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Digitalni celiļ ni telekomunikacijski sistem (faza 2) ï Upravljanje okvar za sisteme baznih postaj (BSS) (GSM 12.11, razliļ ica 4.1.2)

Digital cellular telecommunications system (Phase 2) (GSM); Fault management of the Base Station System (BSS) (GSM 12.11 version 4.1.2)

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Foreword

This European Standard (Telecommunications series) (EN) has been produced by ETSI Special Mobile Group (SMG).

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Introduction

This EN specifies the requirements and model necessary for the standardised fault management (FM) aspects of operation, administration and maintenance (OAM) of a multivendor GSM PLMN.

The management of a GSM PLMN follows the systems management model outlined in ITU-T X.701 [5] which structures systems management into various aspects. This EN addresses the functional aspects of fault management.

Fault management provides the following facilities during the operation and maintenance phases of the PLMN under normal and failure conditions:

- installation and acceptance testing;
- putting into service;
- keeping the network operational.

The structure of this document has been defined taking into consideration two aspects:

1) The structured, top-down process of the standardization. A general description of the 'Fault Management' of a Network Element (NE) is presented in clause 4. In clause 5, there is a specification of the four fault management 'Service Components' and, in clauses 6 and 7, the specification of the 'Functions' which the above service components are based on.

2) The reusability of this specification for other NEs of the PLMN. The requirements in clauses 4, 5 and 6 have been specified in a generic way (referring to a generic NE instead of a specific Base Station System) and all BSS specific management functions are specified separately in clause 7.

GSM fault management is based upon the context set by GSM 12.00. Principles, concepts and definitions are based on the M-series of the ITU-T standards (with the exception of the Alarm Surveillance management functions based on Q.821). Where the M-series of standards is not applicable, then the X-series is used as far as possible.

1 Scope

This EN describes the fault management of any NE of a GSM PLMN through the Q3 interface, with focus on the Base Station System (BSS).

The OAM of the GSM Public Land Mobile Network (PLMN) is organised and described in terms of TMN Management Services. GSM 12.00 describes the architecture and gives a general overview of the OAM services, while the rest of the GSM 12 series gives the detailed specification for each service and other aspects of the OAM.

Among all the TMN Management Services listed in GSM 12.00, the following are addressed by this specification:

- Management of the BSS (also covered by GSM 12.20).
- Restoration and Recovery (also covered by GSM 12.06).

This Phase 2 version of GSM 12.11 deals with "Fault Management" aspects of the above services.

For the TMN Management Services covered, the following "TMN Management Service Components" have been defined in clause 5:

- Alarm surveillance.
- Fault localisation.
- Fault correction.
- Testing.

The above TMN Management Service Components are based on several "Management Functions", some of which are defined in other ITU-T documents (e.g. State Management Functions, Alarm Reporting Functions, etc.), and others which are specifically defined here, in clauses 6 and 7.

For some management functions, the Management Information Model is already provided by some ITU-T recommendations, GSM 12.00 and GSM 12.20.

This EN does not include the GDMO definition of the information model.

Although sometimes considered as part of fault management, various administrative policies and procedures such as trouble ticketing and tracking, parts inventory, etc. are not included in this EN. Such aspects may be considered to be the responsibility of the operator and thus outside the scope of the EN.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

2.1 Normative references

This EN incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this EN only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ITU-T Recommendation M.20: (1992) "Maintenance Philosophy for Telecommunication Networks".

[2] ITU-T Recommendation M.3100: (1995) "Generic Network information Model".

[3] ITU-T Recommendation M.3200: (1992) "TMN Management Services: Overview".

[4] ITU-T Recommendation M.3400: (1992) "TMN Management Functions".

[5] ITU-T Recommendation X.701 (1992) | ISO/IEC 10 040: " Information technology - Open Systems Interconnection - Systems Management Overview ".

[6] ITU-T Recommendation X.721 (1992) | ISO/IEC 10 165-2: " Information technology - Open Systems Interconnection - Structure of management information: Definition of Management Information ".

[7] ITU-T Recommendation X.722 (1992) | ISO/IEC 10 165-4: "Information technology - Open Systems Interconnection - Structure of management information: Guidelines for the Definition of Managed Objects".

[8] ITU-T Recommendation X.732 (1992) | ISO/IEC 10 164-3: "Information technology - Open Systems Interconnection - Systems Management: Attributes for representing relationships".

[9] ITU-T Recommendation X.733 (1992) | ISO/IEC 10 164-4: "Information technology - Open Systems Interconnection - Systems Management: Alarm Reporting Function".

[10] ITU-T Recommendation X.734 (1992) | ISO/IEC 10 164-5: "Information technology - Open Systems Interconnection - Systems Management: Event Report Management Function".

[11] ITU-T Recommendation X.735 (1992) | ISO/IEC 10 164-6: "Information technology - Open Systems Interconnection - Systems Management: Log Control Function".

[12] ITU-T Recommendation X.737 (1995) | (ISO/IEC 10 164-14): "Information technology - Open Systems Interconnection - Systems Management: Confidence and Diagnostic Test Categories".

[13] ITU-T Recommendation X.745 (1994) | ISO/IEC 10 164-12: "Information technology - Open Systems Interconnection - Test Management Function".

[14] ITU-T Recommendation X.751 (1995) | (ISO/IEC 10 164-17): "Information technology - Open Systems Interconnection - Change Over Function".

[15] ITU-T Recommendation Q.821: (1993) "Q3 Interface for Alarm Surveillance".

[16] ETR 100 (GSM 01.04): "Digital cellular telecommunications system (Phase 2); Abbreviations and acronyms".

[17] ETS 300 590 (GSM 08.08): "Digital cellular telecommunications system (Phase 2); Mobile-services Switching Centre Base Station System (MSC-BSS) interface Layer 3 specification".

[18] ETS 300 612-1 (GSM 12.00): "Digital cellular telecommunications system (Phase 2); Objectives and Structure of GSM PLMN Management".

[19] ETS 300 612-2 (GSM 12.01): "Digital cellular telecommunications system (Phase 2); Network Management (NM); Part 2: Common aspects of GSM/DCS 1 800 Network Management".

[20] ETS 300 615 (GSM 12.04): "Digital cellular telecommunications system (Phase 2); Performance data measurements".

[21] ETS 300 617 (GSM 12.06): "Digital cellular telecommunications system (Phase 2); GSM Network Configuration Management".

[22] ETS 300 622 (GSM 12.20): "Digital cellular telecommunications system (Phase 2); Base Station System (BSS) Management Information".

2.2 Informative references

1) ITU-T Recommendation M.3010 (1992): "Principles for a Telecommunications Management Network".

2) ITU-T Recommendation X.710 (1991): "Common management information service definition for CCITT applications". ISO/IEC 9 595: "Information technology - Open Systems Interconnection - Common management information service definition" is technically aligned with ITU-T X.710.

3) ITU-T Recommendation X.711 (1991): "Common management information protocol specification for CCITT applications" ISO/IEC 9 596: "Information technology - Open Systems Interconnection - Common management information protocol specification " is technically aligned with ITU-T X.711.

4) ITU-T Recommendation X.725 (1995): | ISO/IEC 10 165-7: "Information technology - Open Systems Interconnection - Structure of management information: General Relationship Model".

5) ITU-T Recommendation X.731 (1992): | ISO/IEC 10 164-2: "Information technology - Open Systems Interconnection - Systems Management: State Management Function".

6) ETS 300 593 (GSM 08.52): "Digital cellular telecommunications system (Phase 2); Base Station Controller Base Transceiver Station (BSC - BTS) interface; principles".

7) ETS 300 596 (GSM 08.58): "Digital cellular telecommunications system (Phase 2); Base Station Controller - Base Transceiver Station (BSC-BTS) interface Layer 3 specification".

8) ETS 300 597 (GSM 08.60): "Digital cellular telecommunications system (Phase 2); Inband control of remote transcoders and rate adapters for full rate traffic channels".

9) ETS 300 623 (GSM 12.21): "Digital cellular telecommunications system (Phase 2); Network Management (NM) procedures and messages on the A-bis interface".

10) ETS 300 624 (GSM 12.22): "Digital cellular telecommunications system (Phase 2); Interworking of GSM Network Management (NM) procedures and messages at the Base Station Controller (BSC)".

3 Definitions and abbreviations

3.1 Definitions

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

alarm: A notification, of the form defined by the alarm reporting function (ITU-T X.733 [9]), of a specific event.

active resource: An active resource in the context of redundancy is equivalent to a primary resource.

alarm report: A specific type of event report used to convey alarm information.

outstanding alarm condition: The state in which the conditions that originated an alarm are still present in the system.

anomaly: An anomaly is a discrepancy between the actual and desired characteristics of an item (ITU-T M.20 [1]). In the context of this specification, the item may also be external to the NE (e.g.: environmental alarm detector).

asymmetric redundancy: A redundancy where the primary and secondary resources have different capabilities, and therefore cannot exchange their roles (where the secondary may take the primary role, but the primary may not take the secondary role). Once the faulty primary resource is repaired and restored to service a change back needs to be performed.

back up: A back up resource is a secondary resource providing redundancy to a primary resource.

backed up: A backed up resource is a primary resource which has a secondary resource providing redundancy.

change-back: A change back is the reverse change over in an asymmetric redundancy to restore the resources into their original roles.

change-over: Change over is the action within a system capable of supporting redundancy which results in a secondary resource taking over the primary role. In a symmetric redundancy, the primary resource may take the secondary role.

cleared Alarm: An alarm notification with the perceived severity set to cleared.

cold standby: A secondary resource that requires initialisation activity before it can provide backup capability is defined as being in a cold standby state (ITU-T X.751 [14]).

counter: Counters are a management abstraction of an underlying process, which may be associated with a defined internal event in management information. The current value of a counter is incremented when this event occurs (see note). It can take any values in its range. When a counter reaches its maximum value, it wraps around and counts upwards from 0; overflow information is not in general retained. An additional notification may be defined for counters with wrap behaviour.

NOTE: The rule that a counter value can increase only in single increments is a descriptive convention that simplifies the description of a counter threshold. It does not imply that it will always be possible to observe each increment in the counter's range, since the events counted may occur in rapid succession.

counter threshold: A counter threshold is the application of the thresholding mechanism to a counter.

defect: A defect is a limited interruption in the ability of an item to perform a required function. It may or may not lead to maintenance action depending on the results of additional analysis (M.20 [1]). In the context of this specification, the item may also be external to the NE (e.g.: environmental alarm detector).

duplex redundancy: A duplex redundancy is a redundancy in which a given function can be performed by two resources: a primary resource and secondary resource (also known as active and standby resources respectively).

failure: A failure is the termination of the ability of an item to perform a required function (M.20 [1]). In the context of this specification, the item may also be external to the NE (e.g.: environmental alarm detector).

NOTE: After a failure, the item has a fault (M.20 [1]).

fault: A fault is the inability of an item to perform a required function, excluding that inability due to preventive maintenance, lack of external resources or planned actions.

NOTE: A fault is often the result of a failure of the item itself, but may exist without prior failure (M.20 [1]).

gauge: The gauge is the management abstraction of the value of a dynamic variable, such as the number of connections currently operated by a protocol machine or the rate of change of a traffic counter. There is no restriction on what the dynamic variable may represent, within the constraints set out below. The value of the gauge is subject to change in either direction. The value of the increment or decrement is unconstrained, except that a change that would take the gauge beyond its minimum or maximum value, will leave the gauge value at its minimum or maximum value respectively, until it is subsequently again within the gauge range values.

gauge threshold: A gauge threshold is the application of the thresholding mechanism to a gauge.

hot standby: A secondary resource that is able to provide backup capability for a primary resource without the need for initialisation activity is defined as being in a hot standby state (X.751 [14]).

Least Replaceable Unit (LRU): The smallest piece of equipment that can be replaced by field service personnel.

N+K redundancy: A redundancy where a given function can be performed by N primary resources and K secondary resources. When a failure occurs on one of the N primary resources, one of the K secondary resources may take over the role of that faulty primary resource.

primary resource: A primary resource (in a system capable of supporting redundancy) is a resource that is performing a given function. On failure of a primary resource a secondary resource may take over the role of the faulty primary resource. A primary resource may also be referred to as an "active" or "backed up" resource.

redundancy: The capability of a system to perform fault tolerant functionality by means of spare resources (or groups of resources).

secondary resource: A secondary resource (in a system capable of supporting redundancy) is a resource that may back up a primary resource. A secondary resource may take over the role of a primary resource on failure of that resource. A secondary resource may also be referred to as a "standby" or "back up" resource.

standby resource: A standby resource in the context of redundancy is equivalent to a secondary resource.

symmetric redundancy: A redundancy where the primary and secondary resources have the same capabilities, and therefore each of the resources can exchange their roles (primary and secondary). Once the faulty resource is repaired and restored to service there is no need to perform a change back.

thresholding: Thresholding is the general mechanism (based on counters or gauges) to generate a defined notification from numeric changes in the value(s) of a counter(s) or gauge(s). The defined notification is generated as a result of a value change crossing the threshold level of a counter or gauge.

threshold level: A threshold level is a value which a threshold mechanism compares with the value of a counter or gauge, to determine whether a defined notification is to be generated.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply, in addition to those listed in GSM 01.04 [16]:

AO	Associated Object
ACSE	Association Control Service Element
ASN.1	Abstract Syntax Notation (number) 1
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CASC	Current Alarm Summary Control
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
CMIP	Common Management Information Protocol
EFD	Event Forwarding Discriminator
FTAM	File Transfer Access and Management
GDMO	Guidelines for the Definition of Managed Objects
LRU	Least Replaceable Unit
MIB	Management Information Base
MOC	Managed Object Class
MORT	Managed Object Referring to Test
MOS	Management Operations Schedule
NE	Network Element
OAM	Operation, Administration and Maintenance
OMC	Operations and Maintenance Centre
OS	Operations System
OSI	Open Systems Interconnection
PLMN	Public Land Mobile Network
QOS	Quality of Service
ROSE	Remote Operation Service Element

SFTC	Simple File Transfer Control
TARR	Test Action Request Receiver
TMN	Telecommunications Management Network
TO	Test Object

4 General requirements on fault management

GSM fault management follows TMN principles as specified in GSM 12.00 [18]. These principles provide for management of a GSM PLMN based onan information model. This model is developed through the definition of a required set of management services which are then decomposed into service components. These service components are supported by a number of management functions according to M.3400 [4], and finally an information model can be defined for supporting this set of functions. It is expected that this information model will be defined in a future GSM phase 2+ version of this document.

In GSM 12.00, the terms reactive maintenance and proactive maintenance are used to identify two different forms of maintenance for a GSM network element. Reactive maintenance is the use of the above management functions to detect a fault and restore all or part of the network element following a failure. Proactive maintenance is the use of the above management functions and manual routine maintenance activities to prevent, as far as possible, the occurrence of a failure. This EN does not explicitly assign the above management functions to either proactive or reactive maintenance, and generically defines the management functions such that they may be used either as part of proactive or reactive maintenance. The remainder of this EN thus makes no further reference to either proactive or reactive maintenance.

Fault Management is a functional area which can support a number of management services (M.3400) [4]. The following list gives examples of the general objectives of the NE's fault management:

- Inform the operator and/or OS of the current NE condition;
- Provide timely and accurate data regarding any abnormal change in the condition of the NE;
- Maintain synchronisation between the actual conditions in the NEs and the knowledge of the conditions as understood by the OS;
- Provide procedures which allow system recovery either automatically or on operator demand after a fault detection.

To support these objectives the NE shall offer the following set of capabilities:

- Surveillance capability to monitor the system such that faults, defects and anomalies may be detected and reported;
- Fault Localisation capability to identify the one or more replaceable units at fault;
- Fault Correction capability to isolate the faulty units and restore the system to operation;
- Testing capability to verify the proper operation of physical and functional resources in the NE.

To support fault management, the state management capability may also be necessary, for example, to isolate a faulty unit by changing its administrative state, to provide a specific environment for testing etc. The usage of state management for fault management purposes will be described in each clause where it is appropriate.

In addition to the above, the capabilities of other functional management areas are often used in support of fault management. For example, parts of performance management services may be used for the fault detection capability (e.g.: counters and gauges for threshold management) and configuration management functions may be used to restore the system to the best operational configuration.

Based on M.3400 [4], GSM fault management requirements can be achieved by means of the following management service components:

- Alarm surveillance service components;
- Fault localisation service component;
- Fault correction service component;