Source:	**SA5 (Telecom Management)**								

Source: **SA5 (Telecom Management)**

Title: **Rel-5 CRs 32.401 (Performance Management (PM); Concept and requirements)**

Document for: **Approval**

Agenda Item: **7.5.3**

Doc-1st-	Spec	CR	Rev	Phase	Subject	Cat	Version-	Doc-2nd-	Workitem
SP-020502	32.401	003	-	Rel-5	**Description of Alarm IRP usage for performance alarms**	C	5.0.0	S5-028224	OAM-PM
SP-020502	32.401	004	-	Rel-5	**Addition of measurement file XML schema and miscellaneous alignments with CM**	B	5.0.0	S5-028325	OAM-PM

CR-Form-v5

CHANGE REQUEST

| ⌘ | **32.401** CR **003** | ⌘**rev** | **-** | ⌘ | Current version: | **5.0.0** | ⌘ |

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

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

Title:	⌘	Description of Alarm IRP usage for performance alarms
Source:	⌘	S5
Work item code: ⌘	OAM-PM	*Date:* ⌘ 28/06/2002

Category:	⌘ **C**	*Release:* ⌘	*REL-5*

Use <u>one</u> of the following categories:	Use <u>one</u> of the following releases:
F (correction)	2 (GSM Phase 2)
A (corresponds to a correction in an earlier release)	R96 (Release 1996)
B (addition of feature),	R97 (Release 1997)
C (functional modification of feature)	R98 (Release 1998)
D (editorial modification)	R99 (Release 1999)
Detailed explanations of the above categories can	REL-4 (Release 4)
be found in 3GPP <u>TR 21.900</u>.	REL-5 (Release 5)

Reason for change: ⌘	Lack of detailed information on the usage of the Alarm IRP in the context of Performance Management alarms.
Summary of change: ⌘	Introduction of a new section 5.6 "Usage of Alarm IRP for performance alarms". Missing references to Alarm IRP and Notification IRP TSs have also been added.
Consequences if not approved: ⌘	The description of performance alarms is not specific enough and may lead to multiple interpretations and implementations.

Clauses affected: ⌘	2, 5.6
Other specs ⌘ ☐	Other core specifications ⌘
Affected: ☐	Test specifications
☐	O&M Specifications
Other comments: ⌘	

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, edition number, version number, etc.) 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 32.101: "3G Telecom Management: Principles and high level requirements".

[2]   3GPP TS 32.102: "3G Telecom Management architecture".

[3]   3GPP TS 32.600: "Telecommunication Management; 3G configuration management; Concept and high level requirements ".

[4]   3GPP TS 25.442: "UTRAN Implementation Specific O&M Transport".

[5]   ITU-T Recommendation E.880: "Field data collection and evaluation on the performance of equipment, networks and services".

[6]   ITU-T Recommendation X.731: "Information technology - Open Systems Interconnection - Systems Management: State management function".

[7]   ISO 8571: "Information processing systems - Open Systems Interconnection - File Transfer, Access and Management".

[8]   GSM 12.04: "Digital cellular telecommunications system (Phase 2+) (GSM); Performance data measurements".

[9]   GSM 12.06: "Digital cellular telecommunications system (Phase 2+) GSM network configuration management".

[10]   3GPP TS 32.300: "Telecommunication Management; 3G Configuration Management; Name convention for managed objects".

[11]   ~~Void~~3GPP TS 32.302: "Telecommunication Management; Notification Management; Notification Integration Reference Point: Information Service".

[12]   ~~Void~~3GPP TS 32.111-1: "Telecommunication Management; Fault Management; Part 1: 3G Fault Management Requirements".

[13]   Void

[14]   Void

[15]   Void

[16]   Void

[17]   Void

[18]   Void

[19]   Void

[20]   3GPP TR 32.800: "Management level procedures and interaction with UTRAN (Release 4)".

[21]   3GPP TS 32.111-2 ~~-x~~: "Telecommunication Management; Fault Management; Part 2: Alarm Integration Reference Point: Information service".

[22]   3GPP TS 52.402: "Telecommunication Management; Performance Management (PM);
Performance Measurements - GSM".

[23]   3GPP TS 32.403: "Telecommunication Management; Performance Management (PM);
Performance Measurements UMTS and combined UMTS/GSM".

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). Crossing 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 crossing, 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 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 crossed the threshold.

    The value of the measurement.

    The threshold crossing 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 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: "3G Fault Management" [12]). Performance alarms shall be cleared when the threshold is crossed in the opposite direction to the one that triggers the alarm.

CR-Form-v7

CHANGE REQUEST

| ⌘ | **32.401** CR **004** | ⌘ **rev** | **-** | ⌘ | Current version: | **5.0.0** | ⌘ |

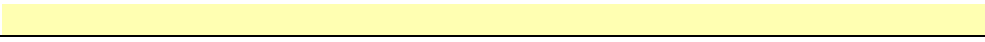*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

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

Title: ⌘	Addition of measurement file XML schema and miscellaneous alignments with CM	
Source: ⌘	S5	
Work item code: ⌘	OAM-PM	***Date:*** ⌘ 23/08/2002
Category: ⌘ **B**		***Release:*** ⌘ Rel-5

Use <u>one</u> 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 <u>TR 21.900</u>.	*Use <u>one</u> 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: ⌘	Unify PM and CM TSs with regard to: • Use of XML schema as description language for XML file formats • Name Convention for Managed Objects (MOs) defined in TS 32.300 • Generic Network Resource Model defined in TS 32.622 • Version identification used for SSs and File Format Definitions
Summary of change: ⌘	• Addition of measurement file XML schema • Addition of examples of XML schema based XML measurement files • Addition of XML schema based XML tags in measurement file parameter description table • Alignment with CM of description for measurement file parameters related to MO naming, NE configuration data, file format version identification • Alignment of ASN.1 format with CM file format version identification • Correction of existing measurement file examples, as per the above changes • Addition of example for DTD based XML measurement file without use of optional positioning information • Addition of note on the intention of removing the DTD based XML format in R6
Consequences if not approved: ⌘	This might lead to different implementations and thus would jeopardize multi-vendor integration at OSS level: PM measurement report file format and content would not be aligned with CM, in terms of used XML format description language and in terms of contained CM data.

Clauses affected: ⌘	2, annex A, A.1, A.2, A.3, A.4 (new), C.2, C.3, C.4 (new)

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

Other comments: ⌘

2 References

●●●

    [23]   3GPP TS 32.403: "Telecommunication Management; Performance Management (PM); Performance Measurements UMTS and combined UMTS/GSM".

    [24]   3GPP TS 32.622: "Telecommunication Management; Configuration Management; Generic Network Resources IRP: Network Resource Model".

    [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".

Annex A (normative):
Measurement Report File Format

This annex describes the format of measurement result files that can be transferred from the network (NEs or EM) to the NM. Two Three alternative format definitions are specified, one using ASN.1 with binary encoding (BER), the two others applying XML (see [25]), which is ASCII based. Of the two alternative XML format definitions, one is based on DTD, while the other 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 the two three alternatives.

> NOTE: It is not intended to have the DTD based XML format from Release 6 onwards defined as one of the alternate valid file formats for measurement result files.

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, except from the measurement job id, which is only needed to correlate measurement result reports with measurement jobs within the area of measurement administration (see clause 5.2.1.4). The two 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 two three format definitions can be regarded as two three different instances of the same single format.

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

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- 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 ellipse notation. XML allows such additions through extra DTDs or XML schemas, provided by the definer 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 file format definitions, DTD based and XML schema based. It also provides an explanation of the individual parameters. The XML tags defined in the DTD (see clause A.3.1) have been kept as short as possible in order to minimise the size of the XML measurement result files. 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	DTD based XML tag	XML schema based XML tag	Description
MeasDataCollection	mdc	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	mfh	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	md	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	mff	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	ffv	fileHeader fileFormatVersion	This parameter identifies the file format version applied by the sender. The format version defined in the present document shall be "2" the abridged number and version of this 3GPP document (see below) for both the XML formats and the ASN.1 formats 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	sn	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 and DTD based XML format, The string may be empty (i.e. string size =0) in case it 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]). XML attribute specification "dnPrefix" may be absent in case the DN prefix is not configured in the sender. XML attribute specification "localDn" may be absent in case the LDN is not configured in the sender.
senderType	st	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.

ASN.1 Tag	DTD based XML tag	XML schema based XML tag	Description
vendorName	vn	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	cbt	measCollec 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	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	neun	managedElement userLabel	This is the user definable NE name ("userLabel"), cf. defined for the NE in 3GPP TS 32.300622 [1024]. 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	nedn	fileHeader dnPrefix and managedElement localDn	This is the dDistinguished 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	nesw	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	mi	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	mts	granPeriod endTime	Time stamp referring to the end of the granularity period.
granularityPeriod	gp	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 "PTnS" (see [28]).
measTypes	mt	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	mv	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").

ASN.1 Tag	DTD based XML tag	XML schema based XML tag	Description
measObjInstId	moid	measValue measObjLdn	The "measObjInstId" field ~~identifies~~ contains the ~~relative~~ local distinguished name (~~R~~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 ~~an~~ a "ManagedElement~~RncFunction~~" representing RNC "~~RF-1~~RNC-Gbg-1", then the "nEDistinguishedName" will be for instance "DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,~~G3~~SubNetwork=~~Sweden~~CountryNN,MeContext=MEC-Gbg-1,~~G3~~ManagedElement=RNC-Gbg-1,~~RncFunction=RF-1~~", and the "measObjInstId" ~~is~~ 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" ~~would~~ will be for instance the same ~~as~~ ~~before~~ above, i.e. "DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,~~G3~~SubNetwork=~~Sweden~~CountryNN,MeContext=MEC-Gbg-1,~~G3~~ManagedElement=RNC-Gbg-1,~~RncFunction=RF-1~~", and the "measObjInstId" ~~is~~ 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	r	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	sf	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	ts	measCollec endTime	ASN.1 GeneralizedTime format. The minimum required information within timestamp is year, month, day, hour, minute, and second.
Not Required	mt p	measType p	An optional positioning XML attribute specification of ~~the <mt/> tag~~ XML elements "mt" (DTD based) and "measType" (XML schema based), used to identify a measurement type for the purpose of correlation to a result. The value of this ~~field~~ XML attribute specification is expected to be a non-zero, non-negative integer value~~,~~ that is unique for each instance of ~~the <mt/> tag~~ XML element "mt" or "measType" that is contained within the measurement data collection file.
Not Required	r p	r p	An optional positioning XML attribute specification of ~~the <r/> tag~~ XML element "r", used to correlate a result to a measurement type. The value ~~used for the r p~~ of this XML attribute specification should match the value of ~~the corresponding mt p~~ XML attribute specification "p" of corresponding XML element "mt" " (DTD based) or "measType" (XML schema based).

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A.2 ASN.1 file format definition

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```
MeasFileHeader::= SEQUENCE
    {
    fileFormatVersion    INTEGERPrintableString (SIZE (0..15)),
    senderName  PrintableString (SIZE (0..400)),
    senderType  SenderType,
    vendorName  PrintableString (SIZE (0..32)),
    collectionBeginTime TimeStamp,
    ...
    }
```

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A.3 DTD based XML file format definition

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For encoding of the information content, XML (see Extensible Markup Language (XML) 1.0, W3C Recommendation 10-Feb-98) will be used. The XML **document type** declaration **definition** contains the mark-up declarations that provide a grammar for the measurement file format. This grammar is known as a Document Type Definition (DTD). The DTD to be used is defined below. The type definitions and constraints for data types and values defined in the ASN.1 format, such as string sizes, shall implicitly be applied to the XML result files also. The representation of the timestamps within the XML file shall follow the "GeneralizedTime" ASN.1 type.

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

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="MeasDataCollection.xsl"−?>
<!DOCTYPE mdc SYSTEM "MeasDataCollection.dtd"−>
<mdc xmlns:HTML="http://www.w3.org/TR/REC-xml">
```

●●●

A.4 XML schema based XML file format definition

A.4.1 Measurement collection data file XML diagram

The following figure describes the XML element structure of the measurement collection data file:

Element named xxx. The maximum number of occurrence is 1.

Element named xxx. The maximum number of occurrences is unbounded. There may be no occurrence.

Required element

Optional element

Sequence

Choice
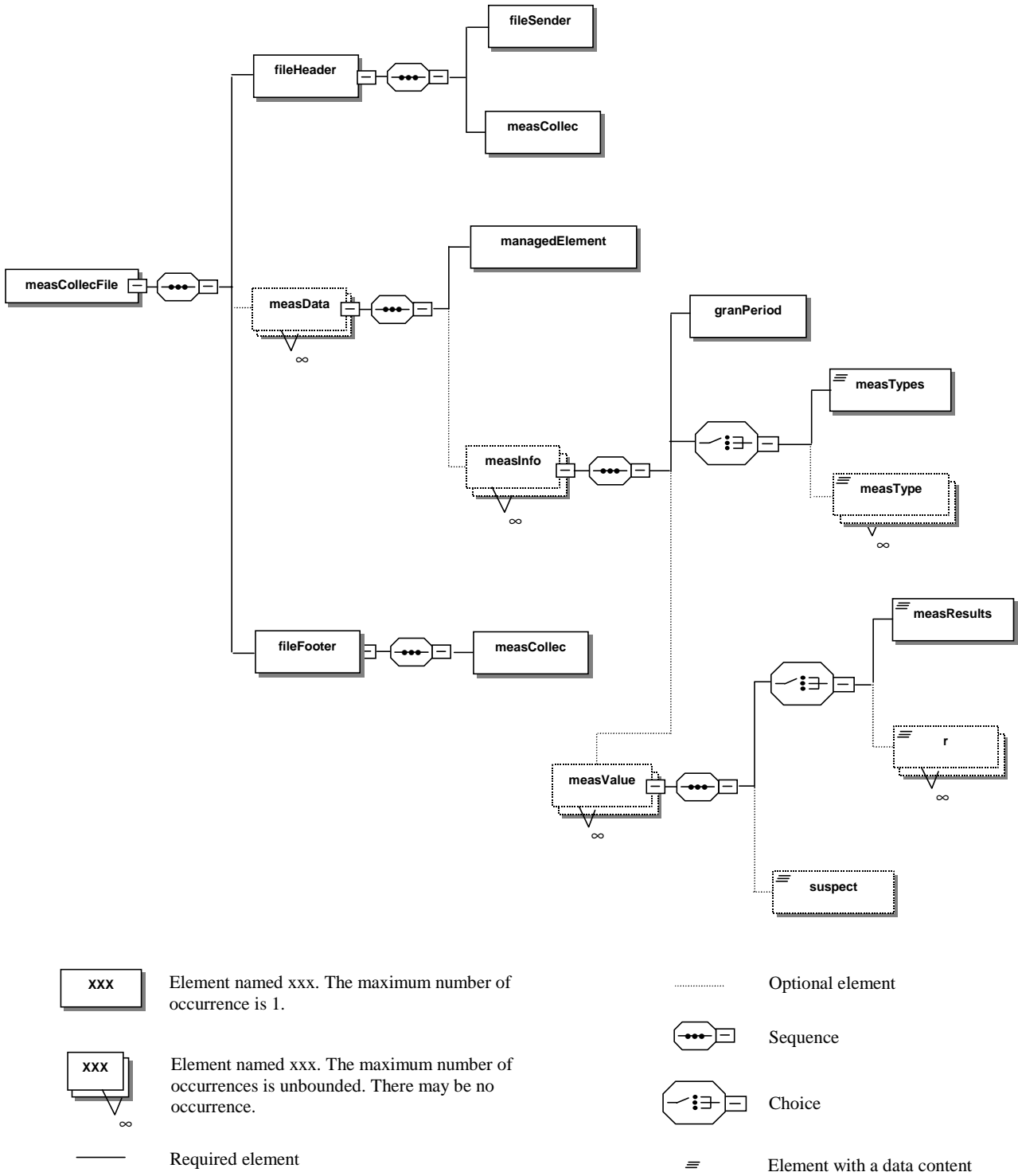
Element with a data content

Figure 3: 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
<?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-5/32_series/32401-500.zip#measCollec"
  elementFormDefault="qualified"
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:mc=
"http://www.3gpp.org/ftp/specs/latest/rel-5/32_series/32401-500.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="granPeriod">
                      <complexType>
                        <attribute
                          name="duration"
                          type="duration"
                          use="required"
                        />
                        <attribute
```

```
                                          name="endTime"
                                           type="dateTime"
                                           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>
            <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-5/32_series/32401-500.zip#measCollec"
>
```

C.2   Example of ASN.1 Measurement Report File

●●●

```
MeasDataCollection ::= {
    measFileHeader  {
        fileFormatVersion ::= 1"32.401 V5.0",
        senderName ::=
"DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,G3SubNetwork=SwedenCountryNN,MeContext=MEC-Gbg-
1,G3ManagedElement=RNC-Gbg-1,RncFunction=RF-1" ,
        senderType  ::= "RNC",
        vendorName  ::= "Telecom corp.Company NN",
        collectionBeginTime  ::= 20000301140000
        },
    measData  {
        nEId {
            nEUserName  ::= "RNC Telecomville",
            nEDistinguishedName  ::=
"DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,G3SubNetwork=SwedenCountryNN,MeContext=MEC-Gbg-
1,G3ManagedElement=RNC-Gbg-1,RncFunction=RF-1",
            nESoftwareVersion  ::= "2.1"
        },
        measInfo {
            measTimeStamp ::= 20000301141430,
            granularityPeriod ::= 900,
            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 ::= FALSETRUE
 }
 }
          }
 },
     measFileFooter ::= 20000301141500
 }
```

C.3   Example of DTD based XML Measurement Report File

The following is an example of a DTD 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"?>
<!DOCTYPE mdc SYSTEM "MeasDataCollection.dtd">
<mdc>
  <mfh>
    <ffv>32.401 V5.0</ffv>
    <sn>DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-Gbg-
1,ManagedElement=RNC-Gbg-1</sn>
    <st>RNC</st>
    <vn>Company NN</vn>
    <cbt>20000301140000</cbt>
  </mfh>
  <md>
    <neid>
      <neun>RNC Telecomville</neun>
      <nedn>DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,SubNetwork=CountryNN,MeContext=MEC-Gbg-
1,ManagedElement=RNC-Gbg-1</nedn>
    </neid>
    <mi>
      <mts>20000301141430</mts>
      <gp>900</gp>
      <mt>attTCHSeizures</mt>
      <mt>succTCHSeizures</mt>
      <mt>attImmediateAssignProcs</mt>
      <mt>succImmediateAssignProcs</mt>
      <mv>
        <moid>RncFunction=RF-1,UtranCell=Gbg-997</moid>
        <r>234</r>
        <r>345</r>
        <r>567</r>
        <r>789</r>
      </mv>
      <mv>
        <moid>RncFunction=RF-1,UtranCell=Gbg-998</moid>
        <r>890</r>
        <r>901</r>
        <r>123</r>
        <r>234</r>
      </mv>
      <mv>
        <moid>RncFunction=RF-1,UtranCell=Gbg-999</moid>
        <r>456</r>
        <r>567</r>
        <r>678</r>
        <r>789</r>
        <sf>TRUE</sf>
      </mv>
    </mi>
  </md>
  <mff>
    <ts>20000301141500</ts>
  </mff>
</mdc>
```

The following is an example of a DTD 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"?>
<!DOCTYPE mdc SYSTEM "MeasDataCollection.dtd">
<mdc>
```

```
   <mfh>
      <ffv>232.401 V5.0</ffv>
      <sn>DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,~~G3~~SubNetwork=~~Sweden~~CountryNN,MeContext=MEC-Gbg-
1,~~G3~~ManagedElement=RNC-Gbg-1~~,RncFunction=RF-1~~</sn>
      <st>RNC</st>
      <vn>~~Telecom corp.~~Company NN</vn>
      <cbt>20000301140000</cbt>
   </mfh>
   <md>
      <neid>
         <neun>RNC Telecomville</neun>
         <nedn>DC=a1.companyNN.com,SubNetwork=1,IRPAgent=1,~~G3~~SubNetwork=~~Sweden~~CountryNN,MeContext=MEC-
Gbg-1,~~G3~~ManagedElement=RNC-Gbg-1~~,RncFunction=RF-1~~</nedn>
      </neid>
      <mi>
         <mts>20000301141430</mts>
         <gp>900</gp>
         <mt p="1">~~attTCHSeizures~~</mt>
         <mt p="2">~~succTCHSeizures~~</mt>
         <mt p="3">~~attImmediateAssignProcs~~</mt>
         <mt p="4">~~succImmediateAssignProcs~~</mt>
         <mv>
            <moid~~>~~RncFunction=RF-1,UtranCell=Gbg-997~~~~</moid>
            <r p="1">~~234~~</r>
            <r p="2">~~345~~</r>
            <r p="3">~~567~~</r>
            <r p="4">~~789~~</r>
~~<sf>FALSE</sf>~~
         </mv>
         <mv>
            <moid>~~RncFunction=RF-1,UtranCell=Gbg-998</moid>
            <r p="1">~~890~~</r>
            <r p="2">~~901~~</r>
            <r p="3">~~123~~</r>
            <r p="4">~~234~~</r>
~~<sf>FALSE</sf>~~
         </mv>
         <mv>
            <moid>~~RncFunction=RF-1,UtranCell=Gbg-999~~</moid>
            <r p="1">~~456~~</r>
            <r p="2">~~567~~</r>
            <r p="3">~~678~~</r>
            <r p="4">~~789~~</r>
            <sf>~~FALSE~~TRUE</sf>
         </mv>
      </mi>
   </md>
   <mff>
      <ts>20000301141500</ts>
   </mff>
</mdc>
```

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-5/32_series/32401-500.zip#measCollec">
  <fileHeader fileFormatVersion="32.401 V5.0"
              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>
      <granPeriod duration="PT900S" endTime="2000-03-01T14:14:30+02:00"/>
```

```
      <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-5/32_series/32401-500.zip#measCollec">
  <fileHeader fileFormatVersion="32.401 V5.0"
              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>
      <granPeriod duration="PT900S" endTime="2000-03-01T14:14:30+02:00"/>
      <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>
```