in S5-049038/9.

Change in Clause 5.1.44

5.1.44 Successful GPRS Update Locations ~~sent to~~returned from the HLR

a) This measurement provides the number of successful GPRS Update Locations returned from the HLR.

b) CC.

c) ~~Transmission~~ Receipt of a 'MAP_UPDATE_LOCATION ack' service ~~request~~response/confirm indicating a successful GPRS Update location (TS 29.002).

d) A single integer value.

e) MM.SuccUpdateGprsLocationHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

End of Change in Clause 5.1.44
End of Document

CR-Form-v7

CHANGE REQUEST

⌘ 32.403 CR 055 ⌘rev - ⌘ Current version: 5.8.0 ⌘

*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 X

Title:	⌘	Correct measurements about GPRS Update Locations sent to the HLR
Source:	⌘	**SA5** (yzyao126@126.com, liyewen@chinamobile.com)
Work item code:	⌘	OAM-PM
Date:	⌘	19/11/2004
Category:	⌘	**A**
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:	⌘	1) For measurements about "GPRS Update Locations sent to the HLR", the condition for successful case is incorrect. Currently, the conditions for successful case and attempted case are the same. 2) Subclause name for these two measurements is not appropriate.
Summary of change:	⌘	Correct the condition for "Successful GPRS Update Locations sent to the HLR" and change the subclause name.
Consequences if not approved:	⌘	Wrong condition for "successful GPRS Update Locations sent to the HLR" which will lead to an incorrect measurement report.

Clauses affected:	⌘	5.1.44

	Y	N		
Other specs affected: ⌘		X	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments:	⌘	Rel-5 Mirror CR to S5-049037.

Change in Clause 5.1.44

5.1.44 Successful GPRS Update Locations ~~sent to~~returned from the HLR

a) This measurement provides the number of successful GPRS Update Locations returned from the HLR.

b) CC.

c) ~~Transmission~~ Receipt of a 'MAP_UPDATE_LOCATION ack' service ~~request~~response/confirm indicating a successful GPRS Update location (TS 29.002).

d) A single integer value.

e) MM.SuccUpdateGprsLocationHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

End of Change in Clause 5.1.44
End of Document

CR-Form-v7

CHANGE REQUEST

⌘ 32.403 CR 056 ⌘rev - ⌘ Current version: 6.5.0 ⌘

*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 X

Title:	⌘	Correct measurements about GPRS Update Locations sent to the HLR
Source:	⌘	**SA5** (yzyao126@126.com, liyewen@chinamobile.com)
Work item code:	⌘	OAM-PM
Date:	⌘	19/11/2004
Category:	⌘	**A**
Release:	⌘	Rel-6

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:	⌘	1) For measurements about "GPRS Update Locations sent to the HLR", the condition for successful case is incorrect. Currently, the conditions for successful case and attempted case are the same. 2) Subclause name for these two measurements is not appropriate.
Summary of change:	⌘	Correct the condition for "Successful GPRS Update Locations sent to the HLR" and change the subclause name.
Consequences if not approved:	⌘	Wrong condition for "successful GPRS Update Locations sent to the HLR" which will lead to an incorrect measurement report.

Clauses affected:	⌘	5.1.33

	Y	N		
Other specs affected: ⌘		X	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments:	⌘	Rel-6 Mirror CR to S5-049037.

Change in Clause 5.1.33

5.1.33 ~~Attempted~~ GPRS Update Locations sent to the HLR

5.1.33.1 Attempted GPRS Update Locations sent to the HLR

a) This measurement provides the number of GPRS Update Locations sent to the HLR.

b) CC.

c) Transmission of a 'MAP_UPDATE_LOCATION' service request (TS 29.002).

d) A single integer value.

e) MM.AttUpdateGprsLocationHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

5.1.33.2 Successful GPRS Update Locations ~~sent to~~returned from the HLR

a) This measurement provides the number of successful GPRS Update Locations returned from the HLR.

b) CC.

c) ~~Transmission~~ Receipt of a 'MAP_UPDATE_LOCATION ack' service ~~request~~response/confirm indicating a successful GPRS Update location (TS 29.002).

d) A single integer value.

e) MM.SuccUpdateGprsLocationHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

End of Change in Clause 5.1.33
End of Document