

# ETSI TS 152 402 V17.0.0 (2022-05)



**Digital cellular telecommunications system (Phase 2+) (GSM);  
Telecommunication management;  
Performance Management (PM);  
Performance measurements - GSM  
(3GPP TS 52.402 version 17.0.0 Release 17)**



---

**Reference**

RTS/TSGS-0552402vh00

---

**Keywords**

GSM

**ETSI**

---

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

---

**Important notice**

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our  
Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

---

**Notice of disclaimer & limitation of liability**

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2022.  
All rights reserved.

---

# Intellectual Property Rights

## Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

# Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

---

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Contents

Intellectual Property Rights .....	2
Legal Notice .....	2
Modal verbs terminology.....	2
Foreword.....	18
Introduction .....	18
1 Scope .....	19
2 References .....	19
3 Abbreviations .....	21
4 Detailed description of the measurement system for a GSM PLMN.....	23
4.1 Introduction .....	23
4.1.1 Basic measurement system functions .....	23
4.1.2 Measurement Object Administration .....	23
4.2 Modelling of measurement jobs .....	24
4.2.1 Measurement job characteristics .....	24
4.2.1.1 Measurement Function.....	24
4.2.1.2 Measurement schedule .....	25
4.2.1.3 Granularity period .....	25
4.2.1.4 Scan reports.....	26
4.2.2 Scanner state and status attributes.....	26
4.2.3 Scanner administration .....	26
4.3 Modelling of measurement results .....	27
4.3.1 Characteristics of the result report .....	28
4.3.2 Result report transfer control .....	28
4.4 Conformance requirements .....	29
4.4.1 Simple scanner.....	29
4.4.2 Scan report record.....	30
4.4.3 Scan report notification.....	30
4.4.4 Activate scan report action.....	31
4.5 Application Context .....	31
<b>Annex A (informative): Graphical examples .....</b>	<b>32</b>
<b>Annex B (normative): Performance Measurement Requirements Summary .....</b>	<b>34</b>
B.1 Measurements Related to the BSC .....	35
B.1.1 BSC Measurement Function.....	35
B.1.1.1 Unsuccessful requests for service .....	35
B.1.1.2 Unsuccessful requests for service, per cause .....	35
B.1.1.3 Mean Inter-arrival Time (Circuit Switched) .....	35
B.1.1.4 Attempted Transmission of Paging Messages, per BSC.....	36
B.1.1.5 Unsuccessful Transmission of Paging Messages, per BSC .....	36
B.1.1.6 Attempted IMMEDIATE ASSIGNMENT Procedures, per BSC.....	36
B.1.1.7 Successful IMMEDIATE ASSIGNMENT Procedures, per BSC.....	37
B.1.1.8 Successful Internal Handovers, intra-CELL, per BSC.....	37
B.1.1.9 Unsuccessful Internal Handovers, intra-CELL, per BSC .....	37
B.1.1.10 Successful Internal Handovers per BSC .....	38
B.1.1.11 Successful Internal Handovers per cause.....	38
B.1.1.12 Unsuccessful Internal Handovers with reconnection to old channels, per BSC .....	38
B.1.1.13 Unsuccessful Internal Handovers with loss of connection, per BSC .....	39
B.1.1.14 Flush Requests Received .....	39
B.1.1.15 Paging Requests Received from SGSN .....	39
B.1.1.16 Mean Inter-arrival Time (Packet Switched).....	40
B.1.1.17 Number of octets of uplink BSSGP PDUs.....	40
B.1.1.18 Number of octets of downlink BSSGP PDUs.....	40

B.1.1.19	Power, Energy and Environmental (PEE) measurements .....	40
B.1.1.19.0	Applicability of measurements .....	40
B.1.1.19.1	Power .....	41
B.1.1.19.1.1	Average Power .....	41
B.1.1.19.1.2	Minimum Power .....	41
B.1.1.19.1.3	Maximum Power .....	41
B.1.1.19.2	Energy .....	41
B.1.1.19.3	Temperature .....	42
B.1.1.19.3.1	Average Temperature .....	42
B.1.1.19.3.2	Minimum Temperature .....	42
B.1.1.19.3.3	Maximum Temperature .....	42
B.1.1.19.4	Voltage .....	42
B.1.1.19.5	Current .....	43
B.1.1.19.6	Humidity .....	43
B.2	Measurements related to the BTS .....	44
B.2.1	CELL Measurement Function .....	44
B.2.1.1	Mean PCH-AGCH queue length .....	44
B.2.1.2	Attempted Transmission of Paging Messages (the PCH) .....	44
B.2.1.3	Unsuccessful Transmission of Paging Messages (the PCH) .....	44
B.2.1.4	Attempted IMMEDIATE ASSIGNMENT Procedures .....	45
B.2.1.5	Successful IMMEDIATE ASSIGNMENT Procedures .....	45
B.2.1.6	Attempted IMMEDIATE ASSIGNMENT Procedures, per cause .....	45
B.2.1.7	Successful IMMEDIATE ASSIGNMENT Procedures, per cause .....	46
B.2.1.8	Number of Pages Discarded from the PCH Queue .....	46
B.2.1.9	Mean duration of a successful Paging Procedure .....	46
B.2.1.10	Number of Time Slots Available for Traffic (Previously TCHs) .....	47
B.2.1.11	Mean number of busy Time Slots Occupied by Circuit Traffic .....	47
B.2.1.12	Maximum number of busy Time Slots Occupied by Circuit Traffic .....	47
B.2.1.13	Mean number of idle Time Slots per interference band (Previously TCHs) .....	48
B.2.1.14	Attempted Time Slots seizures (Previously TCHs) .....	48
B.2.1.15	Successful TCH/PDTCH seizures (Previously TCHs) .....	48
B.2.1.16	Attempted TCH Seizures meeting an TCH blocked state .....	49
B.2.1.17	All Available TCH Allocated Time .....	49
B.2.1.18	Mean busy time of allocated CS Time Slots .....	49
B.2.1.19	Mean TCH queue length .....	50
B.2.1.20	Number of lost Radio links while using a TCH .....	50
B.2.1.21	Number of Available SDCCHs .....	50
B.2.1.22	Mean number of busy SDCCHs .....	51
B.2.1.23	Maximum number of busy SDCCHs .....	51
B.2.1.24	Attempted SDCCH Seizures meeting an SDCCH blocked state .....	51
B.2.1.25	All Available SDCCH Allocated Time .....	52
B.2.1.26	Mean SDCCH queue length .....	52
B.2.1.27	Number of lost Radio links while using an SDCCH .....	52
B.2.1.28	Relative time downlink power control at maximum .....	53
B.2.1.29	Relative time uplink power control at maximum .....	53
B.2.1.30	Successful Internal Handovers, intra-CELL .....	53
B.2.1.31	Unsuccessful Internal Handovers, intra-CELL .....	54
B.2.1.32	Attempted incoming Internal inter CELL Handovers .....	54
B.2.1.33	Successful incoming Internal inter CELL Handovers .....	54
B.2.1.34	Attempted outgoing Internal inter CELL Handovers .....	55
B.2.1.35	Successful outgoing Internal inter CELL Handovers .....	55
B.2.1.36	Unsuccessful Internal Handovers with reconnection to old channels .....	55
B.2.1.37	Unsuccessful Internal Handovers with loss of connection .....	56
B.2.1.38	Number of Available PDCH .....	56
B.2.1.39	Mean Number of Available PDCH .....	56
B.2.1.40	Maximum Number of Available PDCH .....	56
B.2.1.41	Minimum Number of Available PDCH .....	57
B.2.1.42	Mean number of occupied PDCHs .....	57
B.2.1.43	Maximum number of occupied PDCHs .....	58
B.2.1.44	Minimum number of occupied PDCHs .....	58
B.2.1.45	All available PDCH allocated time .....	58

B.2.1.46	Transmission of Packet Paging Messages on the PCCCH.....	59
B.2.1.47	Mean PPCH-PAGCH queue length on PCCCH.....	59
B.2.1.48	Number of Packet Pages Discarded from the PPCH Queue on PCCCH.....	59
B.2.1.49	Number of Packet Channel Assignment Requests, per cause.....	60
B.2.1.50	Successful Packet Channel Assignment Procedures, per cause.....	60
B.2.1.51	Successful PDTCH seizures.....	60
B.2.1.52	Mean PDTCH queue length.....	61
B.2.1.53	Number of service upgrades/downgrades.....	61
B.2.1.54	Mean number of occupied PDCHs for GPRS.....	61
B.2.1.55	Mean number of occupied PDCHs for EGPRS.....	62
B.2.1.56	Mean number of simultaneous GPRS TBF for downlink.....	62
B.2.1.57	Mean number of simultaneous EGPRS TBF for downlink.....	62
B.2.1.58	Number of received acknowledged octets of EGPRS block on RLC layer.....	63
B.2.1.59	Number of transmitted octets of EGPRS block on RLC layer acknowledged by mobile.....	63
B.2.2	Internal HDO Measurement Function.....	64
B.2.2.1	Attempted incoming Internal inter CELL Handovers per originating CELL.....	64
B.2.2.2	Successful incoming Internal inter CELL Handovers per originating CELL.....	64
B.2.2.3	Attempted outgoing Internal inter CELL Handovers per target CELL.....	64
B.2.2.4	Successful outgoing Internal inter CELL Handovers per target CELL.....	65
B.2.3	Power, Energy and Environmental (PEE) measurements.....	65
B.2.3.0	Applicability of measurements.....	65
B.2.3.1	Power.....	65
B.2.3.1.1	Average Power.....	65
B.2.3.1.2	Minimum Power.....	65
B.2.3.1.3	Maximum Power.....	65
B.2.3.2	Energy.....	66
B.2.3.3	Temperature.....	66
B.2.3.3.1	Average Temperature.....	66
B.2.3.3.2	Minimum Temperature.....	66
B.2.3.3.3	Maximum Temperature.....	67
B.2.3.4	Voltage.....	67
B.2.3.5	Current.....	67
B.2.3.6	Humidity.....	67
B.3	Measurements Related to the MSC.....	69
B.3.1	MSC Measurement Function.....	69
B.3.1.1	Number of class mark updates.....	69
B.3.1.2	Attempted mobile originating calls.....	69
B.3.1.3	Successful mobile originating calls.....	69
B.3.1.4	Answered mobile originating calls.....	70
B.3.1.5	Attempted mobile terminating calls.....	70
B.3.1.6	Successful mobile terminating calls.....	70
B.3.1.7	Answered mobile terminating calls.....	71
B.3.1.8	Attempted Mobile Emergency calls.....	71
B.3.1.9	Successful Mobile Emergency calls.....	71
B.3.1.10	Answered Mobile Emergency calls.....	72
B.3.1.11	Attempted ciphering mode control procedures.....	72
B.3.1.12	Successful ciphering mode control procedures.....	72
B.3.1.13	Attempted interrogations of HLRs for routing.....	73
B.3.1.14	Successful interrogations of HLR (MSRN obtained).....	73
B.3.1.15	Successful interrogations of HLR (call Forwarding).....	73
B.3.1.16	Attempted operations for mobile originating point to point SMs.....	74
B.3.1.17	Successful operations for mobile originating point to point SMs.....	74
B.3.1.18	Attempted operations for mobile terminating point to point SMs.....	74
B.3.1.19	Successful operations for mobile terminating point to point SMs.....	75
B.3.1.20	Number of transmitted check IMEI request.....	75
B.3.1.21	Number of white answers in MSC.....	75
B.3.1.22	Number of grey answers in MSC.....	76
B.3.1.23	Number of black answers in MSC.....	76
B.3.1.24	Number of unknown IMEI answers.....	76
B.3.1.25	Mean time to provide the CALL SETUP service.....	77
B.3.1.26	Mean time to provide the LOCATION UPDATING service.....	77

B.3.1.27	Transactions on the MM-layer where subscriber was identified with TMSI.....	77
B.3.1.28	Transactions on the MM-layer where subscriber was identified with IMSI.....	78
B.3.1.29	Attempted TMSI re-allocations .....	78
B.3.1.30	Successful TMSI re-allocations .....	78
B.3.1.31	IMSI detach procedures .....	79
B.3.1.32	IMSI attach procedures.....	79
B.3.1.33	Attempted incoming External intra-MSC Handovers.....	79
B.3.1.34	Successful incoming External intra-MSC Handovers.....	80
B.3.1.35	Attempted outgoing External intra-MSC Handovers.....	80
B.3.1.36	Successful outgoing External intra-MSC Handovers .....	80
B.3.1.37	Attempted incoming inter-MSC Handovers .....	81
B.3.1.38	Successful incoming inter-MSC Handovers .....	81
B.3.1.39	Attempted outgoing inter-MSC Handovers .....	81
B.3.1.40	Successful outgoing inter-MSC Handovers .....	82
B.3.1.41	Attempted subsequent inter-MSC Handovers (back to MSCa) .....	82
B.3.1.42	Successful subsequent inter-MSC Handovers (back to MSCa) .....	82
B.3.1.43	Attempted subsequent inter-MSC Handovers (to MSCc).....	83
B.3.1.44	Successful subsequent inter-MSC Handovers (to MSCc).....	83
B.3.1.45	External Handovers.....	83
B.3.1.46	External Handovers per cause.....	84
B.3.1.47	Unsuccessful External Handovers with reconnection to old channels, per MSC .....	84
B.3.1.48	Unsuccessful External Handovers with loss of connection, per MSC .....	84
B.3.2	External HDO Measurement Function.....	85
B.3.2.1	Attempted incoming External intra-MSC Handovers per originating CELL .....	85
B.3.2.2	Successful incoming External intra-MSC Handovers per originating CELL .....	85
B.3.2.3	Attempted outgoing External intra-MSC Handovers per target CELL.....	85
B.3.2.4	Successful outgoing External intra-MSC Handovers per target CELL .....	86
B.3.2.5	Attempted incoming inter-MSC Handovers per originating CELL .....	86
B.3.2.6	Successful incoming inter-MSC Handovers per originating CELL.....	86
B.3.2.7	Attempted outgoing inter-MSC Handovers per target CELL .....	87
B.3.2.8	Successful outgoing inter-MSC Handovers per target CELL.....	87
B.4	Measurements Related to the HLR .....	88
B.4.1	HLR Measurement Function .....	88
B.4.1.1	Number of current MS's Roaming outside HPLMN.....	88
B.4.1.2	Attempted requests for Authentication sets received by HLR.....	88
B.4.1.3	Successful returned Authentication sets from HLR.....	88
B.4.1.4	Empty responses to request for Authentication sets from HLR.....	89
B.4.1.5	Attempted insert subscriber data service .....	89
B.4.1.6	Successful insert subscriber data service .....	89
B.4.1.7	Attempted Location Updates .....	90
B.4.1.8	Successful Location Updates .....	90
B.4.1.9	Attempted SS related operations in HLR.....	90
B.4.1.10	Successful SS related operations in HLR .....	91
B.4.1.11	Attempted request for SM routing information .....	91
B.4.1.12	Successful request for SM routing information .....	91
B.4.1.13	Attempted SM delivery status report procedures.....	92
B.4.1.14	Successful SM delivery status report procedures.....	92
B.4.1.15	Attempted number of send alerts .....	92
B.4.1.16	Successful number of send alerts.....	93
B.4.1.17	Attempted request for MSRN .....	93
B.4.1.18	Successful request for MSRN.....	93
B.5	Measurements Related to the VLR .....	94
B.5.1	VLR Measurement Function .....	94
B.5.1.1	Attempted MS memory available notifications .....	94
B.5.1.2	Successful MS memory available notifications .....	94
B.5.1.3	Attempted Identification requests to PVLRS .....	94
B.5.1.4	Successful Identification requests to PVLRS .....	95
B.5.1.5	Attempted page requests .....	95
B.5.1.6	Successful page requests.....	95
B.5.1.7	Attempted page requests per Location Area .....	95

B.5.1.8	Successful page requests per Location Area .....	96
B.5.1.9	Attempted requests for Authentication sets sent to HLR by VLRs .....	96
B.5.1.10	Successful received Authentication sets from HLR to VLRs .....	96
B.5.1.11	Empty responses to request for Authentication sets from HLR to VLRs .....	97
B.5.1.12	Attempted authentication procedures in VLR .....	97
B.5.1.13	Successful authentication procedures in the VLR .....	97
B.5.1.14	Attempted intra-VLR Location Updates .....	98
B.5.1.15	Successful intra-VLR Location Updates .....	98
B.5.1.16	Attempted inter-VLR Location Updates .....	98
B.5.1.17	Successful inter-VLR Location Updates .....	99
B.5.1.18	Arrivals of Visitors from other PLMNs .....	99
B.6	Measurements Related to the EIR .....	100
B.6.1	EIR Measurement Function .....	100
B.6.1.1	Number of received IMEI check requests .....	100
B.6.1.2	Number of white answers in EIR .....	100
B.6.1.3	Number of grey answers in EIR .....	100
B.6.1.4	Number of black answers in EIR .....	101
B.6.1.5	Number of unknown IMEI answers .....	101
B.7	Measurements Related to the SMS IWMSC/GMSC .....	102
B.7.1	SMS Measurement Function .....	102
B.7.1.1	Attempted mobile originating SM Forwarding .....	102
B.7.1.2	Successful mobile originating SM Forwarding .....	102
B.7.1.3	Attempted Mobile Terminating SM Forwarding .....	102
B.7.1.4	Successful Mobile Terminating SM Forwarding .....	103
B.8	Measurements Related to the SGSN .....	104
B.8.1	SGSN Measurement Function .....	104
B.8.1.1	LLC Measurements .....	104
B.8.1.1.1	Number of LLC frames sent .....	104
B.8.1.1.2	Number of LLC frames Received .....	104
B.8.1.1.3	Erroneously received LLC frames detected by SGSN .....	104
B.8.1.1.4	Number of Retransmitted LLC frames in Acknowledge Mode .....	105
B.8.1.2	SNDCP Measurements .....	105
B.8.1.2.1	Number of received SNDCP N-PDUs .....	105
B.8.1.2.2	Number of received SNDCP N-PDU octets .....	105
B.8.1.2.3	Number of sent SNDCP N-PDUs .....	106
B.8.1.2.4	Number of sent SNDCP N-PDU octets .....	106
B.8.1.3	BSSGP Measurements .....	106
B.8.1.4	MM Measurements .....	106
B.8.1.4.1	Attempted GPRS attach procedures .....	106
B.8.1.4.2	Successful GPRS attach procedures .....	107
B.8.1.4.3	Attempt of combined GPRS/IMSI attach procedures .....	107
B.8.1.4.4	Successfully combined GPRS/IMSI attach procedures .....	107
B.8.1.4.5	Attempted GPRS attach procedures with IMSI already attached .....	108
B.8.1.4.6	Successful GPRS attach procedures with IMSI already attached .....	108
B.8.1.4.7	Number of attached subscriber .....	108
B.8.1.4.8	Mean number of attached subscriber .....	109
B.8.1.4.9	Maximum number of attached subscriber .....	109
B.8.1.4.10	Attempted GPRS detach procedures initiated by MS .....	109
B.8.1.4.11	Attempt of Combined GPRS/IMSI detach procedures initiated by MS .....	110
B.8.1.4.12	Attempt of IMSI detach procedures initiated by MS .....	110
B.8.1.4.13	Attempted GPRS detach procedures initiated by SGSN .....	110
B.8.1.4.14	Successful GPRS detach procedures initiated by SGSN .....	111
B.8.1.4.15	Attempted intra-SGSN Routing Area Update procedures initiated in this SGSN .....	111
B.8.1.4.16	Successful intra-SGSN Routing Area Update procedures initiated in this SGSN .....	111
B.8.1.4.17	Attempted inter-SGSN Routing Area Update procedures initiated in this SGSN .....	112
B.8.1.4.18	Successful inter-SGSN Routing Area Update procedures initiated in this SGSN .....	112
B.8.1.5	Security .....	113
B.8.1.5.1	Attempted P-TMSI reallocation procedures .....	113
B.8.1.5.2	Successful P-TMSI reallocation procedures .....	113
B.8.1.5.3	Attempted requests for authentication sets sent to HLR by SGSN .....	113



B.8.1.5.4	Successful requests for authentication sets to HLR .....	114
B.8.1.5.5	Empty responses to the request for authentication sets to the HLR .....	114
B.8.1.5.6	Attempt of authentication procedures started by SGSN.....	114
B.8.1.5.7	Successful authentication procedures started by the SGSN .....	115
B.8.1.5.8	Attempted Identity Request procedures .....	115
B.8.1.5.9	Successful Identity Request procedures .....	115
B.8.1.6	State .....	116
B.8.1.6.1	Number of subscribers in the SGSN in STANDBY state. ....	116
B.8.1.6.2	Mean number of subscribers in the SGSN in STANDBY state .....	116
B.8.1.6.3	Maximum number of subscribers in the SGSN in STANDBY state.....	116
B.8.1.6.4	Number of subscribers in the SGSN in READY state .....	117
B.8.1.6.5	Mean number of subscribers in the SGSN in READY state .....	117
B.8.1.6.6	Maximum number of subscribers in the SGSN in READY state.....	117
B.8.1.7	Equipment.....	118
B.8.1.7.1	Number of transmitted check IMEI requests .....	118
B.8.1.7.2	Number of white answers in SGSN .....	118
B.8.1.7.3	Number of grey answers in SGSN .....	118
B.8.1.7.4	Number of black answers in SGSN.....	119
B.8.1.7.5	Number of unknown IMEI answers .....	119
B.8.1.8	RRM Measurements .....	119
B.8.1.8.1	Attempt of packet switched paging procedures.....	119
B.8.1.8.2	Unsuccessful packet switched paging procedures.....	120
B.8.1.8.3	Attempt of packet switched paging procedures per Routing Area .....	120
B.8.1.8.4	Unsuccessful packet switched paging procedures per Routing Area .....	120
B.8.1.9	SM Measurements .....	121
B.8.1.9.1	Attempted PDP context activation procedures initiated by MS .....	121
B.8.1.9.2	Successful PDP context activation procedures initiated by MS.....	121
B.8.1.9.3	Attempted dynamic PDP context activation procedures initiated by MS .....	121
B.8.1.9.4	Successful dynamic PDP context activation procedures initiated by MS .....	122
B.8.1.9.5	Attempted PDP context deactivation procedures initiated by the MS .....	122
B.8.1.9.6	Successful PDP context deactivation procedures initiated by the MS .....	122
B.8.1.9.7	Attempted PDP context deactivation procedures initiated by the GGSN .....	123
B.8.1.9.8	Successful PDP context deactivation procedures initiated by the GGSN .....	123
B.8.1.9.9	Number of subscribers with activated PDP context in SGSN.....	123
B.8.1.9.10	Mean number of subscribers with activated PDP context in SGSN.....	124
B.8.1.9.11	Maximum number of subscribers with activated PDP context in SGSN .....	124
B.9	Measurements Related to the GGSN.....	125
B.9.1	GGSN Measurement Function .....	125
B.9.1.1	Number of PDP context activation procedures initiated by the MS Per APN .....	125
B.9.1.2	Successful PDP context activation procedures initiated by the MS Per APN .....	125
B.9.1.3	Number of dynamic PDP context activation procedures initiated by the MS Per APN .....	125
B.9.1.4	Successful +dynamic PDP context activation procedures initiated by the MS Per APN.....	126
B.9.1.5	Number of PDP context deactivation procedures initiated by the MS Per APN .....	126
B.9.1.6	Successful PDP context deactivation procedures initiated by the MS Per APN.....	126
B.9.1.7	Number of PDP context deactivation procedures initiated by the GGSN Per APN .....	127
B.9.1.8	Successful PDP context deactivation procedures initiated by the GGSN Per APN.....	127
B.9.1.9	Number of active PDP context in GGSN Per APN .....	127
B.9.1.10	Mean number of active PDP context in GGSN Per APN .....	128
B.9.1.11	Maximum number of PDP context in GGSN Per APN .....	128
B.10	Monitoring of Power, Energy and Environmental (PEE) parameters .....	128
<b>Annex C (normative):</b>	<b>Performance Measurement Object Model .....</b>	<b>129</b>
C.1	Measurement Managed Object Classes.....	130
C.1.1	object class from ITU-T ISO.....	130
C.1.2	bscMeasurementFunction.....	130
C.1.3	cellMeasurementFunction .....	130
C.1.4	internalHdoMeasurementFunction .....	132
C.1.5	mscMeasurementFunction.....	132
C.1.6	externalHdoMeasurementFunction .....	134
C.1.7	hlrMeasurementFunction.....	134

C.1.8	vlrMeasurementFunction.....	135
C.1.9	eirMeasurementFunction.....	135
C.1.10	smsMeasurementFunction.....	136
C.1.11	sgsnMeasurementFunction.....	136
C.1.12	ggsnMeasurementFunction.....	137
C.2	Measurement Package Definitions.....	138
C.2.1	General Measurement Function Packages.....	138
C.2.1.1	basicMeasurementFunctionPackage.....	138
C.2.2	BSC Measurement Function Related Packages.....	138
C.2.2.1	requestForServicePackage.....	138
C.2.2.2	requestForServicePerCausePackage.....	138
C.2.2.3	interArrivalTimePackage.....	138
C.2.2.4	pagingMessagePerBSCPackage.....	139
C.2.2.5	immediateAssignmentProceduresPerBSCPackage.....	139
C.2.2.6	internalHandoversIntraCellPerBSCPackage.....	139
C.2.2.7	internalHandoversPerBSCPackage.....	139
C.2.2.8	internalHandoversPerCausePackage.....	139
C.2.2.9	internalHandoverFailuresPerBSCPackage.....	139
C.2.2.10	gprsPDUFlushReqPackage.....	140
C.2.2.11	gprsPagingRequestPackage.....	140
C.2.2.12	gprsInterArrivalPackage.....	140
C.2.3	CELL Measurement Function Related Packages.....	140
C.2.3.1	pchagchQueuePackage.....	140
C.2.3.2	pagingMessagePackage.....	140
C.2.3.3	immediateAssignmentProceduresPackage.....	141
C.2.3.4	immediateAssignmentProceduresPerCausePackage.....	141
C.2.3.5	pageDiscardPackage.....	141
C.2.3.6	durationOfPagingProceduresPackage.....	141
C.2.3.7	tchAvailablePackage.....	141
C.2.3.8	tchBusyPackage.....	141
C.2.3.9	idleTCHsPerInterferenceBandPackage.....	142
C.2.3.10	tchSeizuresPackage.....	142
C.2.3.11	tchAllocatedTimePackage.....	142
C.2.3.12	tchBusyTimePackage.....	142
C.2.3.13	tchQueuePackage.....	142
C.2.3.14	lostRadioLinksPerTCHPackage.....	143
C.2.3.15	sdccchAvailablePackage.....	143
C.2.3.16	sdccchBusyPackage.....	143
C.2.3.17	sdccchSeizuresPackage.....	143
C.2.3.18	sdccchAllocatedTimePackage.....	143
C.2.3.19	sdccchQueuePackage.....	143
C.2.3.20	lostRadioLinksPerSDCCHPackage.....	144
C.2.3.21	downlinkPowerControlPackage.....	144
C.2.3.22	uplinkPowerControlPackage.....	144
C.2.3.23	internalHandoversIntraCellPackage.....	144
C.2.3.24	incomingInternalInterCellHandoversPackage.....	144
C.2.3.25	outgoingInternalInterCellHandoversPackage.....	145
C.2.3.26	internalHandoverFailurePackage.....	145
C.2.3.27	gprsPDCHAvailablePackage.....	145
C.2.3.28	gprsPDCHOccupiedPackage.....	145
C.2.3.29	gprsPDCHAllocatedPackage.....	145
C.2.3.30	gprsPCCCHPagingPackage.....	146
C.2.3.31	gprsPPCHQueueOnPCCCHPackage.....	146
C.2.3.32	gprsPDTCHAssignmentPackage.....	146
C.2.3.33	gprsPDTCHQueuePackage.....	146
C.2.3.34	gprsCSChangePackage.....	146
C.2.4	internal HDO Measurement Function Related Packages.....	147
C.2.4.1	incomingInternalInterCellPerCellHandoversPackage.....	147
C.2.4.2	outgoingInternalInterCellPerCellHandoversPackage.....	147
C.2.5	MSC Measurement Function Related Packages.....	147
C.2.5.1	classMarkPackage.....	147

C.2.5.2	mobileOriginatingCallsPackage .....	147
C.2.5.3	mobileTerminatingCallsPackage .....	147
C.2.5.4	mobileEmergencyCallsPackage.....	148
C.2.5.5	cipheringModePackage.....	148
C.2.5.6	interrogatingHLRPackage .....	148
C.2.5.7	mobileOriginatingPointToPointSMPackage.....	148
C.2.5.8	mobileTerminatingPointToPointSMPackage .....	148
C.2.5.9	imeiRequestPackage .....	149
C.2.5.10	whiteAnswersInMSCPackage.....	149
C.2.5.11	greyAnswersInMSCPackage .....	149
C.2.5.12	blackAnswersInMSCPackage.....	149
C.2.5.13	unknownIMEIAnswersInMSCPackage .....	149
C.2.5.14	callSetupServicePackage .....	149
C.2.5.15	locationUpdatingServicePackage .....	150
C.2.5.16	subscriberIdentifiedWithTMSIPackage.....	150
C.2.5.17	subscriberIdentifiedWithIMSIPackage.....	150
C.2.5.18	tmsiReallocationsPackage .....	150
C.2.5.19	imsiDetachProceduresPackage .....	150
C.2.5.20	incomingExternalIntraMSCHandoversPackage .....	151
C.2.5.21	outgoingExternalIntraMSCHandoversPackage .....	151
C.2.5.22	incomingInterMSCHandoversPackage.....	151
C.2.5.23	outgoingInterMSCHandoversPackage.....	151
C.2.5.24	subsequentInterMSCHandoversToMACaPackage .....	151
C.2.5.25	subsequentInterMSCHandoversToMACcPackage .....	151
C.2.5.26	externalHandoversPackage .....	152
C.2.5.27	externalHandoversPerCausePackage .....	152
C.2.5.28	externalHandoverFailurePerMSCPackage.....	152
C.2.6	external HDO Measurement Function Related Packages.....	152
C.2.6.1	incomingExternalIntraMSCHandoversPerCellPackage.....	152
C.2.6.2	outgoingExternalIntraMSCHandoversPerCellPackage .....	152
C.2.6.3	incomingExternalInterMSCHandoversPerCellPackage.....	153
C.2.6.4	outgoingExternalInterMSCHandoversPerCellPackage .....	153
C.2.7	HLR Measurement Function Related Packages .....	153
C.2.7.1	msRoamingOutsideHPLMNPackage.....	153
C.2.7.2	authenticationSetsHLRToVLRPackage.....	153
C.2.7.3	insertSubscriberDataServicePackage.....	153
C.2.7.4	locationUpdatePackage.....	154
C.2.7.5	ssRelatedOperationsInHLRPackage .....	154
C.2.7.6	requestForSMRoutingPackage .....	154
C.2.7.7	smDeliveryStatusReportProceduresPackage .....	154
C.2.7.8	sendAlertsPackage .....	154
C.2.7.9	requestForMSRNPackage.....	155
C.2.8	VLR Measurement Function Related Packages .....	155
C.2.8.1	msMemoryAvailableNotificationsPackage .....	155
C.2.8.2	identificationRequestToPVLRPackage .....	155
C.2.8.3	pageRequestPackage.....	155
C.2.8.4	pageRequestPerLocationAreaPackage.....	155
C.2.8.5	authenticationSetsVLRtoHLRPackage.....	156
C.2.8.6	authenticationInVLRPackage .....	156
C.2.8.7	intraVLRLocationUpdatePackage .....	156
C.2.8.8	interVLRLocationUpdatePackage .....	156
C.2.8.9	visitorsFromOtherPLMNPackage.....	156
C.2.9	EIR Measurement Function Related Packages.....	157
C.2.9.1	receivedIMEIcheckRequestPackage .....	157
C.2.9.2	whiteAnswersInEIRPackage.....	157
C.2.9.3	greyAnswersInEIRPackage .....	157
C.2.9.4	blackAnswersInEIRPackage.....	157
C.2.9.5	unknownIMEIAnswersInEIRPackage .....	157
C.2.10	SMS Measurement Function Related Packages .....	157
C.2.10.1	mobileOriginatingSMForwardingPackage .....	157
C.2.10.2	mobileTerminatingSMForwardingPackage.....	158
C.2.11	SGSN Measurement Function Related Packages.....	158

C.2.11.1	sgsnLLCPackage .....	158
C.2.11.2	sgsnSNDCPPackage .....	158
C.2.11.3	gprsAttachPackage .....	158
C.2.11.4	gprsIMSIAttachPackage .....	159
C.2.11.5	gprsIMSIALreadyAttachedPackage .....	159
C.2.11.6	gprsAttachedSubscribersPackage .....	159
C.2.11.7	gprsMSDetachPackage .....	159
C.2.11.8	gprsSGSNDetachPackage .....	159
C.2.11.9	gprsRouting AreaUpdatePackage .....	160
C.2.11.10	pTMSIReallocationPackage .....	160
C.2.11.11	sgsnHLRAuthenticationPackage .....	160
C.2.11.12	sgsnAuthenticationProcPackage .....	160
C.2.11.13	sgsnIdentityRequestPackage .....	160
C.2.11.14	sgsnCipheringModePackage .....	161
C.2.11.15	gprsSubsStandbyStatePackage .....	161
C.2.11.16	gprsSubsReadyStatePackage .....	161
C.2.11.17	sgsnIMEICheckRequestsPackage .....	161
C.2.11.18	whiteAnswersInSGSNPackage .....	161
C.2.11.19	greyAnswersInSGSNPackage .....	161
C.2.11.20	blackAnswersInSGSNPackage .....	162
C.2.11.21	unknownIMEIAnswersInSGSNPackage .....	162
C.2.11.22	sgsnPacketSwitched PagingPackage .....	162
C.2.11.23	sgsnPacketSwitched PagingPerRAPackage .....	162
C.2.11.24	sgsnPDPContextActivationByMSPackage .....	162
C.2.11.25	sgsnDynamicPDPContextActivationByMSPackage .....	163
C.2.11.26	sgsnPDPContextDeactivationByMSPackage .....	163
C.2.11.27	sgsnPDPContextDeactivationByGGSNPackage .....	163
C.2.11.28	subscriberPDPContextsAtSGSNPackage .....	163
C.2.12	GGSN Measurement Function Related Packages .....	163
C.2.12.1	ggsnPDPContextActivationByMSPackage .....	163
C.2.12.2	ggsnDynamicPDPContextActivationByMSPackage .....	164
C.2.12.3	ggsnPDPContextDeactivationByMSPackage .....	164
C.2.12.4	ggsnPDPContextDeactivationByGGSNPackage .....	164
C.2.12.5	ActivePDPContextsAtGGSNPackage .....	164
C.3	Measurement Attribute Definitions .....	165
C.3.1	General Measurement Function Related Attributes .....	165
C.3.1.1	measurementFunctionId .....	165
C.3.1.2	observedCell .....	165
C.3.1.3	adjacentCell .....	165
C.3.2	BSC Measurement Function Related Attributes .....	165
C.3.2.1	unsuccReqsForService .....	165
C.3.2.2	unsuccReqsForServicePerCause .....	166
C.3.2.3	meanInterArrivalTime .....	166
C.3.2.4	attTransOfPagingMessagesPerBSC .....	166
C.3.2.5	unsuccTransOfPagingMessagesPerBSC .....	166
C.3.2.6	attImmediateAssingProcsPerBSC .....	166
C.3.2.7	succImmediateAssingProcsPerBSC .....	166
C.3.2.8	succInternalHDOsIntraCellPerBSC .....	167
C.3.2.9	unsuccInternalHDOsIntraCellPerBSC .....	167
C.3.2.10	succInternalHDOsPerBSC .....	167
C.3.2.11	succInternalHDOsPerCause .....	167
C.3.2.12	unsuccInternalHDOsWithReconnectionPerBSC .....	167
C.3.2.13	unsuccInternalHDOsWithLossOfConnectionPerBSC .....	168
C.3.2.14	flushRequestReceived .....	168
C.3.2.15	pagingReqReceivedfromSgsn .....	168
C.3.2.16	meanPSInterArrivalTime .....	168
C.3.3	CELL Measurement Function Related Attributes .....	168
C.3.3.1	meanPCHAGCHQueueLength .....	168
C.3.3.2	attTransOfPagingMessagesThePCH .....	168
C.3.3.3	unsuccTransOfPagingMessagesThePCH .....	169
C.3.3.4	attImmediateAssingProcs .....	169

C.3.3.5	succImmediateAssingProcs .....	169
C.3.3.6	attImmediateAssingProcsPerCause .....	169
C.3.3.7	succImmediateAssingProcsPerCause .....	169
C.3.3.8	nbrOfPagesDiscardedFromPCHQueue.....	169
C.3.3.9	meanDurationOfSuccPagingProcs.....	170
C.3.3.10	nbrOfAvailableTCHs.....	170
C.3.3.11	meanNbrOfBusyTCHs.....	170
C.3.3.12	maxNbrOfBusyTCHs .....	170
C.3.3.13	meanNbrOfIdleTCHsPerInterferenceBand.....	170
C.3.3.14	attTCHSeizures .....	170
C.3.3.15	succTCHSeizures.....	171
C.3.3.16	attTCHSeizuresMeetingTCHBlockedState .....	171
C.3.3.17	allAvailableTCHAllocatedTime .....	171
C.3.3.18	meanTCHBusyTime .....	171
C.3.3.19	meanTCHQueueLength .....	171
C.3.3.20	nbrOfLostRadioLinksTCH .....	172
C.3.3.21	nbrOfAvailableSDCCHs .....	172
C.3.3.22	meanNbrOfBusySDCCHs .....	172
C.3.3.23	maxNbrOfBusySDCCHs .....	172
C.3.3.24	attSDCCHSeizuresMeetingSDCCHBlockedState .....	172
C.3.3.25	allAvailableSDCCHAllocatedTime.....	172
C.3.3.26	meanSDCCHQueueLength.....	173
C.3.3.27	nbrOfLostRadioLinksSDCCH.....	173
C.3.3.28	relativeTimeDLPowerControlAtMax .....	173
C.3.3.29	relativeTimeULPowerControlAtMax .....	173
C.3.3.30	succInternalHDOsIntraCell.....	173
C.3.3.31	unsuccInternalHDOsIntraCell.....	173
C.3.3.32	attIncomingInternalInterCellHDOs .....	174
C.3.3.33	succIncomingInternalInterCellHDOs .....	174
C.3.3.34	attOutgoingInternalInterCellHDOs.....	174
C.3.3.35	succOutgoingInternalInterCellHDOs.....	174
C.3.3.36	unsuccHDOsWithReconnection .....	174
C.3.3.37	unsuccHDOsWithLossOfConnection .....	174
C.3.3.38	availablePDCH .....	175
C.3.3.39	meanNbrAvailablePDCH .....	175
C.3.3.40	maxNbrAvailablePDCH .....	175
C.3.3.41	minNbrAvailablePDCH.....	175
C.3.3.42	meanNbrOfOccPDCH .....	175
C.3.3.43	maxNbrOfOccPDCH.....	176
C.3.3.44	minNbrOfOccPDCH.....	176
C.3.3.45	availablePDCHAllocatedTime .....	176
C.3.3.46	nbrPacketPagingMessagesPCHOnPCCCH .....	176
C.3.3.47	meanPPCHPAGCHQueueLengthOnPCCCH.....	176
C.3.3.48	nbrOfPSPagesDiscardedFromPPCHQueueOnPCCCH .....	176
C.3.3.49	attPCReqAssPerCause .....	177
C.3.3.50	succPDTCHAssProcsPerCause .....	177
C.3.3.51	succPDTCHSeizures.....	177
C.3.3.52	meanPacketQueueLength .....	177
C.3.3.53	nbrOfServiceChanges .....	177
C.3.4	internal HDO Measurement Function Related Attributes .....	178
C.3.4.1	attIncomingInternalInterCellHDOsPerOriginatingCell .....	178
C.3.4.2	succIncomingInternalInterCellHDOsPerOriginatingCell .....	178
C.3.4.3	attOutgoingInternalInterCellHDOsPerTargetCell .....	178
C.3.4.4	succOutgoingInternalInterCellHDOsPerTargetCell .....	178
C.3.5	MSC Measurement Function Related Attributes.....	178
C.3.5.1	nbrOfClassMarkUpdates .....	178
C.3.5.2	attMobileOriginatingCalls .....	179
C.3.5.3	succMobileOriginatingCalls .....	179
C.3.5.4	ansMobileOriginatingCalls .....	179
C.3.5.5	attMobileTerminatingCalls .....	179
C.3.5.6	succMobileTerminatingCalls.....	179
C.3.5.7	ansMobileTerminatingCalls.....	179

C.3.5.8	attMobileEmergencyCalls .....	180
C.3.5.9	succMobileEmergencyCalls .....	180
C.3.5.10	ansMobileEmergencyCalls .....	180
C.3.5.11	attCipherringModeControlProcs .....	180
C.3.5.12	succCipherringModeControlProcs .....	180
C.3.5.13	attInterrogationOfHLRsForRouting .....	180
C.3.5.14	succInterrogationOfHLRsMSRNObtained .....	181
C.3.5.15	succInterrogationOfHLRsCallForwarding .....	181
C.3.5.16	attOpForMobileOriginatingPointToPointSMs .....	181
C.3.5.17	succOpForMobileOriginatingPointToPointSMs .....	181
C.3.5.18	attOpForMobileTerminatingPointToPointSMs .....	181
C.3.5.19	succOpForMobileTerminatingPointToPointSMs .....	181
C.3.5.20	nbrOfTransCheckIMEIRequests .....	182
C.3.5.21	nbrOfWhiteAnsInMSC .....	182
C.3.5.22	nbrOfGreyAnsInMSC .....	182
C.3.5.23	nbrOfBlackAnsInMSC .....	182
C.3.5.24	nbrOfUnknownIMEIAnsInMSC .....	182
C.3.5.25	meanTimeToCallSetupService .....	183
C.3.5.26	meanTimeToLocationUpdateService .....	183
C.3.5.27	transSubIdentifiedWithTMSI .....	183
C.3.5.28	transSubIdentifiedWithIMSI .....	183
C.3.5.29	attTMSIReallocations .....	183
C.3.5.30	succTMSIReallocations .....	183
C.3.5.31	imsiDetachProcs .....	184
C.3.5.32	imsiAttachProcs .....	184
C.3.5.33	attIncomingExternalIntraMSCHDOs .....	184
C.3.5.34	succIncomingExternalIntraMSCHDOs .....	184
C.3.5.35	attOutgoingExternalIntraMSCHDOs .....	184
C.3.5.36	succOutgoingExternalIntraMSCHDOs .....	184
C.3.5.37	attIncomingInterMSCHDOs .....	185
C.3.5.38	succIncomingInterMSCHDOs .....	185
C.3.5.39	attOutgoingInterMSCHDOs .....	185
C.3.5.40	succOutgoingInterMSCHDOs .....	185
C.3.5.41	attSubsequentInterMSCHDOsMSCa .....	185
C.3.5.42	succSubsequentInterMSCHDOsMSCa .....	185
C.3.5.43	attSubsequentInterMSCHDOsMSCc .....	186
C.3.5.44	succSubsequentInterMSCHDOsMSCc .....	186
C.3.5.45	externalHDOs .....	186
C.3.5.46	externalHDOsPerCause .....	186
C.3.5.47	unsuccExternHDOsWithReconnectionPerMSC .....	186
C.3.5.48	unsuccExternHDOsWithLossOfConnectionPerMSC .....	187
C.3.6	external HDO Measurement Function Related Attributes .....	187
C.3.6.1	attIncomingExternalIntraMSCHDOsPerOriginatingCell .....	187
C.3.6.2	succIncomingExternalIntraMSCHDOsPerOriginatingCell .....	187
C.3.6.3	attOutgoingExternalIntraMSCHDOsPerTargetCell .....	187
C.3.6.4	succOutgoingExternalIntraMSCHDOsPerTargetCell .....	187
C.3.6.5	attIncomingInterMSCHDOsPerOriginatingCell .....	187
C.3.6.6	succIncomingInterMSCHDOsPerOriginatingCell .....	188
C.3.6.7	attOutgoingInterMSCHDOsPerTargetCell .....	188
C.3.6.8	succOutgoingInterMSCHDOsPerTargetCell .....	188
C.3.7	HLR Measurement Function Related Attributes .....	188
C.3.7.1	nbrOfCurrentMSsRoamingOutsideHPLMN .....	188
C.3.7.2	attReqForAuthSetsReceivedByHLRFromVLRs .....	188
C.3.7.3	succReturnedAuthSetsFromHLRToVLRs .....	189
C.3.7.4	emptyResponsesForAuthSetsFromHLRToVLRs .....	189
C.3.7.5	attInsertSubDataService .....	189
C.3.7.6	succInsertSubDataService .....	189
C.3.7.7	attLocationUpdate .....	189
C.3.7.8	succLocationUpdate .....	189
C.3.7.9	attSSRelatedOperationsInHLR .....	190
C.3.7.10	succSSRelatedOperationsInHLR .....	190
C.3.7.11	attReqForSMRoutingInfo .....	190

C.3.7.12	succReqForSMRoutingInfo .....	190
C.3.7.13	attSMDeliveryStatusReportProcs .....	190
C.3.7.14	succSMDeliveryStatusReportProcs .....	190
C.3.7.15	attNbrOfSendAlerts .....	191
C.3.7.16	succNbrOfSendAlerts .....	191
C.3.7.17	attReqForMSRN .....	191
C.3.7.18	succReqForMSRN .....	191
C.3.8	VLR Measurement Function Related Attributes .....	191
C.3.8.1	attMSMemoryAvailableNotifications .....	191
C.3.8.2	succMSMemoryAvailableNotifications .....	191
C.3.8.3	attIdentificationReqToPVLRs .....	192
C.3.8.4	succIdentificationReqToPVLRs .....	192
C.3.8.5	attPageReqs .....	192
C.3.8.6	succPageReqs .....	192
C.3.8.7	attPageReqsPerLocationArea .....	192
C.3.8.8	succPageReqsPerLocationArea .....	193
C.3.8.9	attReqForAuthSetsSentToHLR .....	193
C.3.8.10	succReceivedAuthSetsFromHLR .....	193
C.3.8.11	emptyResponsesForAuthFromHLR .....	193
C.3.8.12	attAuthProcsInVLR .....	193
C.3.8.13	succAuthProcsInVLR .....	193
C.3.8.14	attIntraVLRLocationUpdates .....	194
C.3.8.15	succIntraVLRLocationUpdates .....	194
C.3.8.16	attInterVLRLocationUpdates .....	194
C.3.8.17	succInterVLRLocationUpdates .....	194
C.3.8.18	arrivalOfVisitorsFromOtherPLMNs .....	194
C.3.9	EIR Measurement Function Related Attributes .....	194
C.3.9.1	nbrOfReceivedIMEICheckReqs .....	194
C.3.9.2	nbrOfWhiteAnsInEIR .....	195
C.3.9.3	nbrOfGreyAnsInEIR .....	195
C.3.9.4	nbrOfBlackAnsInEIR .....	195
C.3.9.5	nbrOfUnknownIMEIAnsInEIR .....	195
C.3.10	SMS Measurement Function Related Attributes .....	195
C.3.10.1	attMobileOriginatingSMForwardings .....	195
C.3.10.2	succMobileOriginatingSMForwardings .....	196
C.3.10.3	attMobileTerminatingSMForwardings .....	196
C.3.10.4	succMobileTerminatingSMForwardings .....	196
C.3.10.5	attMobileTerminatingSMForwardingsSgsn .....	196
C.3.10.6	succMobileTerminatingSMForwardingsSgsn .....	196
C.3.11	SGSN Measurement Function Related Attributes .....	196
C.3.11.1	nbrLlcFramesSent .....	196
C.3.11.2	nbrLlcFramesReceived .....	197
C.3.11.3	errLlcFramesDetectedBySgsn .....	197
C.3.11.4	retransmittedLlcFramestoMs .....	197
C.3.11.5	uplinkSndcpNpduReceived .....	197
C.3.11.6	uplinkSndcpOctetReceivedMode .....	197
C.3.11.7	downlinkSndcpNpdusent .....	197
C.3.11.8	downlinkSndcpOctetSent .....	198
C.3.11.9	attGprsAttach .....	198
C.3.11.10	succGprsAttach .....	198
C.3.11.11	attCombiAttach .....	198
C.3.11.12	succCombiAttach .....	198
C.3.11.13	attImsiAttach .....	199
C.3.11.14	succImsiAttach .....	199
C.3.11.15	nbrOfAttachedSub .....	199
C.3.11.16	meanNbrOfAttachedSub .....	199
C.3.11.17	maxNbrOfAttachedSub .....	199
C.3.11.18	attGprsDetachMs .....	199
C.3.11.19	attCombiDetachMs .....	200
C.3.11.20	attImsiDetachMs .....	200
C.3.11.21	attGprsdetachSgsn .....	200
C.3.11.22	succGprsdetachSgsn .....	200

C.3.11.23	attIntraSgsnRaUpdate .....	200
C.3.11.24	succIntraSgsnRaUpdate .....	200
C.3.11.25	attInterSgsnRaUpdate .....	201
C.3.11.26	succInterSgsnRaUpdate .....	201
C.3.11.27	attPTMSIRealloc .....	201
C.3.11.28	succPTMSIRealloc.....	201
C.3.11.29	attreqAuthSetsSentToHlrBySgsn .....	201
C.3.11.30	succReqAuthSetsHlr .....	201
C.3.11.31	emptyResponsesForAuthSetsFromHlr .....	202
C.3.11.32	attAuthInSgsn .....	202
C.3.11.33	succAuthInSgsn .....	202
C.3.11.34	attIdentityReq .....	202
C.3.11.35	succIdentityReq .....	202
C.3.11.36	attCipheringModeControlPerSgsn .....	203
C.3.11.37	succCipheringModeControlPerSgsn .....	203
C.3.11.38	nbrOfSubStandby .....	203
C.3.11.39	meanNbrOfSubStandby .....	203
C.3.11.40	maxNbrOfSubStandby .....	203
C.3.11.41	nbrOfSubReady .....	203
C.3.11.42	meanNbrOfSubReady .....	204
C.3.11.43	maxNbrOfSubReady .....	204
C.3.11.44	nbrOfCheckIMEIRequests.....	204
C.3.11.45	nbrOfWhiteAnswerInSgsn.....	204
C.3.11.46	nbrOfGreyAnswerInSgsn .....	204
C.3.11.47	nbrOfBlackAnswerInSgsn .....	204
C.3.11.48	nbrOfUnknownAnswerInSgsn.....	205
C.3.11.49	attPacketSwitchedPaging.....	205
C.3.11.50	unsuccPacketSwitchedPaging.....	205
C.3.11.51	attPsPagingPerRoutingArea.....	205
C.3.11.52	unsuccPsPagingPerRoutingArea.....	205
C.3.11.53	attActPdpContextMSPerSgsn .....	205
C.3.11.54	succActPdpContextMSPerSgsn .....	206
C.3.11.55	attActPdpContextDynMSPerSgsn .....	206
C.3.11.56	succActPdpContextDynMSPerSgsn .....	206
C.3.11.57	attDeactPdpContextMsPerSgsn .....	206
C.3.11.58	succDeactPdpContextMsPerSgsn .....	206
C.3.11.59	attDeactPdpContextGgsnPerSgsn.....	207
C.3.11.60	succDeactPdpContextGgsnPerSgsn.....	207
C.3.11.61	nbrSubsWithActivePdpInSgsn .....	207
C.3.11.62	meanSubsWithActivePdpInSgsn .....	207
C.3.11.63	nmaxSubsWithActivePdpInSgsn .....	207
C.3.12	GGSN Measurement Function Related Attributes .....	207
C.3.12.1	attActPdpContextPerApnOfGgsn .....	207
C.3.12.2	succActPdpContextPerApnOfGgsn .....	208
C.3.12.3	attActPdpContextDnyPerApnOfGgsn .....	208
C.3.12.4	succActPdpContextDnyPerApnOfGgsn .....	208
C.3.12.5	attDeactPdpContextMsPerApnOfGgsn .....	208
C.3.12.6	succDeactPdpContextMsPerApnOfGgsn .....	208
C.3.12.7	attDeactPdpContextByGgsnPerApn .....	208
C.3.12.8	succDeactPdpContextByGgsnMsPerApn.....	209
C.3.12.9	nbrOfActivePdpContextsPerApnAtGgsn .....	209
C.3.12.10	meanNbrOfActivePdpContextsPerApnAtGgsn.....	209
C.3.12.11	maxNbrOfActivePdpContextsPerApnAtGgsn.....	209
C.4	Name Bindings .....	210
C.4.1	BSS Name Binding .....	210
C.4.1.1	simpleScanner-bssFunction .....	210
C.4.2	BSC Name Binding .....	210
C.4.2.1	bscMeasurementFunction-bsc.....	210
C.4.3	BTS Name Binding .....	210
C.4.3.1	cellMeasurementFunction-bts.....	210
C.4.3.2	internalHdoMeasurementFunction-bts.....	210



C.4.4	MSC Name Binding .....	211
C.4.4.1	mscMeasurementFunction-mscFunction .....	211
C.4.4.2	externalHdoMeasurementFunction-mscFunction .....	211
C.4.4.3	simpleScanner-mscFunction .....	211
C.4.5	HLR Name Binding.....	211
C.4.5.1	hlrMeasurementFunction-hlrFunction .....	211
C.4.5.2	simpleScanner-hlrFunction .....	212
C.4.6	VLR Name Binding.....	212
C.4.6.1	vlrMeasurementFunction-vlrFunction .....	212
C.4.6.2	simpleScanner-vlrFunction .....	212
C.4.7	EIR Name Binding .....	212
C.4.7.1	eirMeasurementFunction-eirFunction.....	212
C.4.7.2	simpleScanner-eirFunction .....	212
C.4.8	SMS Name Binding.....	213
C.4.8.1	smsMeasurementFunction-smsGIWFunction.....	213
C.4.8.2	simpleScanner-smsGIWFunction .....	213
C.4.9	SGSN Name Binding .....	213
C.4.9.1	sgsnMeasurementFunction-sgsnFunction .....	213
C.4.9.2	simpleScanner-sgsnFunction .....	213
C.4.10	GGSN Name Binding.....	214
C.4.10.1	ggsnMeasurementFunction-vlrFunction .....	214
C.4.10.2	simpleScanner-ggsnFunction.....	214
C.5	Behaviour Definitions .....	215
C.5.1	simple scanner behaviour .....	215
C.5.2	general measurement function behaviour.....	215
C.5.3	general measurement package behaviour .....	215
C.5.4	general measurement attribute behaviour.....	215
C.6	Abstract syntax definitions .....	216
<b>Annex D (normative): Data Transfer Requirements .....</b>		<b>219</b>
D.1	Data Transfer Requirements.....	219
D.1.1	General .....	219
D.2	Object Model.....	219
D.2.1	Managed Object Classes .....	219
D.2.1.1	"Recommendation X.721: 1992": log.....	219
D.2.1.2	"Recommendation X.738: 1993": scanReportRecord.....	219
D.2.2	Name Bindings .....	219
D.2.2.1	log-managedElement .....	219
D.2.2.2	scanReportRecord-log .....	220
<b>Annex E (informative): Non Standardised Measurements of Interest to PLMN Management...221</b>		
E.1	Measurement Related to the BSC .....	221
E.1.1	BSC Measurement Function.....	221
E.2	Measurement Related to the BTS.....	221
E.2.1	BTS Measurement Function.....	221
E.2.2	CELL Measurement Function .....	221
E.2.3	Internal HDO Measurement Function .....	221
E.3	Measurement Related to the MSC.....	222
E.3.1	MSC Measurement Function.....	222
E.3.1.1	Attempted Mobile to Mobile Calls .....	222
E.3.1.2	Successful Mobile to Mobile Calls .....	222
E.3.1.3	Answered Mobile to Mobile Calls .....	222
E.3.1.4	Attempted Mobile to Land Calls.....	222
E.3.1.5	Successful Mobile to Land Calls .....	222
E.3.1.6	Answered Mobile to Land Calls .....	222
E.3.1.7	Attempted Land to Mobile Calls .....	222
E.3.1.8	Successful Land to Mobile Calls .....	222
E.3.1.9	Answered Land to Mobile Calls .....	222

E.3.1.10	Mean Holding Time of Calls .....	223
E.3.2	External HDO Measurement Function .....	223
E.4	Measurements related to the HLR .....	223
E.4.1	HLR Measurement Function .....	223
E.4.1.1	Instantaneous number of HLR subscribers .....	223
E.4.1.2	Barred subscribers in the HLR .....	223
E.4.1.3	Bearer service indication .....	223
E.4.1.4	SS operation indication .....	223
E.4.1.5	Attempted requests for Authentication sets from the AUC by the HLR .....	223
E.4.1.6	Successful returned Authentication sets from the AUC to the HLR .....	224
E.5	Measurements related to the VLR .....	224
E.5.1	VLR Measurement Function .....	224
E.5.1.1	Subscribers from other PLMNs registered in the VLR .....	224
E.5.1.2	Number of roamers in the VLR .....	224
E.6	Measurements related to the EIR .....	224
E.7	Measurements related to the SMS-IWMSC/GMSC .....	224
E.8	Performance Measurements on non-specific GSM Objects .....	224
E.8.1	Measurements related to a PCM system .....	224
E.8.2	Measurements related to MTP .....	224
E.8.3	Measurements related to SCCP and TCAP .....	224
E.8.4	Measurements related to ISUP .....	224
E.8.5	Measurements related to Internet Protocols .....	225
<b>Annex F (informative):</b>	<b>Index of Measurement Attribute Names .....</b>	<b>226</b>
<b>Annex G (informative):</b>	<b>Bibliography .....</b>	<b>231</b>
<b>Annex H (informative):</b>	<b>Change history .....</b>	<b>232</b>
History .....		233

---

# Foreword

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

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

Version x.y.z

where:

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

---

# Introduction

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

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

The present document is part of a set of specifications, which describe the requirements and information model necessary for the standardised Operation, Administration and Maintenance (OA&M) of a multi-vendor 3G-system GSM or UMTS PLMN.

During the lifetime of a 3G network PLMN, its logical and physical configuration will undergo changes of varying degrees and frequencies in order to optimise the utilisation of the network resources. These changes will be executed through network configuration management activities and/or network engineering, see GSM TS 12.06 [10] and 3GPP TS 32.106 [3].

Many of the activities involved in the daily operation and future network planning of a 3G PLMN network require data on which to base decisions. This data refers to the load carried by the network and the grade of service offered. In order to produce this data performance measurements are executed in the NEs, which comprise the network. The data can then be transferred to an external system, e.g. an Operations System (OS) in TMN terminology, for further evaluation. The purpose of the present document and its companion parts 1 and 3 is to describe the mechanisms involved in the collection of the data and the definition of the data itself.

---

# 1 Scope

The present document describes the TMN model for the administration of measurements and the collection of measurement result data in a GSM system. It also includes the measurement definitions for GSM. The concept and functional requirements for performance management in wireless GSM and UMTS systems is set out in TS 32.401 [31].

---

# 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] GSM 02.16: "Digital cellular telecommunication system (Phase 2+) (GSM); International Mobile Station Equipment Identities (IMEI)".
- [2] GSM 04.08: "Digital cellular telecommunication system (Phase 2+) (GSM); Mobile radio interface layer 3 specification".
- [3] GSM 04.11: "Digital cellular telecommunication system (Phase 2+) (GSM); Point-to-Point (PP) Short Message Service (SMS) Support on Mobile Radio Interface".
- [4] GSM 05.08: "Digital cellular telecommunication system (Phase 2+) (GSM); Radio Subsystem Link Control".
- [5] GSM 08.08: "Digital cellular telecommunication system (Phase 2+) (GSM); Mobile Switching Centre - Base Station system (MSC-BSS) Interface Layer 3 Specification".
- [6] GSM 08.58: "Digital cellular telecommunication system (Phase 2+) (GSM); Base Station Controller - Base Transceiver Station (BCS-BTS) Interface Layer 3 Specification".
- [7] GSM 09.02: "Digital cellular telecommunication system (Phase 2+) (GSM); Mobile Application Part (MAP) Specification".
- [8] GSM 12.00 (ETS 300 612-1): "Digital cellular telecommunication system (Phase 2); Network Management (NM); Part 1: Objectives and structure of network management".
- [9] GSM 12.01 (ETS 300 612-2): "Digital cellular telecommunication system (Phase 2) (GSM); Network Management (NM); Common aspects of GSM/DCS 1800 network management".
- [10] GSM 12.06 (ETS 300 617): "Digital cellular telecommunication system (Phase 2) (GSM); GSM network configuration management".
- [11] GSM 12.30 (ETR 128): "Digital cellular telecommunication system (Phase 2) (GSM); ETSI object identifier tree; Common domain; Mobile domain; Operation and Maintenance (O&M), managed object registration definition".
- [12] ITU-T Recommendation E.880: "Field data collection and evaluation on the performance of equipment, networks and services".
- [13] ITU-T Recommendation X.710: "Information technology - Open Systems Interconnection - Common Management Information Service".
- [14] ITU-T Recommendation X.721: "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".

- [15] ITU-T Recommendation X.730: "Information technology - Open Systems Interconnection - Systems Management: Object management function".
- [16] ITU-T Recommendation X.731: "Information technology - Open Systems Interconnection - Systems Management: State management function".
- [17] ITU-T Recommendation X.734: "Information technology - Open Systems Interconnection - Systems Management: Event report management function".
- [18] ITU-T Recommendation X.735: "Information technology - Open Systems Interconnection - Systems Management: Log control function".
- [19] ITU-T Recommendation X.738: "Information technology - Open Systems Interconnection - Systems management: Summarization function".
- [20] ITU-T Recommendation X.739: "Information technology - Open Systems Interconnection - Systems Management: Metric objects and attributes".
- [21] ISO 8571: "Information processing systems - Open Systems Interconnection - File Transfer, Access and Management".
- [22] GSM 03.60: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS) Service description; Stage 2".
- [23] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".
- [24] GSM 04.64: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) Layer Specification".
- [25] GSM 04.65: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".
- [26] GSM 08.16: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".
- [27] GSM 09.60: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".
- [28] IETF RFC 959: "File Transfer Protocol".
- [29] IETF RFC 783: "TFTP Protocol (revision 2)".
- [30] IETF RFC 1157: "Simple Network Management Protocol (SNMP)".
- [31] 3GPP TS 32.401: "Telecommunication Management; Performance Management (PM); Concept and Requirements".
- [32] Void.

- [33] 3GPP TS 32.404: "Telecommunication Management; Performance Management (PM); Performance measurements - Definitions and template".
- 3GPP TS 32.405: "Telecommunication Management; Performance Management (PM); Performance measurements Universal Terrestrial Radio Access Network (UTRAN)".
- 3GPP TS 32.406: "Telecommunication Management; Performance Management (PM); Performance measurements Core Network (CN) Packet Switched (PS) domain".
- 3GPP TS 32.407: "Telecommunication Management; Performance Management (PM); Performance measurements Core Network (CN) Circuit Switched (CS) domain".
- 3GPP TS 32.408: "Telecommunication Management; Performance Management (PM); Performance measurements Teleservice".
- 3GPP TS 32.409: "Telecommunication Management; Performance Management (PM); Performance measurements IP Multimedia Subsystem (IMS)".
- [34] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS protocol (BSSGP)".
- [35] ES 203 228 V1.0.0: "Environmental Engineering (EE); Assessment of mobile network energy efficiency".
- [36] ETSI ES 202 336-12 V1.1.1: "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (power, cooling and building environment systems used in telecommunication networks); Part 12: ICT equipment power, energy and environmental parameters monitoring information model".

---

## 3 Abbreviations

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

AGCH	Access Grant Channel
APN	Access Point Name
AuC	Authentication Centre
BSC	Base Station Controller
BSS	Base Station System
BSSAP	BSS Application Part
BTS	Base Transceiver Station
CBCH	Cell Broadcast Channel
CCCH	Common Control Channel
CMIS	Common Management Information Service
CMISE	Common Management Information Service Element
DCCH	Dedicated Control Channel
DCN	Data Communication Network
EE	Energy Efficiency
EIR	Equipment Identity Register
ETSI	European Telecommunications Standards Institute
FACCH	Fast Associated Control Channel
FTAM	File Transfer Access and Management
FTP	File Transfer Protocol
GGSN	Gateway GPRS Service Node
GMSC	Gateway Mobile Services Switching Centre
GPRS	General Packet Radio Service
GSN	GPRS Service Node
HLR	Home Location Register
HO	Handover
HPLMN	Home PLMN
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity

ISDN	Integrated Service Digital Network
ISO	International Standards Organisation
ITU-T	The International Telegraph and Telephone Consultative Committee
LLC	Logical Link Control
LR	Location Register
MMI	Man-Machine Interface
MML	Man-Machine Language
MOC	Managed Object Class
MOI	Managed Object Instance
MS	Mobile Station
MSC	Mobile Services Switching Centre
MSRN	Mobile Subscriber Roaming Number
MTP	Message Transfer Part
NE	Network Element
NMC	Network Management Centre
NSS	Network Sub System (including EIR, HLR, SMS-IWMSC, MSC and VLR)
O&M	Operations and Maintenance
OA&M	Operation, Administration and Maintenance
OACSU	Off-Air Call Set Up
OMAP	(ITU-T) Operations, Maintenance and Administration Part
OMC	Operations and Maintenance Centre
OS	Operations System
OSI	Open System Interconnection
PCCCH	Packet Common Control Channel
PCCH	Packet Paging Channel
PCH	Paging Channel
PEE	Power, Energy and Environmental
PLMN	Public Land Mobile Network (including BSS and NSS)
PM	Performance Management
PTCH	Packet Traffic Channel
PVLR	Previous VLR
QoS	Quality of Service
RACH	Random Access Channel
Rec.	Recommendation
Ref.	Reference
RF	Radio Frequency
ROSE	Remote Operation Service Element
RR	Radio Resource
RXLEV	Reception Level
RXQUAL	Reception Quality
SACCH	Slow Associated Control Channel
SCCP	(ITU-T) Signalling Connection Control Part
SDCCH	Stand alone Dedicated Control Channel
SGSN	Serving GPRS Service Node
SMS-IWMSC	Short Message Service Inter Working MSC
SNDCP	Sub Network Dependency Control Protocol
SNMP	Simple Network Management Protocol
Spec.	Specification
SS	Supplementary Service
TCAP	(ITU-T) Transaction Capabilities Application Part
TCH	Traffic Channel
TMN	Telecommunications Management Network
TMSI	Temporary Mobile Subscriber Identity
TS	Technical Specification
VLR	Visitors Location Register

## 4 Detailed description of the measurement system for a GSM PLMN

### 4.1 Introduction

TS 32.401 [31] describes the required functions for the administration of performance measurements and the retrieval of their results. For this purpose, the characteristics of measurement jobs and measurement results have been defined.

The present document explains how these requirements can be met in a GSM system using standard OSI systems management functions or SNMP management operations and, where necessary, tailoring them for GSM PLMN use. In the following, managed object classes and their properties (attributes, notifications, etc.) to be used on the object oriented interface between OS and NEs for the execution of performance management functions are specified.

Note that the implementation of this object oriented approach defined in the following clauses is optional. As an alternative, vendors can also choose to implement their GSM systems or GSM parts of combined GSM/UMTS systems according to the interface definition and requirements specified in TS 32.401 [31], which implies that:

- for measurement administration, the functional requirements are standardised, but technology and details of the implementation are vendor specific;
- for the retrieval of measurement results, only a file based mechanism for transfer of results to a Network Manager is standardised.

#### 4.1.1 Basic measurement system functions

Before measurement data from the NEs can be collected and the results be forwarded to the OS, the measurement jobs that generate the required data shall be activated in the system. In object oriented terms, this corresponds to the instantiation of managed objects which model the measurement process. In order to control the measurement process, appropriate attributes of these objects shall be defined and have to be set to the required/desired values, either when the objects are created or during the lifetime of the objects. The specific attributes and their values will determine the measurement schedule, the measured network resources, the measurement types and the generation of scheduled result reports as well as the layout of the reports. Scheduled results can be forwarded to the OS using a notification that is defined specifically for this purpose as a part of the measurement object class definitions. A dedicated action will be used for requesting current results of active measurements.

#### 4.1.2 Measurement Object Administration

The management of objects in an open system is performed utilising the internationally standardised "Common Management Information Service Element" (CMISE ITU-T Recommendation X.710 [13] or IETF RFC 1157 [30]). Managed objects for the execution of PLMN performance measurement functions can be instantiated and deleted using the M-CREATE and M-DELETE services or SNMP SET and GET operations. Reading and modifying attributes of these objects can be achieved employing the M-GET and M-SET services of CMISE or SET and GET operations of SNMP. The CMISE M-EVENT-REPORT service and SNMP TRAP is defined for the emission of notifications, while actions can be executed using the M-ACTION service.

Specific notifications defined in the OSI object management function (see ITU-T Recommendation X.730 [15]) are used to notify the OS of the creation and deletion of managed objects and of the change of attribute values. For the formal definition of the PLMN performance management object model, refer to annex C.

The measurement job can be ideally modelled by the managed object class "simpleScanner" as defined in ITU-T Recommendation X.738 [19]. The "simpleScanner" is derived from the "homogeneousScanner" object class (see ITU-T Recommendation X.738 [19]), which in turn is a specialisation of the "scanner" class of managed objects (see ITU-T Recommendation X.738 [19]). The "simpleScanner" object has attributes to determine:

- the measurement types;
- the measured network resources;
- the recording periods; and



- the reporting requirements;

of the measurement job. The "simpleScanner" generates measurement result reports in the form of notifications, according to the attributes that prescribe the reporting requirements. The measurement transfer requirements are not modelled in the scanner objects, since generic and general services are used (see clause 4.3.2 and annex D).

## 4.2 Modelling of measurement jobs

A measurement job is represented by a "simpleScanner" object. The following clauses define how the measurement job characteristics are mapped onto the properties of the "simpleScanner" managed object class, and how the measurement types of a measurement job are modelled in the PLMN performance measurement system.

### 4.2.1 Measurement job characteristics

#### 4.2.1.1 Measurement Function

Every measurement job collects measurement data from selected measurement types across one or more network resources of the same type. The selected measurement types shall be identical throughout all network resources observed by a measurement job. For each network resource, the related measurement types have been grouped in one or more measurement functions.

Measurement functions, are modelled by various "measurementFunction" object classes (see annex C). The measurement types for the PLMN performance measurement system are defined in annex B, and their result values are included as attributes in the appropriate "measurementFunction" object class. In case the measurement type is a counter, the attribute represents the counter value as is. In all other cases, the attribute delivers a calculated value (e.g. a mean), over the observed period. The "measurementFunction" objects are contained in the objects that represent the network resource to which the measurement types included in the "measurementFunction" refer. All measurement types that relate only to a network resource alone are grouped into one "measurementFunction" class which is unique for that network resource. Measurement types that are related to the network resource and the same type(s) of adjacent resource(s) (e.g. Handover neighbour cell) are also grouped into one unique type of measurement function which may exist once or more per instance or per set of that adjacent resource(s). The instances of the adjacent resources that are to be addressed by the measurement function are identified by the values of attributes which are part of that specific "measurementFunction" object class definition.

Measurement types that belong together are grouped together in the same package (e.g. "immediateAssignmentProcedurePackage" has attributes "attemptedImmediateAssignmentProcedures" and "successfulImmediateAssignmentProcedures" - for details refer to annex C). Since all measurement types defined in annex B may or may not be supported by the system, all packages of a "measurementFunction" which contain measurement attributes are conditional. A "measurementFunction" needs to be created before a "simpleScanner" can scan its attributes, i.e. before actual measurements can be taken. The create request from the OS shall specify the values of attributes that identify adjacent resources (like Handover neighbour cell), if any, but it may not specify any measurement attributes of the "measurementFunction" object. Upon creation of a "measurementFunction" object, the system will determine the measurement packages that are included in the object according to the measurement types the system supports. If multiple instances of the same "measurementFunction" object class are created, the packages included in the various instances may be different from instance to instance since the system may have restrictions on how many measurement packages of the same type it supports. The OS can inquire the measurement types supported by a "measurementFunction" object from the system, by reading the "packages" attribute or the attribute list of the object (see ITU-T Recommendation X.721 [14]). Unlike the former operation, the latter, however, will also return values of the measurement attributes which are not expected to be meaningful at this time (see below). Deletion of the "measurementFunction" will render the measurement types that correspond to the "measurementFunction" attributes unavailable to the OS. Creation and deletion of a "measurementFunction" will be notified to the OS using the object creation and deletion notifications as defined in ITU-T Recommendation X.730 [15].

Each measurement job may collect data from one or more measurement types across one or more network resources, i.e. a "simpleScanner" object may make a choice of one or more "measurementFunction" instances and scan the same set of attributes across all selected measurement functions. For this purpose, it can scope the set of measurement functions that are eligible for inclusion in the observation, and it may select measurement functions using filtering criteria (similar to the concept of scoping and filtering as described in ITU-T Recommendation X.710 [13]). Alternatively, it can use an explicit list of "measurementFunction" objects for scanning. The "simpleScanner" does not explicitly identify the network resource(s) it measures. Instead, this information is derived from the containment relationship between the selected "measurementFunction" instances and the objects that model the network resources,

and, where necessary, through specific attributes of the "measurementFunction" objects that identify adjacent resources. In principle, a "simpleScanner" is able to scan attributes of any defined "measurementFunction", but for the purpose of the present document, each "simpleScanner" instance is only required to scan attributes of "measurementFunction" objects that are contained in the same "xxxFunction" object as the "simpleScanner" itself, where "xxx" stands for "bss", "msc", "hlr", "vlr", "eir" or "smc", respectively (see figure C.1).

All measurement attributes of any "measurementFunction" should only be read by a "simpleScanner" that has been instantiated for this purpose. By definition they can be read directly by systems management protocol, but their values are not expected to have any meaning apart from the scan. Therefore, the system will not return the "attribute list" in the create reply, and the "attributeList" will also not be included in the object creation notification.

#### 4.2.1.2 Measurement schedule

The measurement schedule specifies the time frame during which the measurement job will be active. The schedule consist of a measurement start- and stoptime and one or more recording intervals which may repeat on a daily or weekly basis. The semantics of the scheduling parameters are described in clause 3.2.1.2.

All of the above parameters are formally defined as attributes of conditional packages of the "simpleScanner" managed object class. The starttime and stoptime are included in the "duration" package and indicate, if the package is present, the specific point in time at which the "simpleScanner" will become active or inactive, respectively. If the "simpleScanner" is instantiated after the specified starttime, this will have the same effect as if no starttime was specified (see clause 3.2.1.2).

The optional recording intervals, if specified, further restrict the time during which the "simpleScanner" actively collects measurement data within the time frame determined by the duration package. The "dailyScheduling" package may be used to define one or more intervals during each day. Alternatively, the "weeklyScheduling" package can be used to define individual intervals for each day of the week. The recording interval should be a multiple of the granularity period (if non-zero) and the start- and endtimes shall be aligned with granularity period boundaries for the system to accept the values.

It is possible to create several "simpleScanner" objects which scan the same attributes of the same "measurementFunction" instances according to different recording intervals. In this case it is, however, required that these intervals do not overlap. Consequently, if it is required to measure the same measurement type with overlapping schedules, it is necessary to have an appropriate number of instances of the same "measurementFunction" available which all support the required attributes (see clause 4.2.1.1).

For the definition of the syntactical and additional behavioural aspects of the above parameters, refer to ITU-T Recommendation X.721 [14] and ITU-T Recommendation X.738 [19].

#### 4.2.1.3 Granularity period

The granularity period defines the periodicity of the generation of results by a measurement job within the timeframe specified in the scheduling attributes. The granularity period of a measurement job is determined by the value of the "granularityPeriod" attribute of the "simpleScanner". The present document requires, as a minimum, the support of granularity periods of 5, 15, 30 and 60 minutes.

The value of this attribute shall specify the required value in minutes. The underlying International Standards allow the modification of the "granularityPeriod" attribute, but for an implementation claiming conformance to the present document, it is not required that its value be changeable during the lifetime of the "simpleScanner" object. If this value is 60, measurement results will be generated every full hour. If the value is 30, results will be generated every 0 and 30 minutes past the full hour. If the value is 15, result output will occur every 0, 15, 30 and 45 minutes past the full hour, and finally, if the value is 5, the "simpleScanner" will generate output every 5 minutes, synchronised on the full hour. Again, measurement results are only reported at the end of each granularity period within the recording interval. Due to these definitions, synchronisation of granularity periods through the conditional "periodSynchronisationPackage" of the "simpleScanner" is not supported in the scope of the present document.

If periodical generation of results is not required from a "simpleScanner" instance, this can be achieved by specifying the value 0 for the "granularityPeriod" attribute. In this case, it will only be possible to request current measurement results from the "simpleScanner" (see below).

#### 4.2.1.4 Scan reports

At the end of each granularity period within the measurement schedule, the "simpleScanner" will emit a "scanReport" notification, defined in ITU-T Recommendation X.738 [19], which contains the measurement results generated by the scanner at the end of that granularity period. The information in the notification shall comprise:

- the managed object class and managed object instance of the "simpleScanner" that emitted the notification, plus the notification type (i.e. "scan report");
- a time stamp that indicates the time at which the measurement results were taken, i.e. the end time of the respective granularity period;
- for each "measurementFunction" object from which measurements were taken by the scanner, a list of measurement attribute values and optional attribute identifiers, plus a suspect flag for each attribute that indicates the validity of the result value. Missing data is indicated in the list. The time stamp that indicates the time offset forward from scan initiation until the value of the measurement attribute was actually taken is not supported in the PLMN measurement system;
- for an incomplete scan the reason why the scan could not be completed.

The definition of the "scanReport" notification in ITU-T Recommendation X.738 [19] provides some flexibility with respect to the actual layout of the report. In the PLMN performance measurement system, the following options can be selected:

- suppressing the reporting of the identification of the "measurementFunction" object from which the measurements reported in the notification were collected. This is only useful when the identification of the "measurementFunction" can be determined by other means, or if the identification is not required by the OS (e.g. when the statistics are to be calculated);
- omitting the attribute identifiers from the report. In this case, the attribute values are reported in an agreed order, which is defined by an attribute of the "simpleScanner";
- measurement values that are identical throughout all "measurementFunction" instances from which the scanner takes measurements may be included in the report only once.

ITU-T Recommendation X.738 [19] defines in detail the attributes of the "simpleScanner" which are used to control the above features. Additional options of ITU-T Recommendation X.738 [19] which are not listed here are not supported in the PLMN performance measurement system (see conformance requirements in clause 4.4).

#### 4.2.2 Scanner state and status attributes

State and status indicators are defined for the measurement job in clause 3.2.2 of the present document. These are modelled through appropriate attributes which reflect the state and status of the "simpleScanner" object. These attributes are: administrativeState, operationalState and availabilityStatus.

**administrativeState:** the administrativeState attribute is used to suspend and resume the scanning performed by the "simpleScanner". This attribute can be altered by means of CMISE M-SET service or SNMP SET operation for the applicable "simpleScanner" object instance.

**operationalState:** the operationalState attribute represents the operational capability of the scanner to perform its functions.

**availabilityStatus:** the availabilityStatus attribute reflects whether or not the simpleScanner object instance is active according to the measurement schedule.

Any changes to the values of the administrativeState and the operationalState attributes will be reported to the OS using the "stateChange" notification, as defined in ITU-T Recommendation X.731 [16].

Further details about these attributes can be found in ITU-T Recommendation X.738 [19].

#### 4.2.3 Scanner administration

The generic CMISE services M-CREATE, M-DELETE, M-GET and M-SET or SNMP SET and GET, applied to a simpleScanner managed object instance respectively represent creation, deletion, display and modification of a

measurement job. A CMISE M-ACTION primitive or SNMP SET with a specific action type for activating a scan report is defined for the retrieval of the current values of measurement results.

**Creating a "simpleScanner":** a "simpleScanner" can be created by issuing an appropriate M-CREATE request or SNMP SET request. On creation of the object, all attribute values have to be supplied that determine:

- the selection of "measurementFunction" instances and their attributes which shall be measured;
- the schedule of the "simpleScanner"; and
- the reporting requirements;

as defined in previous clauses. The "measurementFunction" objects shall be created before the scanner can be instantiated, and the measurement attributes specified in the scanner shall be present in the selected "measurementFunction" instances, for the scan to return its results. For each object that does not exist, an empty report shall be returned and for each attribute that does not exist, an empty value shall be returned within the report. The relationship between the scan attributes and the scanner is explained in ITU-T Recommendation X.738 [19].

**Modifying "simpleScanner" attributes:** modification of "simpleScanner" attributes may be requested by the OS during the lifetime of a scanner, using the CMISE M-SET or SNMP SET operation. The conditions for modification of attributes of the "simpleScanner" are specified in ITU-T Recommendation X.738 [19], but some additional restrictions, defined in the present document with respect to the changeability of "simpleScanner" attributes, apply in the PLMN performance measurement system.

**Displaying scanner objects:** the system operator can get a list of all "simpleScanner" objects that currently exist in the system, together with all available information as stored in the NE. This information consists of the data that was supplied on creation/modification of the objects and the values of the state and status attributes of the "simpleScanner" objects. The CMISE M-GET or SNMP GET operation can be used to selectively retrieve the required information from the system. For details see ITU-T Recommendation X.710 [13].

**Deleting a "simpleScanner":** a "simpleScanner" instance is automatically deleted by the system when the scheduled endtime is reached and all result reports, either scheduled or on request have been generated. A "simpleScanner" object can also be deleted by manual intervention, utilising the CMISE M-DELETE or SNMP SET operation, at any time. When deleted, the measurement process associated with the scanner is stopped, and all allocated resources are released.

**Suspending/resuming scanner operation:** on normal operation, the "simpleScanner" collects measurement data from the selected "measurementFunction" objects according to the values of the "simpleScanner" attributes. However, the system operator may decide for some reason to discard temporarily the collection of measurement data (e.g. in case of system overload or congestion, measurement results not used, ...). The system operator therefore is able to suspend scanner operation at any time, setting the administrativeState attribute to "locked". This implies that the "simpleScanner" instance remains in the system, but no measurement gathering and result reporting activities are performed for this scanner. When scanner operation is resumed, i.e. the administrativeState is "unlocked", measurement data collection and result reporting is started again at the next full granularity period within the measurement schedule.

**Requesting current measurement result values:** the system operator may for some reason be interested in the current values of the measurement results of a particular measurement process, independently of the scheduled data collection and reporting of the respective scanner, e.g. for tracing the increment of some of the measurement attributes. To this aim, the "activateScanReport" CMISE M-ACTION or SNMP GET is used as defined in ITU-T Recommendation X.738 [19]. The action reply will return current results according to the attributes of the scanner that govern the generation of the "scanReport" notification, i.e. the format of the reply is identical to that of scheduled reports generated by the scanner. Any such request does not affect the underlying measurement process, and may only be issued when the scanner is operating according to its schedule and not suspended (i.e. "offduty" not present in the availability status, administrative state equals "unlocked"), otherwise an error will be returned.

## 4.3 Modelling of measurement results

Each measurement produces a result at the end of the granularity period or on request of the OS. Annex B provides for each measurement type a description of the expected measurement result. Annex C contains the formal definition of the attribute that represents the measurement type.

### 4.3.1 Characteristics of the result report

A scheduled result report is generated in the form of a "scanReport" notification. Current measurement results requested by the OS using the "activateScanReport" action will be supplied by the system in the reply to the request. All measurement attributes that are observed by a "simpleScanner" object are included in a single report or action reply, respectively. The layout of the two result reports - notification or action reply - is identical, as far as the contained measurement information is concerned. For details on the result report characteristics, please refer to the previous clauses.

### 4.3.2 Result report transfer control

Result reports from a "simpleScanner" object are either produced according to the measurement schedule (notification) or on receipt of an explicit request (action) from the OS. There are no mechanisms to control the forwarding of the reply to that request (action reply), or to store it in the NE. There are, however, functions to determine the forwarding, local storage in the NE and deferred retrieval of the "scanReport" notification. These functions are described in the following clauses.

The forwarding of notifications can be controlled by the OS via "Event Forwarding Discriminator" (EFD) objects, as defined in ITU-T Recommendation X.734 [17]. For each EFD, the OS can specify a discriminator construct which will be applied as a filter to any event report generated in the system. If an event report passes the filter, a notification will be forwarded to the OS accordingly. The following filter criteria are allowed in an EFD for the PLMN performance measurement system:

- the event type, which allows to enable or disable completely the forwarding of scan report notifications;
- the "simpleScanner" managed object instance, which allows to restrict forwarding of result reports to those that are generated by specific scanner instances;
- the time stamp contained in the scan report ("scanInitiationTime"), which allows to selectively enable the forwarding of result reports that were generated at a specific time or during specific periods of time;
- any operation on the above attributes in any combination.

Measurement result reports can be stored in the NE. This property is modelled through the managed object class "log", as specified in ITU-T Recommendation X.721 [14] and "log control function" as specified in ITU-T Recommendation X.735 [18]. The storage of event reports in the "log" can be controlled through a discriminator construct, similar to the event forwarding control. The present document requires for the "log" discriminator construct the same criteria as for the EFD discriminator construct.

All scan report notifications that pass the discriminator construct of the "log" will create a "scanReportRecord" object which is contained in the log. These records can be retrieved by the OS at any time, as defined in ITU-T Recommendation X.735 [18] and ITU-T Recommendation X.710 [13], using either CMISE, SNMP, FTP or using FTAM (see annex D). The use of FTAM or FTP services is especially suitable for bulk data transfer. From the common procedures defined in GSM TS 12.00 [8] for data transfer in a PLMN, only the method that provides logged information into file(s) can be used for the measurement system. The "resultType" requested in the action will identify the appropriate log instance(s) as the source of the measurement data, and optionally additional filter criteria which determines the actual records to be put into the file(s) can be supplied. The filter criteria that shall be supported are identical to those defined for the discriminator construct of the logs. On receipt of the action, the requested records will be put into one or more files, which will then be made available to the OS. The format of the records in the file shall be according to the definition of the "scanReportRecord" as given in ITU-T Recommendation X.738 [19].

Since all measurement attributes and the identification of the network resource observed by a "simpleScanner" are included in a single attribute of the result reports, it is not possible to filter on the measured resource or the measurement type. If the selective forwarding/logging/retrieval of measurement results referring to individual network resources or individual measurement types is required by the system operator, then "simpleScanner" objects shall be instantiated such that the scanner identity will implicitly identify the measured resource and measurement types, i.e. the scanner attributes should be set such that the scanner observes only the specific resources and/or the specific measurement attributes which shall be filtered, according to the system operator's requirements.

## 4.4 Conformance requirements

In the following clause, conformance requirements for object classes, notifications and actions defined in ITU-T Recommendation X.738 [19] are specified. In cases where requirements in the present document restrict options of ITU-T Recommendation X.738 [19], like e.g. changeability of attribute values, the conditions of the present document shall apply.

### 4.4.1 Simple scanner

The following clause lists the attributes and packages of the "simpleScanner", as defined in ITU-T Recommendation X.738 [19], and those inherited from the "scanner" as defined in ITU-T Recommendation X.738 [19]. It specifies which properties shall be supported to conform with the present document.

#### MANDATORY PACKAGES:

##### scannerPackage:

- scannerId: this attribute identifies a "simpleScanner" instance. It is a mandatory attribute of the "simpleScanner" managed object class and will be supported in the PLMN measurement system;
- granularityPeriod: this attribute specifies the granularity period of the scanner, as defined in clause 4.2.1.3. It is a mandatory attribute of the "simpleScanner" managed object class and will be supported in the PLMN measurement system;
- administrativeState and operationalState: (see clause 4.2.2) are mandatory attributes of the "simpleScanner" managed object class and will be supported in the PLMN measurement system. Their semantics are defined in ITU-T Recommendation X.738 [19].

##### homogeneousScannerPackage:

- scanAttributeIdList: this attribute is interrelated with the "numericAttributeIdArray" attribute of the "simpleScannerPackage". It is supported in the PLMN measurement system according to the definitions of clause 4.2.1.4 and ITU-T Recommendation X.738 [19].

##### simpleScannerPackage:

- numericAttributeIdArray: this attribute is interrelated with the "scanAttributeIdList" attribute of the "homogeneousScannerPackage". It is supported in the PLMN measurement system according to the definitions of clause 4.2.1.4 and ITU-T Recommendation X.738 [19];
- suppressObjectInstance: this attribute determines whether or not the object instance of the observed measurement function is included in the measurement results. It is supported in the PLMN measurement system according to the definitions of clause 4.2.1.4 and ITU-T Recommendation X.738 [19];
- activateScanReport: this action is supported in the PLMN measurement system (see below);
- scanReport: this notification is supported in the PLMN measurement system (see below).

#### CONDITIONAL PACKAGES:

##### availabilityStatusPackage:

- availabilityStatus: this attribute is supported in the PLMN measurement system (see clause 4.2.2) according to the definition of ITU-T Recommendation X.738 [19].

##### duration:

- startTime and stopTime: these attributes constitute the start- and stoptime of the scanner. They are supported according to clause 4.2.1.2 and ITU-T Recommendation X.738 [19].

##### dailyScheduling:

- intervalsOfDay: this attribute defines the periods within a day during which the scanner actively collects measurement data. It is supported according to clause 4.2.1.2 and ITU-T Recommendation X.738 [19].

**weeklyScheduling:**

- weekMask: this attribute defines, for each day of the week, the periods during which the scanner actively collects measurement data. It is supported according to clause 4.2.1.2 and ITU-T Recommendation X.738 [19].

**externalScheduler:**

- The support of this package is not required in the PLMN measurement system.

**periodSynchronisationPackage:**

- The support of this package is not required in the PLMN measurement system. Synchronisation of granularity periods is described in clause 4.2.1.3.

**createDeleteNotificationsPackage:**

- This package contains the object creation and object deletion notifications. Both are required in the PLMN measurement system.

**attributeValueChangeNotificationPackage:**

- This package contains the attribute value change notification. It is required in the PLMN measurement system.

**stateChangeNotificationPackage:**

- This package contains the state change notification. It is required in the PLMN measurement system.

**timeStampReportPackage:**

- timeStampReportMode: this attribute specifies the time stamping requirements for the measurement results. The value "1" ("globalTimeStampOnly") shall be used.

**scopedSelectionPackage and managedObjectInstanceSelectionPackage:**

- Either one of these packages is present in any scanner instance. The attributes contained in the packages determine the measurement functions selected for observation by the scanner. They are supported according to the definitions of ITU-T Recommendation X.738 [19].

**timingSelectionPackage:**

- The support of this package is not applicable in the PLMN measurement system, since the observed "measurementFunction" managed objects do not contain any time attributes.

**onceReportAttributeIdListPackage:**

- onceReportAttributeIdList: this attribute contains a list of attribute identifiers. The values of these attributes shall be included in a result report only once if they are identical throughout all "measurementFunction" objects observed by the "simpleScanner". It may be supported in the PLMN measurement system as an option, see ITU-T Recommendation X.738 [19].

## 4.4.2 Scan report record

The "scanReportRecord" managed object class will be supported in the PLMN measurement system as defined in ITU-T Recommendation X.738 [19] and ITU-T Recommendation X.721 [14].

## 4.4.3 Scan report notification

The "scanReport" notification will be supported in the PLMN measurement system as defined in clause 4.2.1.4 and ITU-T Recommendation X.738 [19].

#### 4.4.4 Activate scan report action

In the scope of the present document, there are no specific conformance requirements for the action request. The action reply will be supported according to the requirements for the scan report notification.

### 4.5 Application Context

The Application Context Name of the 12.04 application context shall have the following object identifier value:

{gsm-OM-DomainId gsm-12-04 (4) protocolSupport (1) applicationContext (0) gsm-Management (0)};

and the following object description value:

"gsm12.04 management application context".

The object identifier gsm-OM-DomainId is defined in the GSM 12.30 [11].

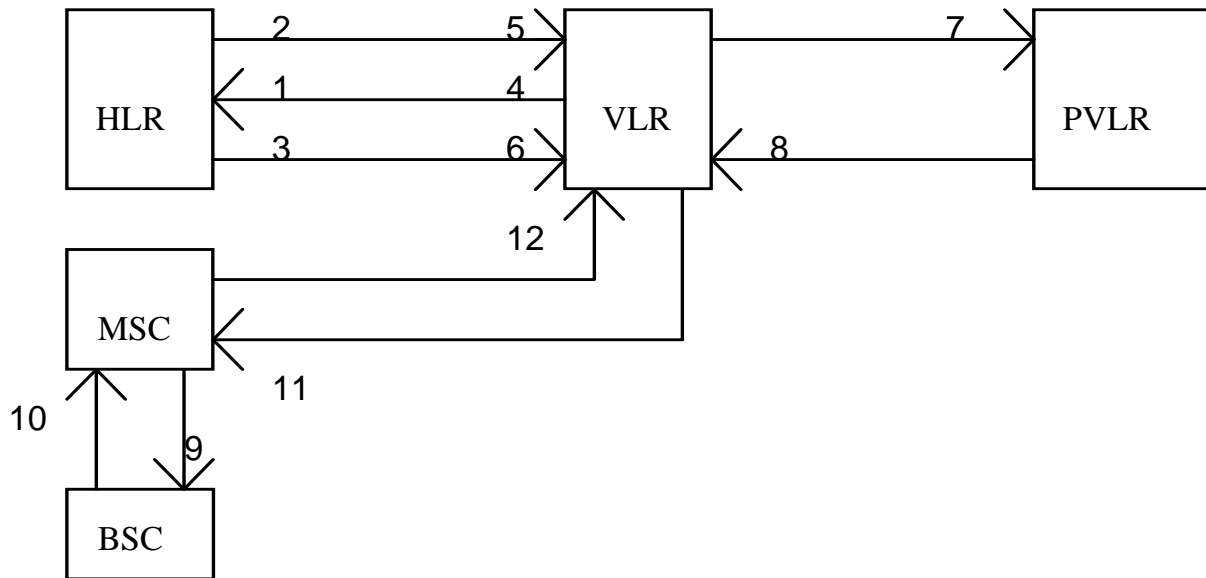


# Annex A (informative): Graphical examples

This annex gives some graphical examples to demonstrate how the measurements in annex B, can be combined to express a specific function.

EXAMPLE 1: Authentication and Authentication Set requests.

This diagram shows which measurements in the annex B need to be activated to collect the statistical information for Authentication of a subscriber.

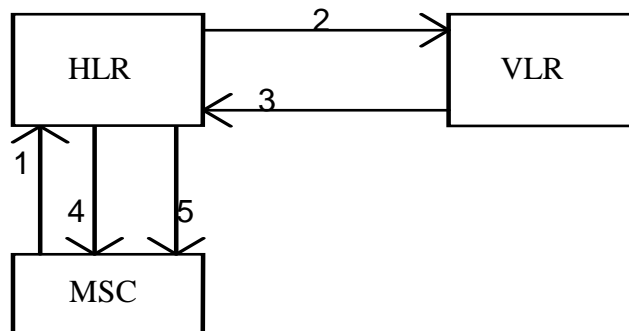


Nbr.	Measurement Attribute Name	Measurement Name
1	attReqForAuthSetsReceivedByHLRFromVLRs	Attempted requests for Authentication sets received by HLR from VLRs
2	succReturnedAuthSetsFromHLRtoVLRs	Successful returned Authentication sets from HLR to VLRs
3	emptyResponsesForAuthSetsFromHLRtoVLRs	Empty responses to request for Authentication sets from HLR to VLRs
4	attReqForAuthSetsSentToHLR	Attempted requests for Authentication sets sent to HLR by the VLRs
5	succReceivedAuthSetsFromHLR	Successful received Authentication sets from the HLR to the VLRs
6	emptyResponsesForAuthFromHLR	Empty responses to request for Authentication sets from HLR to VLRs
7	attIdentificationReqToPVLs	Attempted identification requests to PVLs
8	succIdentificationReqToPVLs	Successful identification requests to PVLs
9	attCipheringModeControlProcs	Attempted ciphering mode controlled procedures
10	succCipheringModeControlProcs	Successful ciphering mode controlled procedures
11	attAuthProcsInVLR	Attempted authentication procedures in the VLR
12	succAuthProcsInVLR	Successful authentication procedures in the VLR

**Example 1: Authentication and Authentication Set requests**

EXAMPLE 2: Interrogation of HLR for routing.

This diagram shows which measurements in the annex B need to be activated to collect the statistical information for Routing.

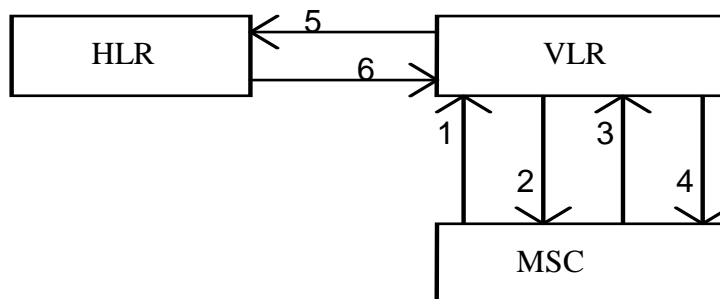


Nbr.	Measurement Attribute Name	Measurement Name
1	attInterrogationOfHLRsForRouting	Attempted interrogations of HLRs for routing
2	attReqForMSRN	Attempted request for MSRN
3	succReqForMSRN	Successful request for MSRN
4	succInterrogationOfHLRsMSRNObtained	Successful interrogations of HLR (MSRN obtained)
5	succInterrogationOfHLRsCallForwarding	Successful interrogations of HLR (call forwarding)

Example 2: Interrogation of HLR for routing

EXAMPLE 3: Location Updating.

This diagram shows which measurements in the annex B need to be activated to collect the statistical information for Location Updating.



Nbr.	Measurement Attribute Name	Measurement Name
1	attIntraVLRLocationUpdates	Attempted intra-VLR location updates
2	succIntraVLRLocationUpdates	Successful intra-VLR location updates
3	attInterVLRLocationUpdates	Attempted inter-VLR location updates
4	succInterVLRLocationUpdates	Successful inter-VLR location updates
5	attLocationUpdate	Attempted location updates
6	succLocationUpdate	Successful location updates

Example 3: Location Updating

---

## Annex B (normative): Performance Measurement Requirements Summary

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

A. Description:

- A short explanation of the measurement operation.

B. Collection Method:

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

C. Condition:

- The GSM condition which causes this measurement data to be updated. Where it is not possible to give a precise GSM condition, then the conditional circumstances leading to the update is stated.

D. Measurement Attribute Name:

- The Measurement Attribute Name which will be referenced by the Object Model.

E. Measurement Result (measured value, Unit):

- A short description of expected result value (e.g. A single integer value).

F. Measurement Function Name:

- Measurement Function Name for which this measurement is defined.

G. Switching Technology:

- The Switching product this Measurement is applicable to. Circuit Switched and/or Packet Switched (GPRS). When packet switching (GPRS) is identified for an MSC measurement function, this measurement type is related to a combined circuit/packet switched event.

---

## B.1 Measurements Related to the BSC

### B.1.1 BSC Measurement Function

#### B.1.1.1 Unsuccessful requests for service

A. This measurement provides the number of unsuccessful mobile originated services for the BSC.

NOTE: The "reject cause" indicates why the service request was rejected. Possible causes include, B-Subscriber busy, network out of order, protocol errors.

B. CC.

C. Transmission of "CM-SERVICE REJECT" Message to MS requesting service (GSM 04.08 [2]).

D. `unsuccReqsForService`.

E. A single integer value.

F. BSC Measurement Function.

G. Valid for circuit switching.

#### B.1.1.2 Unsuccessful requests for service, per cause

A. This measurement provides the number of unsuccessful mobile originated services for the BSC per cause.

NOTE: The "reject cause" indicates why the service request was rejected. Possible causes include, B-Subscriber busy, network out of order, protocol errors.

B. CC.

C. Transmission of "CM-SERVICE REJECT" Message to MS requesting service (GSM 04.08 [2]).

D. `unsuccReqsForServicePerCause`.

E. An integer value per cause.

F. BSC Measurement Function.

G. Valid for circuit switching.

#### B.1.1.3 Mean Inter-arrival Time (Circuit Switched)

A. This measurement provides the arithmetic mean of the sum of time intervals between consecutive mobile originating call attempts.

B. CC.

C. This measurement is obtained by accumulating the time segments between receipt of consecutive access Message on the RACH with establishment cause "MOBILE ORIGINATING CALL" and then taking the arithmetic mean (GSM 04.08 [2]).

D. `meanInterArrivalTime`

E. A single real value.

F. BSC Measurement Function.

G. Valid for circuit switching.

#### B.1.1.4 Attempted Transmission of Paging Messages, per BSC

- A. This measurement provides the number of Paging messages transmitted, on a per BSC basis (these are counted as attempts).
- B. CC.
- C. Transmission of "PAGING REQUEST" (GSM 04.08 [2]).
- D. attTransOfPagingMessagesPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit and packet switching.

#### B.1.1.5 Unsuccessful Transmission of Paging Messages, per BSC

- A. This measurement provides the number of unsuccessful Paging requests, on a per BSC basis.
- B. CC.
- C. No "PAGING RESPONSE" received for the "PAGING REQUEST", expiry of timer T3113 (GSM 04.08 [2]).
- D. unsuccTransOfPagingMessagesPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit and packet switching.

#### B.1.1.6 Attempted IMMEDIATE ASSIGNMENT Procedures, per BSC

- A. This measurement provides the number of attempted immediate assignment procedures, on a per BSC basis.
- B. CC.
- C. Receipt of "CHANNEL REQUEST" Message. Note, the establishment causes are: "EMERGENCY CALL", "CALL RE-ESTABLISHMENT", "ANSWER TO PAGING", "ORIGINATING CALL", "LOCATION UPDATING", "ONE PHASE PACKET ACCESS", "SINGLE BLOCK PACKET ACCESS" and "OTHER PROCEDURES" as defined in (GSM 04.08 [2]).
- D. attImmediateAssingProcsPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit and packet switching.

### B.1.1.7 Successful IMMEDIATE ASSIGNMENT Procedures, per BSC

- A. This measurement provides the number of successful immediate assignment procedures, on a per BSC basis.
- B. CC.
- C. Transmission of "IMMEDIATE ASSIGN COMMAND" Message. This Message contains either an "IMMEDIATE ASSIGNMENT" Message or an "IMMEDIATE ASSIGNMENT EXTENDED" Message. If an "IMMEDIATE ASSIGNMENT EXTENDED" Message is transmitted, the counter shall be incremented by two, because that Message contains assignment information for two mobiles (GSM 04.08 [2]).
- D. succImmediateAssingProcsPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit and packet switching.

### B.1.1.8 Successful Internal Handovers, intra-CELL, per BSC

- A. This measurement provides the number of times a call moves from the occupied channel of the CELL to another free channel of the same CELL, on a per BSC basis.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succInternalHDOsIntraCellPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit switching.

### B.1.1.9 Unsuccessful Internal Handovers, intra-CELL, per BSC

- A. This measurement provides the number of unsuccessful intra CELL Handovers, i.e. an attempt was made to move a call from the occupied channel of the CELL to another free channel of the same CELL, on a per BSC basis.
- B. CC.
- C. Receipt of "ASSIGNMENT FAILURE" Message for the attempted handover (GSM 04.08 [2]).
- D. unsuccInternalHDOsIntraCellPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit switching.

### B.1.1.10 Successful Internal Handovers per BSC

- A. This measurement provides the number of successful Handovers on a per BSC basis, it includes intra-CELL as well as inter-CELL Handovers.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succInternalHDOsPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit switching.

### B.1.1.11 Successful Internal Handovers per cause

- A. This measurement provides the number of successful Handovers per cause, it includes intra-CELL as well as inter-CELL Handovers.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succInternalHDOsPerCause.
- E. An integer value per Handover cause.
- F. BSC Measurement Function.
- G. Valid for circuit switching.

### B.1.1.12 Unsuccessful Internal Handovers with reconnection to old channels, per BSC

- A. This measurement provides the number of unsuccessful Handovers, on a per BSC basis (with reconnection to the original channels).
- B. CC.
- C. Receipt of "HANDOVER FAILURE" Message for the attempted handover (GSM 04.08 [2]).
- D. unsuccInternalHDOsWithReconnectionPerBSC.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit switching.

### B.1.1.13 Unsuccessful Internal Handovers with loss of connection, per BSC

- A. This measurement provides the number of unsuccessful Handovers that end in losing the call, on a per BSC basis.
- B. CC.
- C. Expiry of timer T3103 for Inter CELL Handovers and Expiry of timer T3107 for Intra CELL Handovers (GSM 04.08 [2]).
- D. `unsuccInternalHDOsWithLossOfConnectionPerBSC`.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for circuit switching.

### B.1.1.14 Flush Requests Received

- A. This measurement provides the total number of flush request messages received from the SGSN to flush the PDUs for a given cell.
- B. CC.
- C. Update count for each receipt of a PDU flush request message from the SGSN.
- D. `flushReqReceived`.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for packet switching.

### B.1.1.15 Paging Requests Received from SGSN

- A. This measurement provides the total number of "PAGING" messages received by the BSS from the SGSN.
- B. CC.
- C. Update count for each receipt of a "PAGING" message by the BSS from the SGSN.
- D. `pagingReqReceivedfromSGSN`.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for packet switching.



### B.1.1.16 Mean Inter-arrival Time (Packet Switched)

- A. This measurement provides the arithmetic mean of the sum of time intervals between consecutive mobile originating packet channel access request.
- B. CC.
- C. This measurement is obtained by accumulating the time segments between receipt of consecutive 'PACKET CHANNEL REQUEST' message with the establishment cause being either one phase packet access or single block packet access, on the PRACH and then taking the arithmetic mean 3GPP TS 44.060 [23].
- D. meanPSInterArrivalTime
- E. A single real value.
- F. BSC Measurement Function.
- G. Valid for packet switching.

### B.1.1.17 Number of octets of uplink BSSGP PDUs

- A. This measurement provides the number of octets of uplink BSSGP PDUs on Gb interface.
- B. CC.
- C. On transmission by the BSC of a PDU (type is UL-UNITDATA) on the BSSGP layer. The number of octets of BSSGP layer on Gb interface is calculated by sum of octets length in each BSSGP PDU header including BSSGP PDU header. See TS 48.018 [34].
- D. NbrULBssgpOct.
- E. A single integer value.
- F. BSC Measurement Function.
- G. Valid for packet switched traffic.

### B.1.1.18 Number of octets of downlink BSSGP PDUs

- a) This measurement provides the number of octets of downlink BSSGP PDUs on Gb interface.
- b) CC.
- c) On receipt by the BSC of a PDU (type is DL-UNITDATA) on the BSSGP layer. The number of octets of BSSGP layer on Gb interface is calculated by sum of octets length in each BSSGP PDU header including BSSGP PDU header. See TS 48.018 [34].
- d) NbrDLBssgpOct.
- e) A single integer value.
- f) BSC Measurement Function.
- g) Valid for packet switched traffic

### B.1.1.19 Power, Energy and Environmental (PEE) measurements

#### B.1.1.19.0 Applicability of measurements

The PEE related measurement definitions in the following clauses B.1.1.19.n are valid only for BSCs having built-in sensors (cf. ETSI ES 202 336-12 [36]).

### B.1.1.19.1 Power

#### B.1.1.19.1.1 Average Power

- a) This measurement provides the average power consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.1, 4.4.3.4, Annex A.
- d) Each measurement is a real value in Watt (W).
- e) The measurement name has the form PEE.AvgPower.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

#### B.1.1.19.1.2 Minimum Power

- a) This measurement provides the minimum power consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.1, 4.4.3.4, Annex A.
- d) Each measurement is a real value in Watt (W).
- e) The measurement name has the form PEE.MinPower.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

#### B.1.1.19.1.3 Maximum Power

- a) This measurement provides the maximum power consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.1, 4.4.3.4, Annex A.
- d) Each measurement is a real value in Watt (W).
- e) The measurement name has the form PEE.MaxPower.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

### B.1.1.19.2 Energy

- a) This measurement provides the energy consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.2, 4.4.3.4, Annex A.
- d) Each measurement is a real value in kilo Watt hour (kWh).
- e) The measurement name has the form PEE.Energy.

- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

### B.1.1.19.3 Temperature

#### B.1.1.19.3.1 Average Temperature

- a) This measurement provides the average temperature.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.4, Annex A.
- d) Each measurement is a real value in Degree Celsius (C°).
- e) The measurement name has the form PEE.AvgTemperature.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

#### B.1.1.19.3.2 Minimum Temperature

- a) This measurement provides the minimum temperature.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.4, Annex A.
- d) Each measurement is a real value in Degree Celsius (C°).
- e) The measurement name has the form PEE.MinTemperature.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

#### B.1.1.19.3.3 Maximum Temperature

- a) This measurement provides the maximum temperature.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.4, Annex A.
- d) Each measurement is a real value in Degree Celsius (C°).
- e) The measurement name has the form PEE.MaxTemperature.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

### B.1.1.19.4 Voltage

- a) This measurement provides the voltage.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – Clauses 4.4.3.3, 4.4.3.4, Annex B.

- d) Each measurement is a real value in Volt (V).
- e) The measurement name has the form PEE.Voltage.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

#### B.1.1.19.5 Current

- a) This measurement provides the current.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – Clauses 4.4.3.3, 4.4.3.4, Annex B.
- d) Each measurement is a real value in Ampere (A).
- e) The measurement name has the form PEE.Current.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

#### B.1.1.19.6 Humidity

- a) This measurement provides the percentage of humidity.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.3, Annex B.
- d) Each measurement is a single integer value from 0 to 100.
- e) The measurement name has the form PEE.Humidity.
- f) bscMeasurementFunction.
- g) Valid for circuit and packet switching.

---

## B.2 Measurements related to the BTS

### B.2.1 CELL Measurement Function

#### B.2.1.1 Mean PCH-AGCH queue length

- A. This measurement provides the arithmetic mean of the number of all messages waiting for transmission on the PCH-AGCH. Note: this is valid for circuit only when a PCCCH is provided.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the PCH-AGCH queue length and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanPCHAGCHQueueLength.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

#### B.2.1.2 Attempted Transmission of Paging Messages (the PCH)

- A. This measurement provides the number of Paging messages transmitted (these are counted as attempts). Note: this is valid for circuit only when a PCCCH is provided.
- B. CC.
- C. Transmission of "PAGING REQUEST" (GSM 04.08 [2]).
- D. attTransOfPagingMessagesThePCH.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

#### B.2.1.3 Unsuccessful Transmission of Paging Messages (the PCH)

- A. This measurement provides the number of unsuccessful Paging requests.
- B. CC.
- C. No "PAGING RESPONSE" received for the "PAGING REQUEST", expiry of timer T3113 (GSM 04.08 [2]). Note: this is valid for circuit only when a PCCCH is provided.
- D. unsuccTransOfPagingMessagesThePCH.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.4 Attempted IMMEDIATE ASSIGNMENT Procedures

- A. This measurement provides the number of attempted immediate assignment procedures.
- B. CC.
- C. Receipt of "CHANNEL REQUIRED" Message. Note, the establishment causes are: "EMERGENCY CALL", "CALL RE-ESTABLISHMENT", "ANSWER TO PAGING", "ORIGINATING CALL", "LOCATION UPDATING", "ONE PHASE PACKET ACCESS", "SINGLE BLOCK PACKET ACCESS" and "OTHER PROCEDURES" as defined in (GSM 04.08 [2]).
- D. attImmediateAssingProcs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.5 Successful IMMEDIATE ASSIGNMENT Procedures

- A. This measurement provides the number of successful immediate assignment procedures.
- B. CC.
- C. Transmission of "IMMEDIATE ASSIGN COMMAND" Message. This message contains either an "IMMEDIATE ASSIGNMENT" Message or an "IMMEDIATE ASSIGNMENT EXTENDED" Message. If an "IMMEDIATE ASSIGNMENT EXTENDED" Message is transmitted, the counter shall be incremented by two, because that Message contains assignment information for two mobiles (GSM 04.08 [2]).
- D. succImmediateAssingProcs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.6 Attempted IMMEDIATE ASSIGNMENT Procedures, per cause

- A. This measurement provides the number of attempted immediate assignment procedures, per cause.
- B. CC.
- C. Receipt of "CHANNEL REQUIRED" Message. Note, the establishment causes are: "EMERGENCY CALL", "CALL RE-ESTABLISHMENT", "ANSWER TO PAGING", "ORIGINATING CALL", "LOCATION UPDATING" and "OTHER PROCEDURES" as defined in (GSM 04.08 [2]).

NOTE: System implementation will allow the establishments causes of **PS \*\*\* Att IMM ASS Poc** can be incorporated in this measurement.

- F. attImmediateAssingProcsPerCause.
- G. An integer value per cause.
- H. CELL Measurement Function.
- I. Valid for circuit and packet switching.

### B.2.1.7 Successful IMMEDIATE ASSIGNMENT Procedures, per cause

- A. This measurement provides the number of successful immediate assignment procedures, per cause.
- B. CC.
- C. Transmission of "IMMEDIATE ASSIGN COMMAND" Message. This Message contains either an "IMMEDIATE ASSIGNMENT" Message or an "IMMEDIATE ASSIGNMENT EXTENDED" Message, per cause. Note, the establishment causes are: "EMERGENCY CALL", "CALL RE-ESTABLISHMENT", "ANSWER TO PAGING", "ORIGINATING CALL", "LOCATION UPDATING" and "OTHER PROCEDURES". The "IMMEDIATE ASSIGNMENT EXTENDED" Message contains assignment information for two mobiles (GSM 04.08 [2]). If the establishment cause is identical for the two mobile stations, the counter shall be incremented by two. Otherwise the affected counters shall be incremented by one.

NOTE: System implementation will allow the establishments causes of **PS \*\*\* Att IMM ASS Poc** can be incorporated in this measurement.

- D. succImmediateAssingProcsPerCause.
- E. An integer value per cause.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.8 Number of Pages Discarded from the PCH Queue

- A. This measurement provides the number of Paging messages which are discarded from the PCH queue before they could be transmitted.
- B. CC.
- C. Pages can be discarded from the queues (assuming queuing is in operation) for a number of reasons, including queue overflow, priority insertion in the queue causing an overflow and in-queue timer expiry (GSM 04.08 [2]).

NOTE: This is valid for circuit only when a PCCCH is provided.

- D. nbrOfPagesDiscardedFromPCHQueue.
- E. An integer value for the paging queue in the CELL.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.9 Mean duration of a successful Paging Procedure

- A. This measurement provides the arithmetic mean duration of a successful Paging procedure, i.e. from transmission of the page request towards the MS and receipt of a positive response.
- B. CC.
- C. An accumulation is performed for the time taken by each Paging procedure during the granularity period and an arithmetic mean is taken from the observed values. The measured time will be between Transmission of a "PAGING REQUEST" service request to Receipt of "PAGING RESPONSE" service confirmation (GSM 04.08 [2]).
- D. meanDurationOfSuccPagingProcs.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.10 Number of Time Slots Available for Traffic (Previously TCHs)

- A. This measurement provides the number of TS which are available for use by either CS or PS traffic(including those which are actually in use).
- B. GAUGE.
- C. The gauge will be incremented when the TS becomes available and decremented when it becomes unavailable. The TS is available when its administrative state is "unlocked" or "shuttingdown" and the operational state is "enabled", and is unavailable when its administrative state changes to "locked" or operational state changes to "disabled". The gauge value equals the number of TS with an administrative state of "unlocked" or "shuttingdown" and an operational state of "enabled", (GSM 04.08 [2]).
- D. nbrOfAvailableTCHs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.11 Mean number of busy Time Slots Occupied by Circuit Traffic

- A. This measurement provides the arithmetic mean number of TS which are simultaneously in use for CS traffic (TCHs).
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of TS which are carrying circuit traffic (TCHs) and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanNbrOfBusyTCHs.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.12 Maximum number of busy Time Slots Occupied by Circuit Traffic

- A. This measurement provides the highest recorded value for the number of TS simultaneously in use for Circuit switched traffic.
- B. GAUGE.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of TSs which are "busy", and then taking the maximum of all such values at the end of the granularity period. A TS is busy between an "ASSIGNMENT COMPLETE" Message and the complementary "RELEASE" Message, (GSM 04.08 [2]).
- D. maxNbrOfBusyTCHs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.



### B.2.1.13 Mean number of idle Time Slots per interference band (Previously TCHs)

- A. This measurement provides the arithmetic mean of the number of idle TS per interference band. The TS is said to be idle if it can be allocated for a request. Idle TS are allocated in five classes (GSM 05.01) depending on the measured interference level.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of idle TS per interference band and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanNbrOfIdleTCHsPerInterferenceBand.
- E. A real value per interference band.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.14 Attempted Time Slots seizures (Previously TCHs)

- A. This measurement provides the number of attempted TS seizures.
- B. CC.
- C. Transmission of "ASSIGNMENT COMMAND" Message to the MS, (GSM 04.08 [2]).
- D. attTCHSeizures.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.15 Successful TCH/PDTCH seizures (Previously TCHs)

- A. This measurement provides the number of successful TCH/PDTCH seizures.
- B. CC.
- C. Receipt of "ASSIGNMENT COMPLETE" Message from the MS, (GSM 04.08 [2]).
- D. succTCHSeizures.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit and packet switching.

### B.2.1.16 Attempted TCH Seizures meeting an TCH blocked state

- A. This measurement provides the number of attempted TCH seizures meeting all busy TCH state.
- B. CC.
- C. Receipt of "SETUP" Message from the MS meeting all TCH busy state (GSM 04.08 [2]).
- D. attTCHSeizuresMeetingTCHBlockedState.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.17 All Available TCH Allocated Time

- A. This measurement provides the accumulated time during the granularity period when all available Time slots available for CS traffic were in use or otherwise unavailable to be allocated.
- B. CC.
- C. Each time segment represents the elapsed time from the last available TS being allocated to the next occurrence of a release of a TCH, so making it available for allocation. The allocation event can be for any reason e.g. new call, Handover and is represented by an "ASSIGNMENT COMPLETE" Message. These time segments are accumulated to give a single total (GSM 04.08 [2]).
- D. allAvailableTCHAllocatedTime.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.18 Mean busy time of allocated CS Time Slots

- A. This measurement provides the arithmetic mean of the busy time of the maximum number of Time slots allocated for CS TCHs in a CELL.
- B. SI.
- C. This measurement is obtained by accumulating each Timeslots busy time. A TS is considered busy when it carries one or more TCHs, i.e. between an "ASSIGNMENT COMPLETE" Message and the complementary "RELEASE" Message for those TCHs. All values are added up and divided by the number of TS (maximum allocated for circuit on this Cell) at the end of the granularity period to obtain the arithmetic mean. (Further information can be found in GSM 04.08 [2]).
- D. meanTCHBusyTime.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.19 Mean TCH queue length

- A. This measurement provides the arithmetic mean of the number of queued TCH assignment procedures.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the TCH queue length and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanTCHQueueLength.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.20 Number of lost Radio links while using a TCH

- A. This measurement provides the number of calls terminated due to RF failure on the radio path.
- B. CC.
- C. A local end release due to a "RADIO LINK FAILURE" experienced by the BTS when using a TCH (GSM 05.08 [4]).
- D. nbrOfLostRadioLinksTCH.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.21 Number of Available SDCCHs

- A. This measurement provides the number of SDCCHs which are available to be used (including those actually in use).
- B. GAUGE.
- C. The gauge will be incremented when the SDCCH becomes available and decremented when it becomes unavailable. The SDCCH is available when its administrative state is "unlocked" or "shuttingdown" and the operational state is "enabled", and is unavailable when its administrative state changes to "locked" or operational state changes to "disabled". The gauge value equals the number of SDCCHs with an administrative state of "unlocked" or "shuttingdown" and an operational state of "enabled", (GSM 04.08 [2]).
- D. nbrOfAvailableSDCCHs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.22 Mean number of busy SDCCHs

- A. This measurement provides the arithmetic mean of the number of SDCCHs which are simultaneously in use.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the SDCCHs which are busy and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanNbrOfBusySDCCHs.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.23 Maximum number of busy SDCCHs

- A. This measurement provides the highest recorded value for the number of SDCCHs simultaneously in use.
- B. GAUGE.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of SDCCHs which are "busy", and then taking the maximum of all such values at the end of the granularity period, (GSM 04.08 [2]).
- D. maxNbrOfBusySDCCHs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.24 Attempted SDCCH Seizures meeting an SDCCH blocked state

- A. This measurement provides the number of attempted SDCCH seizures meeting all busy SDCCH state.
- B. CC.
- C. Receipt of "CHANNEL REQUEST" Message from the MS sent on the RACH meeting all SDCCH busy state (GSM 04.08 [2]).
- D. attSDCCHSeizuresMeetingSDCCHBlockedState.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.25 All Available SDCCH Allocated Time

- A. This measurement provides the accumulated time during the granularity period when all available SDCCHs are in use or otherwise unavailable to be allocated.
- B. CC.
- C. Each time segment represents the elapsed time from the last available SDCCH being allocated to the next occurrence of a release of a SDCCH, so making it available for allocation. The allocation event can be for any reason e.g. new call, Handover, and is represented by a SABM Message. These time segments are accumulated to give a single total (GSM 04.08 [2]).
- D. allAvailableSDCCHAllocatedTime.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.26 Mean SDCCH queue length

- A. This measurement provides the arithmetic mean of the number of all messages waiting for transmission on the SDCCH.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the SDCCH queue length and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanSDCCHQueueLength.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.27 Number of lost Radio links while using an SDCCH

- A. This measurement provides the number of RF failure while using the SDCCH.
- B. CC.
- C. A local end release, due to a "RADIO LINK FAILURE", experienced by the BTS when using an SDCCH (GSM 08.58 [6]).
- D. nbrOfLostRadioLinksSDCCH.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.28 Relative time downlink power control at maximum

- A. This measurement provides the time downlink power control was running at maximum level for the busy TCHs over the measured period, relative to the total TCH busy time.
- B. CC.
- C. Each time segment represents the elapsed time when BS\_TXPWR\_MAX is at maximum for each busy TCH. These time segments are accumulated to give a single total. From this information a value is derived such that it reflects a percentage of the total channel busy time, (GSM 05.08 [4]).
- D. relativeTimeDLPowerControlAtMax.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.29 Relative time uplink power control at maximum

- A. This measurement provides the time uplink power control was running at maximum level for the seized TCHs over the measured period, relative to the total TCH busy time.
- B. CC.
- C. Each time segment represents the elapsed time when MS\_TXPWR\_MAX is at maximum for each busy TCH. These time segments are accumulated to give a single total. From this information a value is derived such that it reflects a percentage of the total channel busy time, (GSM 05.08 [4]).
- D. relativeTimeULPowerControlAtMax.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.30 Successful Internal Handovers, intra-CELL

- A. This measurement provides the number of times a call moves from the occupied channel of the CELL to another free channel of the same CELL.
- B. CC.
- C. Transmission of "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succInternalHDOsIntraCell.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.31 Unsuccessful Internal Handovers, intra-CELL

- A. This measurement provides the number of unsuccessful intra CELL Handovers, i.e. an attempt was made to move a call from the occupied channel of the CELL to another free channel of the same CELL.
- B. CC.
- C. Receipt of "ASSIGNMENT FAILURE" Message for the attempted handover (GSM 04.08 [2]).
- D. `unsuccInternalHDOsIntraCell`.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.32 Attempted incoming Internal inter CELL Handovers

- A. This measurement provides the number of attempted incoming Handovers into the observed CELL from the related adjacent CELLS controlled by the same BSC, further information can be found in GSM 04.08 [2], GSM 08.08 [5] and GSM 08.58 [6].
- B. CC.
- C. An occurrence of a BSC internal event, depending on Handover algorithm.
- D. `attIncomingInternalInterCellHDOs`.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.33 Successful incoming Internal inter CELL Handovers

- A. This measurement provides the number of successful incoming Handovers into the observed CELL from the related adjacent CELLS controlled by the same BSC.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. `succIncomingInternalInterCellHDOs`.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.34 Attempted outgoing Internal inter CELL Handovers

- A. This measurement provides the number of attempted outgoing Handovers from the observed CELL to the related adjacent CELLS controlled by the same BSC.
- B. CC.
- C. Transmission of a "HANDOVER COMMAND" Message (GSM 08.08 [5]).
- D. attOutgoingInternalInterCellHDOs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.35 Successful outgoing Internal inter CELL Handovers

- A. This measurement provides the number of successful outgoing Handovers from the observed CELL to the related adjacent CELLS controlled by the same BSC.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succOutgoingInternalInterCellHDOs.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.36 Unsuccessful Internal Handovers with reconnection to old channels

- A. This measurement provides the number of unsuccessful Handovers (with reconnection to the original channels), for the observed CELL.
- B. CC.
- C. Receipt of "HANDOVER FAILURE" Message received for the attempted handover (GSM 04.08 [2]).
- D. unsuccHDOsWithReconnection.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.



### B.2.1.37 Unsuccessful Internal Handovers with loss of connection

- A. This measurement provides the number of unsuccessful Handovers that end in loosing the speech channel, for the observed CELL.
- B. CC.
- C. Expiry of timer T3103 for Inter CELL Handovers and Expiry of timer T3107 for Intra CELL Handovers (GSM 04.08 [2]).
- D. `unsuccHDOsWithLossOfConnection`.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for circuit switching.

### B.2.1.38 Number of Available PDCH

- A. This measurement provides the current number of PDCHs which are available to be used (including those actually in use).
- B. GAUGE.
- C. The gauge will be incremented when the PDCH becomes available and decremented when it becomes unavailable. The PDCH is available when its administrative state is "unlocked" or "shuttingdown" and the operational state is "enabled", and is unavailable when its administrative state changes to "locked" or operational state changes to "disabled". The gauge value equals the number of PDCHs with an administrative state of "unlocked" or "shuttingdown" and an operational state of "enabled".
- D. `availablePDCH`.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.39 Mean Number of Available PDCH

- A. This measurement provides the mean number of PDCHs which are available to be used (including those actually in use) over the measured period.
- B. GAUGE.
- C. The gauge will be incremented when the PDCH becomes available and decremented when it becomes unavailable. The PDCH is available when its administrative state is "unlocked" or "shuttingdown" and the operational state is "enabled", and is unavailable when its administrative state changes to "locked" or operational state changes to "disabled". The gauge value equals the number of PDCHs with an administrative state of "unlocked" or "shuttingdown" and an operational state of "enabled".
- D. `meanNbrAvailablePDCH`
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.40 Maximum Number of Available PDCH

- A. This measurement provides the maximum number of PDCHs which are available to be used (including those actually in use) over the measured period.

**B. GAUGE.**

- C. The gauge will be incremented when the PDCH becomes available and decremented when it becomes unavailable. The PDCH is available when its administrative state is "unlocked" or "shuttingdown" and the operational state is "enabled", and is unavailable when its administrative state changes to "locked" or operational state changes to "disabled". The gauge value equals the number of PDCHs with an administrative state of "unlocked" or "shuttingdown" and an operational state of "enabled".
- D. maxNbrAvailablePDCH.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

**B.2.1.41 Minimum Number of Available PDCH**

- A. This measurement provides the minimum number of PDCHs which are available to be used (including those actually in use) over the measured period.
- B. GAUGE.
- C. The gauge will be incremented when the PDCH becomes available and decremented when it becomes unavailable. The PDCH is available when its administrative state is "unlocked" or "shuttingdown" and the operational state is "enabled", and is unavailable when its administrative state changes to "locked" or operational state changes to "disabled". The gauge value equals the number of PDCHs with an administrative state of "unlocked" or "shuttingdown" and an operational state of "enabled".
- D. minNbrAvailablePDCH.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

**B.2.1.42 Mean number of occupied PDCHs**

NOTE: This measurement is subject to the "2 out of 3 approach".

- A. This measurement provides the arithmetic mean number of occupied PDCHs.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of PDCHs which are carrying packet traffic and then taking the arithmetic mean (3GPP TS 44.060 [23]).
- D. meanNbrOfOccPDCHs.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.43 Maximum number of occupied PDCHs

- A. This measurement provides the highest recorded value for the number occupied by PDCHs.
- B. GAUGE.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the maximum number of PDCHs which are carrying packet traffic. (3GPP TS 44.060 [23]).
- D. maxNbrOfOccPDCHss.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.44 Minimum number of occupied PDCHs

- A. This measurement provides the lowest recorded value for the number of occupied PDCHs.
- B. GAUGE.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the maximum number of PDCHs which are carrying packet traffic. (3GPP TS 44.060 [23]).
- D. minNbrOfOccPDCHss.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.45 All available PDCH allocated time

- A. This measurement gives the total amount of time in the granularity period, where all PDCHs were allocated.
- B. SI.
- C. This time is computed with starting time when the last PDCH is assigned and the end time when a PDCH is first released.
- D. availablePDCHAllocatedTime.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.46 Transmission of Packet Paging Messages on the PCCCH

- A. This measurement provides the number of Packet Paging messages transmitted over PCCCH (these are counted as attempts).
- B. CC.
- C. Transmission of "PACKET PAGING REQUEST" (3GPP TS 44.060 [23]).
- D. `nbrPacketPagingMessagesPCHOnPCCCH`.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.47 Mean PPCH-PAGCH queue length on PCCCH

- A. This measurement provides the arithmetic mean of the number of all messages waiting for transmission on the PPCH-PAGCH sub channel on the PCCCH.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the PPCH-PAGCH queue length and then taking the arithmetic mean (3GPP TS 44.060 [23]).
- D. `meanPPCHPAGCHQueueLengthOnPCCCH`.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.48 Number of Packet Pages Discarded from the PPCH Queue on PCCCH

- A. This measurement provides the number of Packet Paging messages which are discarded from the PPCH queue before they could be transmitted on PCCCH.
- B. CC.
- C. Pages can be discarded from the queues (assuming queuing is in operation) for a number of reasons, including queue overflow, priority insertion in the queue causing an overflow and in-queue timer expiry (3GPP TS 44.060 [23]).
- D. `nbrOfPSPagesDiscardedFromPPCHQueueOnPCCCH`.
- E. An integer value for the paging queue in the CELL.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.49 Number of Packet Channel Assignment Requests, per cause

- A. This measurement provides the number of packet channel assignment requests, per cause.
- B. CC.
- C. Receipt of "PACKET CHANNEL REQUEST" message sent from the MS on the PRACH or by the "CHANNEL REQUEST" message sent on the RACH.. Note, the establishment causes are: defined in (GSM 04.08 [2]) for channel request message and (3GPP TS 44.060 [23]) for the packet channel request message.
- D. attPCReqAssPerCause.
- E. An integer value per cause.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.50 Successful Packet Channel Assignment Procedures, per cause

- A. This measurement provides the number of successful packet channel assignment procedures, per cause. Note: A packet channel assignment is considered successful when either the "PACKET UPLINK ASSIGNMENT" message or the "IMMEDIATE ASSIGNMENT COMMAND" message is sent.
- B. CC.
- C. Transmission of "IMMEDIATE ASSIGN COMMAND" message on the AGCH or the "PACKET UPLINK ASSIGNMENT" message on the PAGCH. Note, If the message contains assignment information for two mobiles (3GPP TS 44.060 [23]). If the establishment cause is identical for the two mobile stations, the counter shall be incremented by two. Otherwise the affected counters shall be incremented by one.

NOTE: System implementation will allow these establishment causes to be incorporated into B 2.1.7.

- D. succPDTCHAssProcsPerCause.
- E. An integer value per cause.
- F. CELL Measurement Function.
- G. Valid for packet switching.

### B.2.1.51 Successful PDTCH seizures

- A. This measurement provides the number of successful PDTCH seizures.
- B. CC.
- C. Receipt of the first RLC Block (PDU) on the PDTCH from the MS, (3GPP TS 44.060 [23]).
- D. succPDTCHSeizures.
- E. A single integer value.
- F. CELL Measurement Function.
- G. Valid for Packet switching.

### B.2.1.52 Mean PDTCH queue length

- A. This measurement provides the arithmetic mean of the number of all messages waiting for transmission on the PDTCH.
- B. CC.
- C. This measurement is obtained by sampling at a predefined interval (System design), the PDTCH queue length and then taking the arithmetic mean.
- D. meanPacketQueueLength.
- E. A single real value.
- F. CELL Measurement function.
- G. Valid for packet switching.

### B.2.1.53 Number of service upgrades/downgrades

- A. With service upgrade and downgrade it is meant a switch from the used coding scheme (CS1, CS2, ...) to another one. This measurement counts the number of these upgrades/downgrades per cell.
- B. CC.
- C. The Trigger Event is a Service upgrade or downgrade for the observed object.
- D. nbrOfServiceChanges.
- E. A single integer value for Upgrades and a single integer value for downgrades.
- F. CELL Measurement function.
- G. Valid for packet switching.

### B.2.1.54 Mean number of occupied PDCHs for GPRS

NOTE: This measurement is subject to the "2 out of 3 approach".

- A. This measurement provides the mean number of occupied PDCHs for GPRS.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval the number of PDCHs which are carrying packet traffic for GPRS and then taking the arithmetic mean (TS 44.060 [23]).
- D. A single real value.
- E. MeanNbrGprsOccPDCHs.
- F. CELL Measurement Function.
- G. Valid for packet switched traffic.

### B.2.1.55 Mean number of occupied PDCHs for EGPRS

NOTE: This measurement is subject to the "2 out of 3 approach".

- A. This measurement provides the mean number of occupied PDCHs for EGPRS.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval the number of PDCHs which are carrying packet traffic for EGPRS and then taking the arithmetic mean (TS 44.060 [23]).
- D. A single real value.
- E. MeanNbrEgprsOccPDCHs.
- F. CELL Measurement Function.
- G. Valid for packet switched traffic.

### B.2.1.56 Mean number of simultaneous GPRS TBF for downlink

- A. This measurement provides the mean number of simultaneous GPRS TBF for downlink.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval the number of simultaneous GPRS TBF and then taking the arithmetic mean.
- D. MeanNbrDLGprsTBF.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for packet switched traffic.

### B.2.1.57 Mean number of simultaneous EGPRS TBF for downlink

- A. This measurement provides the mean number of simultaneous EGPRS TBF for downlink.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval the number of simultaneous EGPRS TBF and then taking the arithmetic mean.
- D. MeanNbrDLEgprsTBF.
- E. A single real value.
- F. CELL Measurement Function.
- G. Valid for packet switched traffic.

### B.2.1.58 Number of received acknowledged octets of EGPRS block on RLC layer

- a) This measurement provides the number of octets of received by BSS acknowledged octets of EGPRS block on RLC layer.
- b) CC.
- c) On receipt by the BSS of an EGPRS block acknowledged by message PACKET UPLINK ACK on the RLC layer. The number of octets of EGPRS block on RLC layer is calculated by sum of octets length in each EGPRS block. See TS 44.060 [23].
- d) NbrReceivedAckOctEgprsOnRlc.
- e) A single integer value.
- f) CELL Measurement Function.
- g) Valid for packet switched traffic.
- h) GSM.
- i) One usage of this measurement is to support the performance indicator  $DV_{MN}$  for EE evaluation in [35].

### B.2.1.59 Number of transmitted octets of EGPRS block on RLC layer acknowledged by mobile

- a) This measurement provides the number of transmitted octets of EGPRS block on RLC layer acknowledged by mobile.
- b) CC.
- c) On receipt by the BSS of message PACKET DOWNLINK ACK for the transmitted an EGPRS block on the RLC layer. The number of octets of EGPRS block on RLC layer is calculated by sum of octets length in each EGPRS block. See TS 44.060 [23].
- d) NbrTransAckOctEgprsOnRlc.
- e) A single integer value.
- f) CELL Measurement Function.
- g) Valid for packet switched traffic.
- h) GSM.
- i) One usage of this measurement is to support the performance indicator  $DV_{MN}$  for EE evaluation in [35].



## B.2.2 Internal HDO Measurement Function

This measurement function allows Internal Handover information per observed CELL to be collected on a per adjacent originating or target CELL basis. This is achieved by specifying the adjacent originating or target CELL identity as parameter when initiating the Measurement Function.

### B.2.2.1 Attempted incoming Internal inter CELL Handovers per originating CELL

- A. This measurement provides the number of attempted incoming Handovers into the observed CELL from the specified adjacent originating CELL, controlled by this BSC, further information can be found in GSM 04.08 [2], GSM 08.08 [5] and GSM 08.58 [6].
- B. CC.
- C. An occurrence of a BSC internal event, depending on Handover algorithm.
- D. attIncomingInternalInterCellHDOsPerOriginatingCell.
- E. A single integer value for the observed CELL from the originating CELL.
- F. Internal HDO Measurement Function.
- G. Valid for circuit switching.

### B.2.2.2 Successful incoming Internal inter CELL Handovers per originating CELL

- A. This measurement provides the number of successful incoming Handovers into the observed CELL from the specified adjacent originating CELL controlled by this BSC.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succIncomingInternalInterCellHDOsPerOriginatingCell.
- E. A single integer value for the observed CELL from the originating CELL.
- F. Internal HDO Measurement Function.
- G. Valid for circuit switching.

### B.2.2.3 Attempted outgoing Internal inter CELL Handovers per target CELL

- A. This measurement provides the number of attempted outgoing Handovers from the observed CELL to the specified adjacent target CELL controlled by this BSC.
- B. CC.
- C. Transmission of a "HANDOVER COMMAND" Message (GSM 04.08 [2]).
- D. attOutgoingInternalInterCellHDOsPerTargetCell.
- E. A single integer value for the observed CELL to the target CELL.
- F. Internal HDO Measurement Function.
- G. Valid for circuit switching.

## B.2.2.4 Successful outgoing Internal inter CELL Handovers per target CELL

- A. This measurement provides the number of successful outgoing Handovers from the observed CELL to the specified adjacent target CELL controlled by this BSC.
- B. CC.
- C. Transmission of a "HANDOVER PERFORMED" Message to the MSC (GSM 08.08 [5]).
- D. succOutgoingInternalInterCellHDOsPerTargetCell.
- E. A single integer value for the observed CELL to the target CELL.
- F. Internal HDO Measurement Function.
- G. Valid for circuit switching.

## B.2.3 Power, Energy and Environmental (PEE) measurements

### B.2.3.0 Applicability of measurements

The energy efficiency related measurement definitions in the following clauses B.2.x.n are valid only for BTSs having built-in sensors (cf. ETSI ES 202 336-12 [36]).

### B.2.3.1 Power

#### B.2.3.1.1 Average Power

- a) This measurement provides the average power consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.1, 4.4.3.4, Annex A.
- d) Each measurement is a real value in Watt (W).
- e) The measurement name has the form PEE.AvgPower.
- f) BTS Measurement Function.g) Valid for circuit and packet switching.

#### B.2.3.1.2 Minimum Power

- a) This measurement provides the minimum power consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.1, 4.4.3.4, Annex A.
- d) Each measurement is a real value in Watt (W).
- e) The measurement name has the form PEE.MinPower.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

#### B.2.3.1.3 Maximum Power

- a) This measurement provides the maximum power consumed.

- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.1, 4.4.3.4, Annex A.
- d) Each measurement is a real value in Watt (W).
- e) The measurement name has the form PEE.MaxPower.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

### B.2.3.2 Energy

- a) This measurement provides the energy consumed.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clauses 4.4.3.2, 4.4.3.4, Annex A.
- d) Each measurement is a real value in kilo Watt hour (kWh).
- e) The measurement name has the form PEE.Energy.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

### B.2.3.3 Temperature

#### B.2.3.3.1 Average Temperature

- a) This measurement provides the average temperature.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.4, Annex A.
- d) Each measurement is a real value in Degree Celsius (C°).
- e) The measurement name has the form PEE.AvgTemperature.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

#### B.2.3.3.2 Minimum Temperature

- a) This measurement provides the minimum temperature.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.4, Annex A.
- d) Each measurement is a real value in Degree Celsius (C°).
- e) The measurement name has the form PEE.MinTemperature.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

#### B.2.3.3.3 Maximum Temperature

- a) This measurement provides the maximum temperature.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.4, Annex A.
- d) Each measurement is a real value in Degree Celsius (C°).
- e) The measurement name has the form PEE.MaxTemperature.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

#### B.2.3.4 Voltage

- a) This measurement provides the voltage.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – Clauses 4.4.3.3, 4.4.3.4, Annex B.
- d) Each measurement is a real value in Volt (V).
- e) The measurement name has the form PEE.Voltage.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

#### B.2.3.5 Current

- a) This measurement provides the current.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – Clauses 4.4.3.3, 4.4.3.4, Annex B.
- d) Each measurement is a real value in Ampere (A).
- e) The measurement name has the form PEE.Current.
- f) BTS Measurement Function.
- g) Valid for circuit and packet switching.

#### B.2.3.6 Humidity

- a) This measurement provides the percentage of humidity.
- b) SI.
- c) This measurement is obtained according to the method defined in ETSI ES 202 336-12 [36] – clause 4.4.3.3, Annex B.
- d) Each measurement is a single integer value from 0 to 100.
- e) The measurement name has the form PEE.Humidity.
- f) BTS Measurement Function.

g) Valid for circuit and packet switching.

---

## B.3 Measurements Related to the MSC

### B.3.1 MSC Measurement Function

#### B.3.1.1 Number of class mark updates

- A. This measurement provides the number of classmark updates received from the BSS at the MSC.
- B. CC.
- C. Receipt of "CLASSMARK UPDATE" Message (GSM 08.08 [5]).
- D. nbrOfClassMarkUpdates.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

#### B.3.1.2 Attempted mobile originating calls

- A. This measurement provides the number of call attempts for mobile originating traffic.
- B. CC.
- C. Receipt of "CM\_SERV\_REQ" Message from the originating MS, with service type set to originating call establishment (GSM 04.08 [2]).
- D. attMobileOriginatingCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

#### B.3.1.3 Successful mobile originating calls

- A. This measurement provides the number of successful calls for mobile originating traffic.
- B. CC.
- C. Receipt of "ASSIGNMENT COMPLETE" Message from the originating MS, for the requested mobile originating call (GSM 08.08 [5]).

NOTE: The "ALERTING" Message from GSM 04.08 [2] is not used as the implementation of it is optional.

- D. succMobileOriginatingCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.4 Answered mobile originating calls

- A. This measurement provides the number of answered calls for mobile originating traffic.
- B. CC.
- C. Receipt of "CONNECT ACKNOWLEDGE" Message from the originating MS, for the requested mobile originating call (GSM 04.08 [2]).
- D. ansMobileOriginatingCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.5 Attempted mobile terminating calls

- A. This measurement provides the number of call attempts for mobile terminating traffic.
- B. CC.
- C. Transmission of "SETUP" Message to the called MS, for the requested mobile terminating call (GSM 04.08 [2]).
- D. attMobileTerminatingCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.6 Successful mobile terminating calls

- A. This measurement provides the number of successful calls for mobile terminating traffic.
  - B. CC.
  - C. Receipt of "ASSIGNMENT COMPLETE" Message from the called MS, for the requested mobile terminating call (GSM 08.08 [5])
- NOTE: The "ALERTING" Message from GSM 04.08 [2] is not used as the implementation of it is optional.
- D. succMobileTerminatingCalls.
  - E. A single integer value.
  - F. MSC Measurement Function.
  - G. Valid for circuit switching.

### B.3.1.7 Answered mobile terminating calls

- A. This measurement provides the number of answered calls for mobile terminating traffic.
- B. CC.
- C. Transmission of "CONNECTION ACKNOWLEDGE" Message to the called MS, for the requested mobile terminating call (GSM 04.08 [2]).
- D. ansMobileTerminatingCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.8 Attempted Mobile Emergency calls

- A. This measurement provides the number of emergency call attempts.
- B. CC.
- C. Receipt of "CM\_SERV\_REQ" Message from the originating MS, with service indicator set to emergency call (GSM 04.08 [2]).
- D. attMobileEmergencyCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.9 Successful Mobile Emergency calls

- A. This measurement provides the number of successful emergency calls.
- B. CC.
- C. Receipt of "ASSIGNMENT COMPLETE" Message from the originating MS, for the requested emergency call (GSM 08.08 [5]).

NOTE: The "ALERTING" Message from GSM 04.08 [2] is not used as the implementation of it is optional.

- D. succMobileEmergencyCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.



### B.3.1.10 Answered Mobile Emergency calls

- A. This measurement provides the number of answered emergency calls.
- B. CC.
- C. Receipt of "CONNECTION ACKNOWLEDGE" Message from the originating MS, for the requested emergency call (GSM 04.08 [2]).
- D. ansMobileEmergencyCalls.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.11 Attempted ciphering mode control procedures

- A. This measurement provides the number of ciphering mode control procedures transmitted (these are counted as attempts).
- B. CC.
- C. Transmission of "CIPHER MODE COMMAND" (GSM 08.08 [5]).
- D. attCipheringModeControlProcs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.12 Successful ciphering mode control procedures

- A. This measurement provides the number of successful ciphering mode control procedures.
- B. CC.
- C. Receipt of "CIPHER MODE COMPLETE" Message (GSM 08.08 [5]).
- D. succCipheringModeControlProcs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.13 Attempted interrogations of HLRs for routing

- A. This measurement provides the number of HLR interrogations by the GMSC with the purpose of routing incoming calls (these are counted as attempts).
- B. CC.
- C. Transmission of a "MAP\_SEND\_ROUTING\_INFORMATION" service request (GSM 09.02 [7]).
- D. attInterrogationOfHLRsForRouting.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.14 Successful interrogations of HLR (MSRN obtained)

- A. This measurement provides the number of successful HLR interrogations, where MSRN is obtained.
- B. CC.
- C. Receipt of "MAP\_SEND\_ROUTING\_INFORMATION" service confirmation containing a "MSRN" parameter value (GSM 09.02 [7]).
- D. succInterrogationOfHLRsMSRNObtained.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.15 Successful interrogations of HLR (call Forwarding)

- A. This measurement provides the number of successful HLR interrogations, by the GMSC for call forwarding.
- B. CC.
- C. Receipt of "MAP\_SEND\_ROUTING\_INFORMATION" service confirmation containing a "Forwarding Data" parameter value (GSM 09.02 [7]).
- D. succInterrogationOfHLRsCallForwarding.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.16 Attempted operations for mobile originating point to point SMs

- A. This measurement provides the number of operations for mobile originating point to point short messages (these are counted as attempts).
- B. CC.
- C. Receipt of "RP-DATA" Message (GSM 04.11 [3]).
- D. attOpForMobileOriginatingPointToPointSMs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.17 Successful operations for mobile originating point to point SMs

- A. This measurement provides the number of successful operations for mobile originating point to point short messages.
- B. CC.
- C. Transmission of "RP-ACK" Message (GSM 04.11 [3]).
- D. succOpForMobileOriginatingPointToPointSMs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.18 Attempted operations for mobile terminating point to point SMs

- A. This measurement provides the number of operations for mobile terminating point to point short messages (these are counted as attempts).
- B. CC.
- C. Transmission of "RP-DATA" Message (GSM 04.11 [3]).
- D. attOpForMobileTerminatingPointToPointSMs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.19 Successful operations for mobile terminating point to point SMs

- A. This measurement provides the number of successful operations for mobile terminating point to point short messages.
- B. CC.
- C. Receipt of "RP-ACK" Message (GSM 04.11 [3]).
- D. succOpForMobileTerminatingPointToPointSMs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.20 Number of transmitted check IMEI request

- A. This measurement provides the number of check IMEI request sent from MSC to the EIR.
- B. CC.
- C. Transmission of "MAP\_CHECK\_IMEI" service request (GSM 09.02 [7]).
- D. nbrOfTransCheckIMEIRequests.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.21 Number of white answers in MSC

- A. This measurement provides the number of white answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_CHECK\_IMEI" service confirmation containing an "equipment status" referring to white listed equipment (GSM 09.02 [7] and GSM 02.16 [1]).
- D. nbrOfWhiteAnsInMSC.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.22 Number of grey answers in MSC

- A. This measurement provides the number of grey answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_CHECK\_IMEI" service confirmation containing an "equipment status" referring to grey listed equipment (GSM 09.02 [7] and GSM 02.16 [1]).
- D. nbrOfGreyAnsInMSC.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.23 Number of black answers in MSC

- A. This measurement provides the number of black answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_CHECK\_IMEI" service confirmation containing an "equipment status" referring to black listed equipment (GSM 09.02 [7] and GSM 02.16 [1]).
- D. nbrOfBlackAnsInMSC.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.24 Number of unknown IMEI answers

- A. This measurement provides the number of unknown IMEI answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_CHECK\_IMEI" service confirmation with a parameter "user error" referring to unknown equipment (GSM 09.02 [7]).
- D. nbrOfUnknownIMEIAnsInMSC.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.25 Mean time to provide the CALL SETUP service

- A. This measurement provides the arithmetic mean of the time to provide the CALL SETUP service to a requesting MS.
- B. DER.
- C. This measurement is obtained by accumulating the time intervals between "SETUP" and the corresponding "ASSIGNMENT COMPLETE" messages over a granularity period using DER. This end value of the time will then be divided by the number of call set-ups observed in the granularity period to give the arithmetic mean (GSM 04.08 [2] and GSM 08.08 [5]).
- D. meanTimeToCallSetupService.
- E. A single real value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.26 Mean time to provide the LOCATION UPDATING service

- A. This measurement provides the arithmetic mean of the time to provide the LOCATION UPDATING service to an MS changing Location area.
- B. DER.
- C. This measurement is obtained by accumulating the time interval between "LOCATION UPDATING REQUEST" and the corresponding "LOCATION UPDATING ACCEPT" Message over a granularity period using DER. This end value of the time will then be divided by number of Location Updating requests observed in the granularity period to give the arithmetic mean (GSM 04.08 [2]).
- D. meanTimeToLocationUpdateService.
- E. A single real value.
- F. MSC Measurement Function.
- G. Valid for circuit and packet switching.

### B.3.1.27 Transactions on the MM-layer where subscriber was identified with TMSI

- A. This measurement provides the number of transactions on the MM-layer where the mobile subscriber was identified with his TMSI.
- B. CC.
- C. Any MM-layer transaction which causes the MS to be identified with his TMSI (GSM 04.08 [2]) i.e. CM\_Re-establishment, CM\_Service request, Identity response, IMSI detach indication, Location updating accept, Location updating request, TMSI re-allocation command.
- D. transSubIdentifiedWithTMSI.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.28 Transactions on the MM-layer where subscriber was identified with IMSI

- A. This measurement provides the number of transactions on the MM-layer where the mobile subscriber was identified with his IMSI.
- B. CC.
- C. Any MM-layer transaction which causes the MS to be identified with his IMSI (GSM 04.08 [2]), i.e. CM\_Re-establishment, CM\_Service request, Identity response, IMSI detach indication, Location updating accept, Location updating request, TMSI re-allocation command.
- D. transSubIdentifiedWithIMSI.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.29 Attempted TMSI re-allocations

- A. This measurement provides the number of TMSI re-allocation, invoked either explicitly as part of TMSI re-allocation procedure or implicitly as part of Location Update procedure.
- B. CC.
- C. Transmission of "TMSI REALLOCATION COMMAND" Message, or a "LOCATION UPDATING ACCEPT" Message where the MS is identified with TMSI (GSM 04.08 [2]).
- D. attTMSIReallocations.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.30 Successful TMSI re-allocations

- A. This measurement provides the number of successfully performed TMSI re-allocations.
- B. CC.
- C. Receipt of "TMSI REALLOCATION COMPLETE" Message (GSM 04.08 [2]).
- D. succTMSIReallocations.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.31 IMSI detach procedures

- A. This measurement provides the number of IMSI procedures that involve a detach within one MSC area, (see BSC Measurement Function for IMSI attach procedures).
- B. CC.
- C. Receipt of "IMSI DETACH INDICATION" Message from the MS (GSM 04.08 [2]).
- D. `imsiDetachProcs`.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit and packet switching.

### B.3.1.32 IMSI attach procedures

- A. This measurement provides the number of IMSI procedures that involve an attach within one MSC area.
- B. CC.
- C. Receipt of "LOCATION UPDATING REQUEST" Message from the MS, indicating an IMSI attach, (GSM 04.08 [2]) (see MSC Measurement Function for IMSI detach procedures).
- D. `imsiAttachProcs`.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching and packet switched.

### B.3.1.33 Attempted incoming External intra-MSC Handovers

- A. This measurement provides the number of attempted incoming Handovers into the observed CELL from the related adjacent CELLS controlled by this MSC.
- B. CC.
- C. Transmission of a "HANDOVER REQUEST" Message to the BSC (GSM 08.08 [5]).
- D. `attIncomingExternalIntraMSCHDOs`.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.



### B.3.1.34 Successful incoming External intra-MSC Handovers

- A. This measurement provides the number of successful incoming Handovers into the observed CELL from the related adjacent CELLS controlled by this MSC.
- B. CC.
- C. Receipt of a "HANDOVER COMPLETE" Message from the BSC (GSM 08.08 [5]).
- D. succIncomingExternalIntraMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.35 Attempted outgoing External intra-MSC Handovers

- A. This measurement provides the number of attempted outgoing Handovers from the observed CELL to the related adjacent CELLS controlled by this MSC (only first attempt shall be counted).
- B. CC.
- C. Receipt of a "HANDOVER REQUIRED" Message from the BSC (GSM 08.08 [5]).
- D. attOutgoingExternalIntraMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.36 Successful outgoing External intra-MSC Handovers

- A. This measurement provides the number of successful outgoing Handovers from the observed CELL to the related adjacent CELLS controlled by this MSC, further information can be found in GSM 04.08 [2], 08.08 [5], and 08.58 [6].
- B. CC.
- C. Completion of release procedure for the involved channel.
- D. succOutgoingExternalIntraMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.37 Attempted incoming inter-MSC Handovers

- A. This measurement provides the number of attempted incoming Handovers into the observed CELL from the related adjacent CELLS NOT controlled by this MSC.
- B. CC.
- C. Receipt of a "MAP\_PERFORM\_HANDBOVER" service indication with target CELL identity equal to the observed CELL (GSM 09.02 [7]).
- D. attIncomingInterMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.38 Successful incoming inter-MSC Handovers

- A. This measurement provides the number of successful incoming Handovers into the observed CELL from the related adjacent CELLS NOT controlled by this MSC.
- B. CC.
- C. Receipt of a "MAP\_SEND\_END\_SIGNAL" service confirmation (GSM 09.02 [7]).
- D. succIncomingInterMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.39 Attempted outgoing inter-MSC Handovers

- A. This measurement provides the number of attempted outgoing Handovers from the observed CELL to the related adjacent CELLS NOT controlled by this MSC.
- B. CC.
- C. Transmission of a "MAP\_PERFORM\_HANDBOVER" service request (GSM 09.02 [7]).
- D. attOutgoingInterMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.40 Successful outgoing inter-MSC Handovers

- A. This measurement provides the number of successful outgoing Handovers from the observed CELL to the related adjacent CELLS NOT controlled by this MSC.
- B. CC.
- C. Transmission of "MAP\_SEND\_END\_SIGNAL" service response (GSM 09.02 [7]).
- D. succOutgoingInterMSCHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.41 Attempted subsequent inter-MSC Handovers (back to MSCa)

- A. This measurement provides the number of attempted subsequent inter-MSC Handovers, where the call is handed back to the anchor MSC (MSCa), i.e. the first hand over takes place from MSCa to MSCb then subsequently an attempt is made to hand back to MSCa.
- B. CC.
- C. Receipt of "MAP\_PERFORM\_SUBSEQUENT\_HANDOVER" service indication with target MSC identity equal to MSCa (GSM 09.02 [7]).
- D. attSubsequentInterMSCHDOsMSCa.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.42 Successful subsequent inter-MSC Handovers (back to MSCa)

- A. This measurement provides the number of successful subsequent inter-MSC Handovers, where the call is handed back to the anchor MSC (MSCa). i.e. the first hand over takes place from MSCa to MSCb then the call is subsequently successfully handed back to MSCa.
- B. CC.
- C. Transmission of "MAP\_SEND\_END\_SIGNAL" service response (Handover to MSCa) (GSM 09.02 [7]).
- D. succSubsequentInterMSCHDOsMSCa.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.43 Attempted subsequent inter-MSC Handovers (to MSCc)

- A. This measurement provides the number of attempted subsequent inter-MSC Handovers, where the call is handed over to MSCc, i.e. the first hand over takes place from MSCa to MSCb then subsequently an attempt is made to hand over to MSCc.
- B. CC.
- C. Receipt of "MAP\_PERFORM\_SUBSEQUENT\_HANOVER" service indication, with target MSC identity equal to MSCc (GSM 09.02 [7]).
- D. attSubsequentInterMSCHDOsMSCc.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.44 Successful subsequent inter-MSC Handovers (to MSCc)

- A. This measurement provides the number of successful subsequent inter-MSC Handovers, where the call is handed over to MSCc, i.e. the first hand over takes place from MSCa to MSCb then the call is subsequently successfully handed over to MSCc.
- B. CC.
- C. Transmission of "MAP\_SEND\_END\_SIGNAL" service response (Handover to MSCc) (GSM 09.02 [7]).
- D. succSubsequentInterMSCHDOsMSCc.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.45 External Handovers

- A. This measurement provides the number of attempted MSC controlled Handovers.
- B. CC.
- C. Receipt of a "HANDOVER REQUIRED" Message (GSM 08.08 [5]).
- D. externalHDOs.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.46 External Handovers per cause

- A. This measurement provides the number of attempted MSC controlled Handovers, per cause.
- B. CC.
- C. Receipt of a "HANDOVER REQUIRED" Message (GSM 08.08 [5]).
- D. externalHDOsPerCause.
- E. An integer value per cause.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.47 Unsuccessful External Handovers with reconnection to old channels, per MSC

- A. This measurement provides the number of unsuccessful Handovers with reconnection to the original channels (TCH & SDCCH), on a per MSC basis.
- B. CC.
- C. Receipt of: "HANDOVER FAILURE" Message for the attempted handover (GSM 08.08 [5]).
- D. unsuccExternHDOsWithReconnectionPerMSC.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

### B.3.1.48 Unsuccessful External Handovers with loss of connection, per MSC

- A. This measurement provides the number of unsuccessful Handovers, with loss of the call, on a per MSC basis.
- B. CC.
- C. Receipt of "CLEAR REQUEST" Message for the requested Handover (GSM 08.08 [5]).
- D. unsuccExternHDOsWithLossOfConnectionPerMSC.
- E. A single integer value.
- F. MSC Measurement Function.
- G. Valid for circuit switching.

## B.3.2 External HDO Measurement Function

This measurement function allows external Handover information per observed CELL to be collected on a per adjacent originating or target CELL basis. For the external Handovers both the observed CELL and the adjacent originating or target CELL identity has to be specified as the parameter when initiating the Measurement Function.

### B.3.2.1 Attempted incoming External intra-MSC Handovers per originating CELL

- A. This measurement provides the number of attempted incoming Handovers into the observed CELL from the specified adjacent originating CELL, controlled by this MSC.
- B. CC.
- C. Transmission of a "HANDOVER REQUEST" Message to the BSC (GSM 08.08 [5]).
- D. attIncomingExternalIntraMSCHDOsPerOriginatingCell.
- E. A single integer value for the observed CELL from the originating CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.2 Successful incoming External intra-MSC Handovers per originating CELL

- A. This measurement provides the number of successful incoming Handovers into the observed CELL from the specified adjacent originating CELL, controlled by this MSC.
- B. CC.
- C. Receipt of a "HANDOVER COMPLETE" Message from the BSC (GSM 08.08 [5]).
- D. succIncomingExternalIntraMSCHDOsPerOriginatingCell.
- E. A single integer value for the observed CELL from the originating CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.3 Attempted outgoing External intra-MSC Handovers per target CELL

- A. This measurement provides the number of attempted outgoing Handovers from the observed CELL to the specified adjacent target CELL, controlled by this MSC (only first attempt shall be counted).
- B. CC.
- C. Receipt of a "HANDOVER REQUIRED" Message from the BSC (GSM 08.08 [5]).
- D. attOutgoingExternalIntraMSCHDOsPerTargetCell.
- E. A single integer value for the observed CELL to the target CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.4 Successful outgoing External intra-MSC Handovers per target CELL

- A. This measurement provides the number of successful outgoing Handovers from the observed CELL to the specified adjacent target CELL, controlled by this MSC, further information can be found in GSM 04.08 [2], 08.08 [5], and 08.58 [6].
- B. CC.
- C. Completion of release procedure for the involved channel.
- D. succOutgoingExternalIntraMSCHDOsPerTargetCell.
- E. A single integer value for the observed CELL to the target CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.5 Attempted incoming inter-MSC Handovers per originating CELL

- A. This measurement provides the number of attempted incoming Handovers into the observed CELL from the specified adjacent originating CELL, NOT controlled by this MSC.
- B. CC.
- C. Receipt of a "MAP\_PERFORM\_HANOVER" service indication with target CELL identity equal to the observed CELL (GSM 09.02 [7]).
- D. attIncomingInterMSCHDOsPerOriginatingCell.
- E. A single integer value for the observed CELL from the originating CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.6 Successful incoming inter-MSC Handovers per originating CELL

- A. This measurement provides the number of successful incoming Handovers into the observed CELL from the specified adjacent originating CELL, NOT controlled by this MSC.
- B. CC.
- C. Receipt of a "MAP\_SEND\_END\_SIGNAL" service confirmation (GSM 09.02 [7]).
- D. succIncomingInterMSCHDOsPerOriginatingCell.
- E. A single integer value for the observed CELL from the originating CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.7 Attempted outgoing inter-MSC Handovers per target CELL

- A. This measurement provides the number of attempted outgoing Handovers from the observed CELL to the specified adjacent target CELL, NOT controlled by this MSC.
- B. CC.
- C. Transmission of a "MAP\_PERFORM\_HANOVER" service request (GSM 09.02 [7]).
- D. attOutgoingInterMSCHDOsPerTargetCell.
- E. A single integer value for the observed CELL to the target CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.

### B.3.2.8 Successful outgoing inter-MSC Handovers per target CELL

- A. This measurement provides the number of successful outgoing Handovers from the observed CELL to the specified adjacent target CELL, NOT controlled by this MSC.
- B. CC.
- C. Transmission of "MAP\_SEND\_END\_SIGNAL" service response (GSM 09.02 [7]).
- D. succOutgoingInterMSCHDOsPerTargetCell.
- E. A single integer value for the observed CELL to the target CELL.
- F. External HDO Measurement Function.
- G. Valid for circuit switching.



---

## B.4 Measurements Related to the HLR

### B.4.1 HLR Measurement Function

#### B.4.1.1 Number of current MS's Roaming outside HPLMN

- A. This measurement provides the current number of home subscribers roaming outside HPLMN.
- B. GAUGE.
- C. The gauge is updated (increased or decreased) on receipt of a "MAP\_UPDATE\_LOCATION" service indication in the HLR(GSM 09.02 [7]).
- D. nbrOfCurrentMSsRoamingOutsideHPLMN.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.2 Attempted requests for Authentication sets received by HLR

- A. This measurement provides the number of requests for Authentication sets received by the HLR (these are counted as attempts).
- B. CC.
- C. Receipt of an "MAP\_SEND\_AUTHENTICATION\_INFO" service indication requesting Authentication sets (parameter "AuthenticationSetKind" present GSM 09.02 [7]).
- D. attReqForAuthSetsReceivedByHLR.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.3 Successful returned Authentication sets from HLR

- A. This measurement provides the number of successful requests for Authentication sets from the HLR.
- B. CC.
- C. Transmission of an "MAP\_SEND\_AUTHENTICATION\_INFO" service response containing Authentication sets (parameter "AuthenticationSetList" present GSM 09.02 [7]).
- D. succReturnedAuthSetsFromHLR.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.4 Empty responses to request for Authentication sets from HLR

- A. This measurement provides the number of empty responses sent in response to requests for Authentication sets (the implication is that the destination node will have to reuse old Authentication sets).
- B. CC.
- C. Transmission of an "MAP\_SEND\_AUTHENTICATION\_INFO" service response, no Authentication sets present (GSM 09.02 [7]).
- D. emptyResponsesForAuthSetsFromHLR.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.5 Attempted insert subscriber data service

- A. This measurement provides the number of insert subscriber data services sent (these are counted as attempts).
- B. CC.
- C. Transmission of "MAP\_INSERT\_SUBSCRIBER\_DATA" service request (GSM 09.02 [7]).
- D. attInsertSubDataService.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.6 Successful insert subscriber data service

- A. This measurement provides the number of successful insert subscriber data services sent.
- B. CC.
- C. Receipt of "MAP\_INSERT\_SUBSCRIBER\_DATA" service indication without "user error" parameter value (GSM 09.02 [7]).
- D. succInsertSubDataService.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

### B.4.1.7 Attempted Location Updates

- A. This measurement provides the number of Location Updates to be performed by the HLR (these are counted as attempts).
- B. CC.
- C. Receipt of "MAP\_UPDATE\_LOCATION" service indication (GSM 09.02 [7]).
- D. attLocationUpdate.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

### B.4.1.8 Successful Location Updates

- A. This measurement provides the number of successfully performed Location Updates in the HLR.
- B. CC.
- C. Transmission of "MAP\_UPDATE\_LOCATION" service response without "user error" parameter value (GSM 09.02 [7]).
- D. succLocationUpdate.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

### B.4.1.9 Attempted SS related operations in HLR

- A. This measurement provides the number of attempted SS related operations.
- B. CC.
- C. Receipt of a MAP service indication of: registerSS, eraseSS, activateSS, deactivateSS, registerPassword, interrogateSS, processSSrequest operations in the HLR, (GSM 09.02 [7]).
- D. attSSRelatedOperationsInHLR.
- E. A single integer value per SS operation.
- F. HLR Measurement Function.
- G. Valid for circuit switching.

#### B.4.1.10 Successful SS related operations in HLR

- A. This measurement provides the number of successful SS related operations.
- B. CC.
- C. Transmission of MAP service response to: registerSS, eraseSS, activateSS, deactivateSS, registerPassword, interrogateSS, processSSrequest operations in the HLR without "user error" parameter (GSM 09.02 [7]).
- D. succSSRelatedOperationsInHLR.
- E. A single integer value per SS operation.
- F. HLR Measurement Function.
- G. Valid for circuit switching.

#### B.4.1.11 Attempted request for SM routing information

- A. This measurement provides the number of requests for short Message routing information (these are counted as attempts).
- B. CC.
- C. Receipt of "MAP\_SEND\_ROUTING\_INFO\_FOR\_SM" service indication (GSM 09.02 [7]).
- D. attReqForSMRoutingInfo.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.12 Successful request for SM routing information

- A. This measurement provides the number of successful requests for short Message routing information.
- B. CC.
- C. Transmission of "MAP\_SEND\_ROUTING\_INFO\_FOR\_SM" service response without "user error" parameter (GSM 09.02 [7]).
- D. succReqForSMRoutingInfo.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

### B.4.1.13 Attempted SM delivery status report procedures

- A. This measurement provides the number of requests to set Message waiting data into HLR or to inform HLR of successful SM transfer after polling (these are counted as attempts).
- B. CC.
- C. Receipt of "MAP\_REPORT\_SM\_DELIVERY\_STATUS" service indication (GSM 09.02 [7]).
- D. attSMDeliveryStatusReportProcs.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

### B.4.1.14 Successful SM delivery status report procedures

- A. This measurement provides the number of successful requests to set Message waiting data into HLR or to inform HLR of successful SM transfer after polling.
- B. CC.
- C. Transmission of "MAP\_REPORT\_SM\_DELIVERY\_STATUS" service response without "user error" parameter value (GSM 09.02 [7]).
- D. succSMDeliveryStatusReportProcs.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

### B.4.1.15 Attempted number of send alerts

- A. This measurement provides the number of transmissions of send alerts (these are counted as attempts).
- B. CC.
- C. Transmission of a "MAP\_ALERT\_SERVICE\_CENTRE" service request (GSM 09.02 [7]).
- D. attNbrOfSendAlerts.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.16 Successful number of send alerts

- A. This measurement provides the successful transmissions of send alerts.
- B. CC.
- C. Receipt of a "MAP\_ALERT\_SERVICE\_CENTRE" service confirmation without "user error" parameter value (GSM 09.02 [7]).
- D. succNbrOfSendAlerts.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.4.1.17 Attempted request for MSRN

- A. This measurement provides the number of requests for MSRN from the VLR (these are counted as attempts).
- B. CC.
- C. Transmission of "MAP\_PROVIDE\_ROAMING\_NUMBER" service request (GSM 09.02 [7]).
- D. attReqForMSRN.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit switching.

#### B.4.1.18 Successful request for MSRN

- A. This measurement provides the successful responses for allocations of MSRN received from the VLR.
- B. CC.
- C. Receipt of "MAP\_PROVIDE\_ROAMING\_NUMBER" service confirmation without "user error" parameter value (GSM 09.02 [7]).
- D. succReqForMSRN.
- E. A single integer value.
- F. HLR Measurement Function.
- G. Valid for circuit switching.

---

## B.5 Measurements Related to the VLR

### B.5.1 VLR Measurement Function

#### B.5.1.1 Attempted MS memory available notifications

- A. This measurement provides the number of times a VLR informs the HLR that a MS is available for receiving short messages once again (these are counted as attempts).
- B. CC.
- C. Transmission of a "MAP\_READY\_FOR\_SM" service request (GSM 09.02 [7]).
- D. attMSMemoryAvailableNotifications.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

#### B.5.1.2 Successful MS memory available notifications

- A. This measurement provides the number of times a VLR successfully informs the HLR that a MS is available for receiving short messages once again.
- B. CC.
- C. Receipt of "MAP\_READY\_FOR\_SM" service confirmation without "user error" parameter value (GSM 09.02 [7]).
- D. succMSMemoryAvailableNotifications.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

#### B.5.1.3 Attempted Identification requests to PVLRs

- A. This measurement provides the number of identification information requests to the PVLR for subscribers registering afresh in this VLR (these are counted as attempts).
- B. CC.
- C. Transmission of "MAP\_SEND\_IDENTIFICATION" service request (GSM 09.02 [7]).
- D. attIdentificationReqToPVLRs.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

#### B.5.1.4 Successful Identification requests to PVLRs

- A. This measurement provides the number of successful identification requests to the PVLR for subscriber registering afresh in this VLR.
- B. CC.
- C. Receipt of "MAP\_SEND\_IDENTIFICATION" service confirmation without "user error" parameter value (GSM 09.02 [7]).
- D. succIdentificationReqToPVLRs.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

#### B.5.1.5 Attempted page requests

- A. This measurement provides the number of page requests (these are counted as attempts).
- B. CC.
- C. Transmission of "MAP\_PAGE" service request (GSM 09.02 [7]).
- D. attPageReqs.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

#### B.5.1.6 Successful page requests

- A. This measurement provides the number of successful page requests.
- B. CC.
- C. Receipt of "MAP\_PAGE" service confirmation without a "user error" parameter value (GSM 09.02 [7]).
- D. succPageReqs.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

#### B.5.1.7 Attempted page requests per Location Area

- A. This measurement provides the number of page requests per Location Area (these are counted as attempts).
- B. CC.
- C. Transmission of "MAP\_PAGE" service request (GSM 09.02 [7]).
- D. attPageReqsPerLocationArea.
- E. An integer value per Location Area.
- F. VLR Measurement Function.
- G. Valid for circuit switching.



### B.5.1.8 Successful page requests per Location Area

- A. This measurement provides the number of successful page requests per Location Area.
- B. CC.
- C. Receipt of "MAP\_PAGE" service confirmation without a "user error" parameter value (GSM 09.02 [7]).
- D. succPageReqsPerLocationArea.
- E. An integer value per Location Area.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.9 Attempted requests for Authentication sets sent to HLR by VLRs

- A. This measurement provides the number of requests to the HLR by the VLR for Authentication sets (these are counted as attempts).
- B. CC.
- C. Transmission of a "MAP\_SEND\_AUTHENTICATION\_INFO" service request, requesting Authentication sets (parameter "AuthenticationSetKind" present GSM 09.02 [7]).
- D. attReqForAuthSetsSentToHLR.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.10 Successful received Authentication sets from HLR to VLRs

- A. This measurement provides the number of successful requests for Authentication sets from the HLR to the VLR.
- B. CC.
- C. Receipt of a "MAP\_SEND\_AUTHENTICATION\_INFO" service confirmation, containing requested Authentication sets parameter "AuthenticationSetList" present (GSM 09.02 [7]).
- D. succReceivedAuthSetsFromHLR.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.11 Empty responses to request for Authentication sets from HLR to VLRs

- A. This measurement provides the number of empty responses received by the VLR in response to requests for Authentication sets (the implication is that the VLR will have to reuse old Authentication sets).
- B. CC.
- C. Receipt of a "MAP\_SEND\_AUTHENTICATION\_INFO" service confirmation, no Authentication sets present (GSM 09.02 [7]).
- D. emptyResponsesForAuthFromHLR.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.12 Attempted authentication procedures in VLR

- A. This measurement provides the number of authentication requests which are sent to the MSC (these are counted as attempts).
- B. CC.
- C. Transmission of a "MAP\_AUTHENTICATE" service request (GSM 09.02 [7]).
- D. attAuthProcsInVLR.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.13 Successful authentication procedures in the VLR

- A. This measurement provides the number of successful authentication procedures in the VLR.
- B. CC.
- C. Receipt of a "MAP\_AUTHENTICATE" service confirmation, where the received SRES parameter value matches value stored in the Location register (GSM 09.02 [7]).
- D. succAuthProcsInVLR.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.14 Attempted intra-VLR Location Updates

- A. This measurement provides the number of Location Updates, between Location areas of the same VLR (these are counted as attempts).
- B. CC.
- C. Receipt of "MAP\_UPDATE\_LOCATION\_AREA" service indication, with previous Location Area identification parameter referring to the Location Area identity of the same VLR (GSM 09.02 [7]).
- D. attIntraVLRLocationUpdates.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.15 Successful intra-VLR Location Updates

- A. This measurement provides the successful Location Updates between Location Areas of the same VLR.
- B. CC.
- C. Transmission of "MAP\_UPDATE\_LOCATION\_AREA" service response without "user error" parameter value, for attempted intra-VLR Location Update (GSM 09.02 [7]).
- D. succIntraVLRLocationUpdates.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.16 Attempted inter-VLR Location Updates

- A. This measurement provides the number of Location Updates between Location Areas of different VLR (these are counted as attempts).
- B. CC.
- C. Receipt of "MAP\_UPDATE\_LOCATION\_AREA" service indication, with previous Location Area identification parameter referring to the Location Area identity of the different VLR, or no previous VLR identity (GSM 09.02 [7]).
- D. attInterVLRLocationUpdates.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.17 Successful inter-VLR Location Updates

- A. This measurement provides the number of successful Location Updates between Location Areas of different VLRs.
- B. CC.
- C. Transmission of "MAP\_UPDATE\_LOCATION\_AREA" service response without "user error" parameter value, for attempted inter-VLR Location Update (GSM 09.02 [7]).
- D. succInterVLRLocationUpdates.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

### B.5.1.18 Arrivals of Visitors from other PLMNs

- A. This measurement provides the number of arrivals of visitors from other PLMNs i.e. exclude own MS's returning to HPLMN. This measurement has to be taken in each VLR of the HPLMN to get the total.
- B. CC.
- C. Receipt of "MAP\_UPDATE\_LOCATION\_AREA" service indication, the previous Location of the subscriber was another PLMN (GSM 09.02 [7]).
- D. arrivalOfVisitorsFromOtherPLMNs.
- E. A single integer value.
- F. VLR Measurement Function.
- G. Valid for circuit switching.

---

## B.6 Measurements Related to the EIR

### B.6.1 EIR Measurement Function

#### B.6.1.1 Number of received IMEI check requests

- A. This measurement provides the number of IMEI check requests received by the EIR.
- B. CC.
- C. Receipt of "MAP\_CHECK\_IMEI" service indication (GSM 09.02 [7]).
- D. `nbrOfReceivedIMEICheckReqs`.
- E. A single integer value.
- F. EIR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.6.1.2 Number of white answers in EIR

- A. This measurement provides the number of white answers transmitted by the EIR.
- B. CC.
- C. Transmission of "MAP\_CHECK\_IMEI" service response containing an "equipment status" referring to a white listed equipment (GSM 09.02 [7] and GSM 02.16 [1]).
- D. `nbrOfWhiteAnsInEIR`.
- E. A single integer value.
- F. EIR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.6.1.3 Number of grey answers in EIR

- A. This measurement provides the number of grey answers transmitted by the EIR.
- B. CC.
- C. Transmission of "MAP\_CHECK\_IMEI" service response containing an "equipment status" referring to a grey listed equipment (GSM 09.02 [7] and GSM 02.16 [1]).
- D. `nbrOfGreyAnsInEIR`.
- E. A single integer value.
- F. EIR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.6.1.4 Number of black answers in EIR

- A. This measurement provides the number of black answers transmitted by the EIR.
- B. CC.
- C. Transmission of "MAP\_CHECK\_IMEI" service response containing an "equipment status" referring to a black listed equipment (GSM 09.02 [7] and GSM 02.16 [1]).
- D. nbrOfBlackAnsInEIR.
- E. A single integer value.
- F. EIR Measurement Function.
- G. Valid for circuit and packet switching.

#### B.6.1.5 Number of unknown IMEI answers

- A. This measurement provides the number of unknown IMEI answers transmitted by the EIR.
- B. CC.
- C. Transmission of "MAP\_CHECK\_IMEI" service response containing a parameter "user error" referring to a unknown equipment (GSM 09.02 [7]).
- D. nbrOfUnknownIMEIAnsInEIR.
- E. A single integer value.
- F. EIR Measurement Function.
- G. Valid for circuit and packet switching.

---

## B.7 Measurements Related to the SMS IWMSC/GMSC

### B.7.1 SMS Measurement Function

#### B.7.1.1 Attempted mobile originating SM Forwarding

- A. This measurement provides the number of attempted short Message forwarding handled by the interworking MSC.
- B. CC.
- C. Receipt of "MAP\_FORWARD\_SHORT\_MESSAGE" service indication (GSM 09.02 [7]).
- D. attMobileOriginatingSMForwardings.
- E. A single integer value.
- F. SMS Measurement Function.
- G. Valid for circuit and packet switching.

#### B.7.1.2 Successful mobile originating SM Forwarding

- A. This measurement provides the number of successful short Message forwarding handled by the interworking MSC.
- B. CC.
- C. Transmission of "MAP\_FORWARD\_SHORT\_MESSAGE" service response without a "user error" parameter value (GSM 09.02 [7]).
- D. succMobileOriginatingSMForwardings.
- E. A single integer value.
- F. SMS Measurement Function
- G. Valid for circuit and packet switching.

#### B.7.1.3 Attempted Mobile Terminating SM Forwarding

- A. This measurement provides the number of short messages forwarding from SMS-GMSC to the service node, MSC or SGSN (these are counted as attempts).
- B. CC.
- C. Transmission of a "MAP\_FORWARD\_SHORT\_MESSAGE" service request (GSM 09.02 [7]).
- D. attMobileTerminatingSMForwardings.
- E. A single integer value.
- F. SMS Measurement Function.
- G. Valid for circuit and packet switching.

#### B.7.1.4 Successful Mobile Terminating SM Forwarding

- A. This measurement provides the number of successful of short Message forwarding from SMS-GMSC to the service node, MSC or SGSN.
- B. CC.
- C. Receipt of a "MAP\_FORWARD\_SHORT\_MESSAGE" service response without a "user error" parameter value (GSM 09.02 [7]).
- D. succMobileTerminatingSMForwardings.
- E. A single integer value.
- F. SMS Measurement Function.
- G. Valid for circuit and packet switching.



---

## B.8 Measurements Related to the SGSN

### B.8.1 SGSN Measurement Function

#### B.8.1.1 LLC Measurements

##### B.8.1.1.1 Number of LLC frames sent

- A. This measurement provides the number of LLC frames sent by the SGSN.
- B. CC.
- C. Transmission of LLC frame to a peer entity GSM TS 04.64 [24].
- D. `nbrLlcFramesSent`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

##### B.8.1.1.2 Number of LLC frames Received

- A. This measurement provides the number of received LLC frames by the SGSN.
- B. CC.
- C. Receipt of a LLC frames from a peer entity and before any error checking(GSM TS 04.64).
- D. `nbrLlcFramesReceived`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

##### B.8.1.1.3 Erroneously received LLC frames detected by SGSN

- A. This measurement provides the number of erroneously received LLC frames in case of error detection in the SGSN (uplink transmission, SGSN).
- B. CC.
- C. Discard of a received frame in the SGSN, GSM TS 04.64 [24].
- D. `errLlcFramesDetectedBySgsn`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.1.4 Number of Retransmitted LLC frames in Acknowledge Mode

- A. This measurement provides the number of retransmitted LLC frames in LLC acknowledge mode, detected in the MS and signalled to the SGSN (downlink transmission, MS).
- B. CC.
- C. Receipt of a NACK or SACK frame from the peer entity (MS), GSM TS 04.64 [24].
- D. `retransmittedLlcFramestoMs`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.2 SNDCP Measurements

##### B.8.1.2.1 Number of received SNDCP N-PDUs

- A. This measurement provides the number of incoming N-PDUs received by the SNDCP protocol.
- B. CC.
- C. Receipt of the "SN-DATA.ind" or "SN-UNITDATA.ind" primitive, GSM TS 04.65 [25].
- D. `uplinkSndcpNpduReceived`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

##### B.8.1.2.2 Number of received SNDCP N-PDU octets

- A. This measurement provides the number of octets in incoming N-PDUs received by the SNDCP protocol layer.
- B. CC.
- C. Receipt of the "SN-DATA.ind" or "SN-UNITDATA.ind" primitive, GSM TS 04.65 [25].
- D. `uplinkSndcpOctetReceivedMode`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.2.3 Number of sent SNDCP N-PDUs

- A. This measurement provides the number of outgoing N-PDUs sent by the SNDCP protocol layer.
- B. CC.
- C. Sent of the "SN-DATA.req" and "SN-UNITDATA.req" primitive(GSM TS 04.65).
- D. downlinkSndcpNpduSent.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.2.4 Number of sent SNDCP N-PDU octets

- A. This measurement provides the number of octets in outgoing N-PDUs sent by the SNDCP protocol layer.
- B. CC.
- C. Sent of the "SN-DATA.req" and "SN-UNITDATA.req" primitive(GSM TS 04.65).
- D. downlinkSndcpOctetSent.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.3 BSSGP Measurements.

FFS, to be defined.

### B.8.1.4 MM Measurements

#### B.8.1.4.1 Attempted GPRS attach procedures

- A. This measurement provides the number of attempted GPRS attach procedures initiated within this SGSN area.
- B. CC.
- C. Receipt of "ATTACH REQUEST" message from the MS, indicating a GPRS attach(GSM 04.08 [2]).
- D. attGprsAttach.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.2 Successful GPRS attach procedures

- A. This measurement provides the number of successfully performed GPRS attach procedures within this SGSN area.
- B. CC.
- C. Transmission of "ATTACH ACCEPT" message to the MS, indicating a GPRS only attached (GSM 04.08 [2]).
- D. succGprsAttach.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.3 Attempt of combined GPRS/IMSI attach procedures

- A. This measurement provides the number of attempt of combined GPRS/IMSI attach procedures initiated within this SGSN area.
- B. CC.
- C. Receipt of "ATTACH REQUEST" message from the MS, indicating combined GPRS/IMSI attach (GSM 04.08 [2]).
- D. attCombiAttach.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.4 Successfully combined GPRS/IMSI attach procedures

- A. This measurement provides the number of successfully completed of Combined GPRS/IMSI attach procedures initiated within this SGSN area.
- B. CC.
- C. Transmission of "ATTACH ACCEPT" message to the MS, indicating combined GPRS/IMSI attach (GSM 04.08 [2]).
- D. succCombiAttach.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.5 Attempted GPRS attach procedures with IMSI already attached

- A. This measurement provides the number of attempted GPRS attach procedures, while IMSI is already attached. The attempts initiated within this SGSN area are counted.
- B. CC.
- C. Receipt of "ATTACH REQUEST" Message from the MS, indicating GPRS attach while IMSI attached (GSM 04.08 [2]).
- D. attImsiAttach.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.6 Successful GPRS attach procedures with IMSI already attached

- A. This measurement provides the number of successfully performed GPRS attach procedures, while IMSI is already attached. The attempts initiated within this SGSN area are counted.
- B. CC.
- C. Transmission of a "ATTACH ACCEPT" message to the MS, indicating a GPRS attach while IMSI attached (GSM 04.08 [2]).
- D. succImsiAttach.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.7 Number of attached subscriber

- A. This measurement provides the number of attached subscriber within this SGSN area.
- B. GAUGE.
- C. The gauge will be incremented at transmission of a "ATTACH ACCEPT" message to the MS and will be decremented at transmission of a "DETACH ACCEPT" message to the MS (GSM 04.08 [2]).
- D. nbrOfAttachedSub.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.8 Mean number of attached subscriber

- A. This measurement provides the arithmetic mean of the number of attached subscriber within this SGSN area.
- B. GAUGE.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of subscribers which are attached and then taking the arithmetic mean (GSM 04.08 [2]).
- D. meanNbrOfAttachedSub.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.9 Maximum number of attached subscriber

- A. This measurement provides the highest recorded value for the number of attached subscriber within this SGSN area.
- B. GAUGE.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of subscriber which are "attached", and then taking the maximum of all such values at the end of the granularity period (GSM 04.08 [2]).
- D. maxNbrOfAttachedSub.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.10 Attempted GPRS detach procedures initiated by MS

- A. This measurement provides the number of attempted GPRS detach procedures within this SGSN area.
- B. CC.
- C. Receipt of "DETACH REQUEST" message from the MS, indicating a GPRS detach(GSM 04.08 [2]).
- D. attGprsDetachMs.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.11 Attempt of Combined GPRS/IMSI detach procedures initiated by MS

- A. This measurement provides the number of attempted Combined GPRS/IMSI detach procedures MS-initiated within this SGSN area.
- B. CC.
- C. Receipt of "DETACH REQUEST" message from the MS, indicating a Combined GPRS/IMSI detach (GSM 04.08 [2]).
- D. attCombiDetachMs.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.12 Attempt of IMSI detach procedures initiated by MS

- A. This measurement provides the number of attempted IMSI detach procedures MS-initiated within this SGSN area.
- B. CC.
- C. Receipt of "DETACH REQUEST" message from the MS, indicating a IMSI detach (GSM 04.08 [2]).
- D. attImsiDetachMS.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.13 Attempted GPRS detach procedures initiated by SGSN

- A. This measurement provides the number of attempted GPRS detach procedures initiated by SGSN.
- B. CC.
- C. Transmission of a "DETACH REQUEST" message to the MS (GSM 04.08 [2]).
- D. attGprsDetachSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

**B.8.1.4.14 Successful GPRS detach procedures initiated by SGSN**

- A. This measurement provides the number of successfully completed GPRS detach procedures SGSN-initiated within this SGSN area.
- B. CC.
- C. Receipt of "DETACH ACCEPT" message from the MS (GSM 04.08 [2]).
- D. succGprsDetachSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

**B.8.1.4.15 Attempted intra-SGSN Routing Area Update procedures initiated in this SGSN**

- A. This measurement provides the number of attempted intra-SGSN Routing Area Update procedures initiated within this SGSN area.
- B. CC.
- C. Receipt of a "ROUTING AREA UPDATE REQUEST" message from the MS, where the old RA and the new RA are served by this SGSN (GSM 04.08 [2]).
- D. attIntraSgsnRaUpdate.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

**B.8.1.4.16 Successful intra-SGSN Routing Area Update procedures initiated in this SGSN**

- A. This measurement provides the number of successfully performed intra-SGSN Routing Area Update procedures initiated in this SGSN.
- B. CC.
- C. Transmission of "ROUTING AREA UPDATE ACCEPT" message to the MS, GSM 04.08 [2].
- D. succIntraSgsnRaUpdate.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.



#### B.8.1.4.17 Attempted inter-SGSN Routing Area Update procedures initiated in this SGSN

- A. This measurement provides the number of attempted inter-SGSN Routing Area Update procedures initiated in this SGSN, where the old RA is served by another SGSN, GSM 04.08 [2].
- B. CC.
- C. Receipt of a "ROUTING AREA UPDATE REQUEST" message from the MS, GSM 04.08 [2].
- D. attInterSgsnRaUpdate.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.4.18 Successful inter-SGSN Routing Area Update procedures initiated in this SGSN

- A. This measurement provides the number of successfully completed inter-SGSN Routing Area Update procedures in this SGSN.
- B. CC.
- C. Receipt of a "ROUTING AREA UPDATE COMPLETE" message from the MS, GSM 04.08 [2].
- D. succInterSgsnRaUpdate.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

## B.8.1.5 Security

### B.8.1.5.1 Attempted P-TMSI reallocation procedures

- A. This measurement provides the number of attempted P-TMSI reallocation, or implicitly as part of the Location Updating, procedures in this SGSN.
- B. CC.
- C. Transmission of "P-TMSI REALLOCATION COMMAND" message by the SGSN, GSM 04.08 [2].
- D. attPTMSIRealloc.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.5.2 Successful P-TMSI reallocation procedures

- A. This measurement provides the number of successfully performed P-TMSI reallocation procedures in this SGSN.
- B. CC.
- C. Receipt of "P-TMSI REALLOCATION COMPLETE" message by the SGSN, GSM 04.08 [2].
- D. succPTMSIRealloc.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.5.3 Attempted requests for authentication sets sent to HLR by SGSN

- A. This measurement provides the number of number of attempted requests for authentication sets, sent to the HLR by SGSN, these are counted as attempts.
- B. CC.
- C. Transmission of a "MAP SEND\_AUTHENTICATION\_INFO" service request, requesting authentication sets parameter "AuthenticationSetKind" present, GSM 09.02 [7].
- D. attReqAuthSetsSentToHlrBySgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.5.4 Successful requests for authentication sets to HLR

- A. This measurement provides the number of successful requests for authentication sets that were sent from the HLR to the SGSN.
- B. CC.
- C. Receipt of a "MAP\_SEND\_AUTHENTICATION\_INFO" service confirmation, containing requested authentication sets (parameter "AuthenticationSetList" present GSM 09.02 [7]).
- D. succReqAuthSetsHlr.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.5.5 Empty responses to the request for authentication sets to the HLR

- A. This measurement provides the number of empty responses to the request for authentication sets that were sent to the HLR.
- B. CC.
- C. Receipt of a "MAP\_SEND\_AUTHENTICATION\_INFO " service confirmation, no Authentication sets present, GSM 09.02 [7].
- D. emptyResponsesForAuthSetsFromHlr.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.5.6 Attempt of authentication procedures started by SGSN

- A. This measurement provides the number of authentication procedures that are started within this SGSN area.
- B. CC.
- C. Transmission of an "AUTHENTICATION AND CIPHERING REQUEST" message to the MS (GSM 04.08).
- D. attAuthInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.5.7 Successful authentication procedures started by the SGSN

- A. This measurement provides the number of successful authentication procedures within this SGSN area.
- B. CC.
- C. Receipt of an "AUTHENTICATION AND CIPHERING RESPONSE" message from the MS, where the receipt SRES parameter value matches the value stored in the SGSN (GSM 04.08).
- D. succAuthInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.5.8 Attempted Identity Request procedures

- A. This measurement provides the number of attempted Identity Request procedures initiated by this SGSN.
- B. CC.
- C. Transmission of an "IDENTITY REQUEST" message to the MS (GSM 04.08).
- D. attIdentityReq.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.5.9 Successful Identity Request procedures

- A. This measurement provides the number of successfully completed Identity Request procedures initiated by this SGSN.
- B. CC.
- C. Receipt of an "IDENTITY RESPONSE" message with IMSI by the SGSN from the MS (GSM 04.08).
- D. succIdentityReq.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

## B.8.1.6 State

### B.8.1.6.1 Number of subscribers in the SGSN in STANDBY state.

- A. This measurement provides the number of subscribers in 'STANDBY' state within this SGSN area.
- B. GAUGE.
- C. Transition of a GPRS subscriber registered in the SGSN into/from the operational state 'STANDBY'.
- D. nbrOfSubStandby.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.6.2 Mean number of subscribers in the SGSN in STANDBY state

- A. This measurement provides the arithmetic mean of the number of subscriber in 'STANDBY' state within this SGSN area.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of subscribers in the STANDBY state, and then taking the arithmetic mean.
- D. meanNbrOfSubStandby.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.6.3 Maximum number of subscribers in the SGSN in STANDBY state.

- A. This measurement provides the highest recorded value for number of subscribers in 'STANDBY' state within this SGSN area.
- B. GAUGE.
- C. This measurement is obtained by comparing on an update of the actual number of subscribers in the STANDBY state, this value with the currently maximal value within the actual granularity period.
- D. maxNbrOfSubStandby.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.6.4 Number of subscribers in the SGSN in READY state

- A. This measurement provides the number of subscribers in 'READY' state within this SGSN area.
- B. GAUGE.
- C. Transition of a GPRS subscriber registered in the SGSN into/from the operational state 'READY'.
- D. nbrOfSubReady.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.6.5 Mean number of subscribers in the SGSN in READY state

- A. This measurement provides the arithmetic mean of the number of subscriber in 'READY' state within this SGSN area.
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System design), the number of subscribers in the READY state, and then taking the arithmetic mean.
- D. meanNbrOfSubReady.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.6.6 Maximum number of subscribers in the SGSN in READY state

- A. This measurement provides the highest recorded value for number of subscribers in 'READY' state within this SGSN area.
- B. GAUGE.
- C. This measurement is obtained by comparing on an update of the actual number of subscribers in the READY state, this value with the currently maximal value within the actual granularity period.
- D. maxNbrOfSubReady.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

## B.8.1.7 Equipment

### B.8.1.7.1 Number of transmitted check IMEI requests

- A. This measurement provides the number of check IMEI requests sent to the EIR.
- B. CC.
- C. Transmission of "MAP\_IMEI\_CHECK" service request (GSM 09.02 [7]).
- D. nbrOfCheckIMEIRequest.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.7.2 Number of white answers in SGSN

- A. This measurement provides the number of white list answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_IMEI\_CHECK" service confirmation with parameter "equipment status" referring to the white listed equipment.(GSM 09.02 and GSM 02.16).
- D. nbrOfWhiteAnswerInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.7.3 Number of grey answers in SGSN

- A. This measurement provides the number of grey list answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_IMEI\_CHECK" service confirmation with parameter "equipment status" referring to the grey listed equipment.(GSM 09.02 and GSM 02.16).
- D. nbrOfGreyAnswerInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.7.4 Number of black answers in SGSN

- A. This measurement provides the number of black list answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_IMEI\_CHECK" service confirmation with parameter "equipment status" referring to the black listed equipment.(GSM 09.02 and GSM 02.16).
- D. nbrOfBlackAnswerInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.7.5 Number of unknown IMEI answers

- A. This measurement provides the number of unknown IMEI answers received from the EIR.
- B. CC.
- C. Receipt of "MAP\_IMEI\_CHECK" service confirmation with parameter "equipment status" referring to unknown equipment.(GSM 09.02).
- D. nbrOfUnknownAnswerInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.8 RRM Measurements

#### B.8.1.8.1 Attempt of packet switched paging procedures

- A. This measurement provides the number of attempted packet switched paging procedures, for GPRS services, within this SGSN area. The initial paging procedures as well the repeated paging procedures are counted.
- B. CC.
- C. Transmission of "GMM-PAGING.req" message (GSM 08.18).
- D. attPacketSwitchingPaging.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.



#### B.8.1.8.2 Unsuccessful packet switched paging procedures

- A. This measurement provides the number of unsuccessful packet switched paging (GPRS) procedures within this SGSN area, i.e. packet switching paging procedures that are re-started when the previous attempt has timed out.
- B. CC.
- C. Receipt of timeout for the "GMM-PAGING.req" message (GSM TS 08.18).
- D. `unsuccPacketSwitchingPaging`.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.8.3 Attempt of packet switched paging procedures per Routing Area

- A. This measurement provides the number of attempted packet switched paging procedures, for GPRS services, within this Routing Area. The initial paging procedures as well the repeated paging procedures are counted.
- B. CC.
- C. Transmission of "GMM-PAGING.req" message (GSM 08.18).
- D. `attPsPagingPerRoutingArea`.
- E. A single integer value per Routing Area.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.8.4 Unsuccessful packet switched paging procedures per Routing Area

- A. This measurement provides the number of unsuccessful packet switched paging (GPRS) procedures within this Routing Area, i.e. packet switching paging procedures that are re-started when the previous attempt has timed out.
- B. CC.
- C. Receipt of timeout for the "GMM-PAGING.req" message (GSM 08.18).
- D. `unsuccPsPagingPerRoutingArea`.
- E. A single integer value per Routing Area.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

## B.8.1.9 SM Measurements

### B.8.1.9.1 Attempted PDP context activation procedures initiated by MS

- A. This measurement provides the number of attempted PDP context activation procedures. These include the static as well as the dynamic PDP addresses.
- B. CC.
- C. Receipt of a "Activate PDP Context Request" message from the MS (GSM 04.08).
- D. attActPdpContextMSPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.9.2 Successful PDP context activation procedures initiated by MS

- A. This measurement provides the number of successfully completed PDP context activations. For these context activations, the GGSN is updated successfully.
- B. CC.
- C. Transmission of a "Activate PDP Context Accept" message to the MS (GSM 04.08).
- D. succActPdpContextMSPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

### B.8.1.9.3 Attempted dynamic PDP context activation procedures initiated by MS

- A. This measurement provides the number of attempted PDP context activation requests where a dynamic PDP address is required to be used.
- B. CC.
- C. Receipt of a "Activate PDP Context Request" message from the MS with an empty PDP address (GSM 04.08).
- D. attActPdpContextDynMSPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.9.4 Successful dynamic PDP context activation procedures initiated by MS

- A. This measurement provides the number of successfully completed PDP context activations where a dynamic PDP address is used.
- B. CC.
- C. Transmission of a "Activate PDP Context Accept" message to the MS (GSM TS 04.08) when the PDP address has been dynamically assigned.
- D. succActPdpDynContextDynMsPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.9.5 Attempted PDP context deactivation procedures initiated by the MS

- A. This measurement provides the number of PDP context deactivation procedures.
- B. CC.
- C. Receipt of a "Deactivate PDP Context Request" message from the MS (GSM 04.08).
- D. attDeactPdpContextMsPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.9.6 Successful PDP context deactivation procedures initiated by the MS

- A. This measurement provides the number of successfully completed PDP context deactivations. For these context deactivations, the GGSN is updated successfully (i.e. deletion of the PDP context).
- B. CC.
- C. Transmission of a "Deactivate PDP Context Accept" message to the MS (GSM 04.08).
- D. succDeactPdpContextMsPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

**B.8.1.9.7 Attempted PDP context deactivation procedures initiated by the GGSN**

- A. This measurement provides the number of PDP context deactivation procedures initiated by the GGSN.
- B. CC.
- C. Receipt of a "Delete PDP Context Request" message from the GGSN (GSM 09.60).
- D. attDeactPdpContextGgsnPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

**B.8.1.9.8 Successful PDP context deactivation procedures initiated by the GGSN**

- A. This measurement provides the number of successfully handled PDP context deactivations initiated by the GGSN. For these context deactivations, the MS has accepted the PDP context deactivation.
- B. CC.
- C. Transmission of a "Delete PDP Context Response" message to the GGSN (GSM 09.60).
- D. succDeactPdpContextGgsnPerSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

**B.8.1.9.9 Number of subscribers with activated PDP context in SGSN**

- A. This measurement provides the number of mobile subscribers with activated PDP context (i.e. subscribers that can send/receive GPRS packet data).
- B. GAUGE.
- C. Addition of first PDP context or removal of last PDP context in SGSN location register for a particular subscriber.
- D. nbrSubsWithActivePdpInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.9.10 Mean number of subscribers with activated PDP context in SGSN

- A. This measurement provides the arithmetic mean number value of subscribers that have activated PDP context (i.e. subscribers that can send/receive GPRS packet data).
- B. SI.
- C. This measurement is obtained by sampling at a pre-defined interval (System design), the number of subscribers with activated PDP context in SGSN, and then taking the arithmetic mean.
- D. meanSubsWithActivePdpInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

#### B.8.1.9.11 Maximum number of subscribers with activated PDP context in SGSN

- A. This measurement provides the highest recorded value for number of subscribers with activated PDP contexts (i.e. subscribers that can send/receive GPRS packet data).
- B. GAUGE.
- C. This measurement is obtained by comparing on an update of the actual number of subscribers with activated PDP context in SGSN, this value with the currently maximal value within the actual granularity period.
- D. maxSubsWithActivePdpInSgsn.
- E. A single integer value.
- F. SGSN Measurement Function.
- G. Valid for packet switching.

---

## B.9 Measurements Related to the GGSN

### B.9.1 GGSN Measurement Function

#### B.9.1.1 Number of PDP context activation procedures initiated by the MS Per APN

- A. This measurement provides the number of PDP context activation procedures initiated by the MS on a per APN of the GGSN.
- B. CC.
- C. Receipt of a "Create PDP Context Request" message from the SGSN (GSM 09.60).
- D. attActPdpContextPerApnOfGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

#### B.9.1.2 Successful PDP context activation procedures initiated by the MS Per APN

- A. This measurement provides the number of successfully completed activation PDP context procedures initiated by the MS on a per APN of the GGSN.
- B. CC.
- C. Transmission of "Create PDP Context Response" from GGSN (GSM 09.60).
- D. succActPdpContextPerApnOfGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

#### B.9.1.3 Number of dynamic PDP context activation procedures initiated by the MS Per APN

- A. This measurement provides the number of dynamic PDP context activation procedures initiated by the MS where a dynamic PDP address is requested on a per APN of the GGSN.
- B. CC.
- C. Receipt of a "Create PDP Context Request" message MS with an empty PDP address (GSM 09.60).
- D. attActPdpContextDynPerApnOfGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

#### B.9.1.4 Successful +dynamic PDP context activation procedures initiated by the MS Per APN

- A. This measurement provides the number of successfully attempted dynamic PDP context activation procedures initiated by the MS where a dynamic PDP address is requested on a per APN of the GGSN.
- B. CC.
- C. Transmission of "Create PDP Context Response" from GGSN (GSM 09.60), the PDP address has been dynamically assigned.
- D. succActPdpContextDynPerApnOfGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

#### B.9.1.5 Number of PDP context deactivation procedures initiated by the MS Per APN

- A. This measurement provides the number of PDP context deactivation procedures initiated by the MS on a per APN of the GGSN.
- B. CC.
- C. Receipt of a "Delete PDP Context Request" message from the SGSN (GSM 09.60).
- D. attDeactPdpContextPerApnOfGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

#### B.9.1.6 Successful PDP context deactivation procedures initiated by the MS Per APN

- A. This measurement provides the number of successfully completed PDP context deactivation procedures initiated by the MS on a per APN of the GGSN.
- B. CC.
- C. Transmission of a "Delete PDP Context Response" message to the SGSN (GSM TS 09.60).
- D. succDeactPdpContextPerApnOfGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

### B.9.1.7 Number of PDP context deactivation procedures initiated by the GGSN Per APN

- A. This measurement provides the number of PDP context deactivation procedures initiated by the GGSN, on a per APN of the GGSN.
- B. CC.
- C. Transmission of a "Deactivate PDP Context Request" message to the SGSN (GSM 09.60).
- D. attDeactPdpContextByGgsnPerApn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

### B.9.1.8 Successful PDP context deactivation procedures initiated by the GGSN Per APN

- A. This measurement provides the number of successfully completed PDP context deactivation procedures initiated by the GGSN, on a per APN of the GGSN.
- B. CC.
- C. Receipt of "Delete PDP Context Response" message from the SGSN (GSM 09.60).
- D. succDeactPdpContextByGgsnPerApn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

### B.9.1.9 Number of active PDP context in GGSN Per APN

- A. This measurement provides the number of active PDP context in this GGSN.
- B. GAUGE.
- C. Addition or removal of a PDP context in GGSN.
- D. nbrOfActivePdpContextsPerApnAtGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.



### B.9.1.10 Mean number of active PDP context in GGSN Per APN

- A. This measurement is obtained by sampling at a pre-defined interval (System designed), the number of active PDP context in GGSN per APN, and then taking the arithmetic mean.
- B. SI.
- C. Addition or removal of a PDP context in GGSN.
- D. meanNbrOfActivePdpContextsPerApnAtGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

### B.9.1.11 Maximum number of PDP context in GGSN Per APN

- A. This measurement is obtained by comparing on an update of the actual number of active PDP context in GGSN per APN, this value with the currently maximal value within the actual granularity period.
- B. GAUGE.
- C. Addition a PDP context in GGSN.
- D. maxnbrOfActivePdpContextsPerApnAtGgsn.
- E. A single integer value.
- F. GGSN Measurement Function.
- G. Valid for packet switching.

---

## B.10 Monitoring of Power, Energy and Environmental (PEE) parameters

Power, Energy and Environmental (PEE) parameters, combined with data volume measurements, are valuable information for operators to measure the energy efficiency (EE) of their GSM network. Hence it is necessary to define performance measurements related to GERAN PEE parameters such as power, energy, temperature, voltage, current, humidity.

# Annex C (normative): Performance Measurement Object Model

This annex to GSM 12.04 comprises the Object Model for Performance Measurement to complement the high level Object Model in GSM 12.00 [8].

The whole management approach defined in GSM 12.00 [8] defines all entities of GSM network as managed functions. These are BSS, MSC, HLR etc. and one or more of these can be contained in managed element and each of these functions can contain it's own measurement function.

The SGSN and GGSN detailed, are additional to GSM 12.00 [8] due to the introduction of GPRS.

## Model Structure and Content

The following measurement function model takes its basis from the proposed GSM 12.00 [8] high level model. Figure C.1 shows the containment tree of all the measurement Object Classes. The formal GDMO definitions of the Managed Object Classes concerning measurement functions are described in this clause, except the "log", which is described in annex D under data transfer requirements.

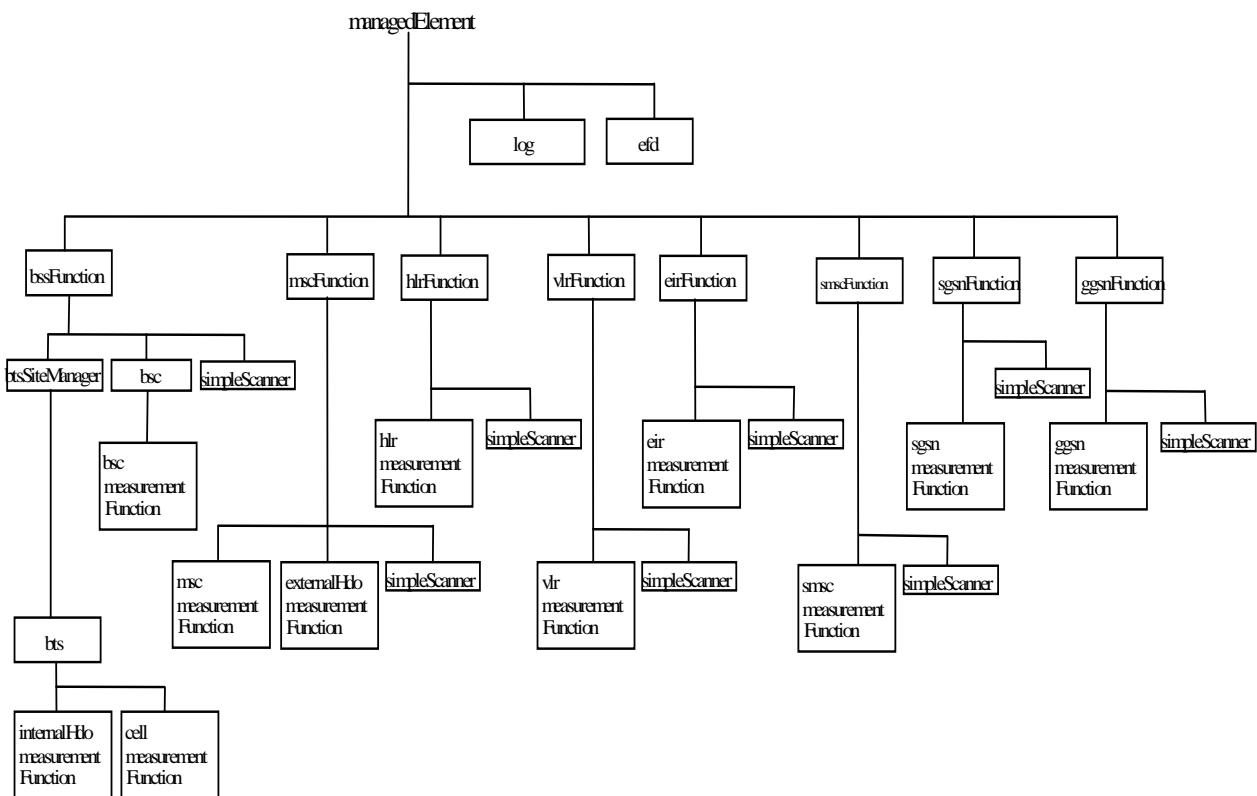


Figure C.1: GSM 12.04 Performance Measurement Object Class Containment

## C.1 Measurement Managed Object Classes

### C.1.1 object class from ITU-T ISO

The object class used by the present document is the simple scanner, as defined in ISO 10164-13 [34]. Within the realm of the present document, each "simpleScanner" instance is only required to scan attributes of "measurementFunction" objects that are contained in the same "xxxFunction" object as the "simpleScanner" itself, where "xxx" stands for "bss", "msc", "hlr", "vlr", "eir", "sgsn", "ggsn" or "smsc", respectively (see containment tree diagram on previous page).

### C.1.2 bscMeasurementFunction

bscMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

requestForServicePackage supports it",	<b>PRESENT IF</b> "an instance
requestForServicePerCausePackage supports it",	<b>PRESENT IF</b> "an instance
interArrivalTimePackage supports it",	<b>PRESENT IF</b> "an instance
pagingMessagePerBSCPackage supports it",	<b>PRESENT IF</b> "an instance
immediateAssignmentProceduresPerBSCPackage supports it",	<b>PRESENT IF</b> "an instance
internalHandoversIntraCellPerBSCPackage supports it",	<b>PRESENT IF</b> "an instance
internalHandoversPerBSCPackage supports it",	<b>PRESENT IF</b> "an instance
internalHandoversPerCausePackage supports it",	<b>PRESENT IF</b> "an instance
internalHandoverFailuresPerBSCPackage supports it",	<b>PRESENT IF</b> "an instance
gprsPDUFlushReqPackage supports it",	<b>PRESENT IF</b> "an instance
gprsPagingRequestPackage supports it",	<b>PRESENT IF</b> "an instance
gprsInterArrivalPackage supports it";	<b>PRESENT IF</b> "an instance

**REGISTERED AS** {gsm1204managedobjectClass 121};

### C.1.3 cellMeasurementFunction

cellMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

pchagchQueuePackage supports it", pagingMess	<b>PRESENT IF</b> "an instance
--	--------------------------------

agePackage supports it",	<b>PRESENT IF</b> "an instance
immediateAssignmentProceduresPackage supports it",	<b>PRESENT IF</b> "an instance
immediateAssignmentProceduresPerCausePackage supports it",	<b>PRESENT IF</b> "an instance
pageDiscardPackage supports it",	<b>PRESENT IF</b> "an instance
durationOfPagingProceduresPackage supports it",	<b>PRESENT IF</b> "an instance
tchAvailablePackage supports it",	<b>PRESENT IF</b> "an instance
tchBusyPackage supports it",	<b>PRESENT IF</b> "an instance
idleTCHsPerInterferenceBandPackage supports it",	<b>PRESENT IF</b> "an instance
tchSeizuresPackage supports it",	<b>PRESENT IF</b> "an instance
tchAllocatedTimePackage supports it",	<b>PRESENT IF</b> "an instance
tchBusyTimePackage supports it",	<b>PRESENT IF</b> "an instance
tchQueuePackage supports it",	<b>PRESENT IF</b> "an instance
lostRadioLinksPerTCHPackage supports it",	<b>PRESENT IF</b> "an instance
sdccchAvailablePackage supports it",	<b>PRESENT IF</b> "an instance
sdccchBusyPackage supports it",	<b>PRESENT IF</b> "an instance
sdccchSeizuresPackage supports it",	<b>PRESENT IF</b> "an instance
sdccchAllocatedTimePackage supports it",	<b>PRESENT IF</b> "an instance
sdccchQueuePackage supports it",	<b>PRESENT IF</b> "an instance
lostRadioLinksPerSDCCHPackage supports it",	<b>PRESENT IF</b> "an instance
downlinkPowerControlPackage supports it",	<b>PRESENT IF</b> "an instance
uplinkPowerControlPackage supports it",	<b>PRESENT IF</b> "an instance
internalHandoversIntraCellPackage supports it",	<b>PRESENT IF</b> "an instance
incomingInternalInterCellHandoversPackage supports it",	<b>PRESENT IF</b> "an instance
outgoingInternalInterCellHandoversPackage supports it",	<b>PRESENT IF</b> "an instance
internalHandoverFailurePackage supports it",	<b>PRESENT IF</b> "an instance
gprsPDCHAvailablePackage supports it",	<b>PRESENT IF</b> "an instance
gprsPDCHOccupiedPackage supports it",	<b>PRESENT IF</b> "an instance
gprsPDCHAllocatedPackage supports it",	<b>PRESENT IF</b> "an instance
gprsPCCCHPagingPackage supports it",	<b>PRESENT IF</b> "an instance

gprsPPCHQueueOnPCCCHPackage  
supports it",  
gprsPDTCHAssignmentPackage  
supports it",  
gprsPDTCHQueuePackage  
supports it",  
gprsCSChangePackage  
supports it";

**PRESENT IF** "an instance**PRESENT IF** "an instance**PRESENT IF** "an instance**PRESENT IF** "an instance**REGISTERED AS** {gsm1204managedobjectClass 131};

## C.1.4 internalHdoMeasurementFunction

internalHdoMeasurementFunction **MANAGED OBJECT CLASS****DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**basicMeasurementFunctionPackage,  
internalHdoMeasurementFunctionPackage;**CONDITIONAL PACKAGES**incomingInternalInterCellPerCellHandoversPackage **PRESENT IF** "an instance  
supports it",outgoingInternalInterCellPerCellHandoversPackage **PRESENT IF** "an instance  
supports it";**REGISTERED AS** {gsm1204managedobjectClass 140};internalHdoMeasurementFunctionPackage **PACKAGE****BEHAVIOUR**

internalHdoMeasurementFunctionBehaviour;

**ATTRIBUTES**

"gsm1220: 1993": adjacentCellId

**GET;****REGISTERED AS** {gsm1204package 140};internalHdoMeasurementFunctionBehaviour **BEHAVIOUR****DEFINED AS**

"This object is defined to contain the various optional measurement packages and will exist in multiple instances. Creation is only allowed if the value of the adjacent cell attribute is identical to the value of the adjacent cell attribute in one of the <HDO adjacent Cell> objects. There can be one or more instance(s) of the HDO measurement function for each created instance of <HDO adjacent cell> MOC. If the adjacent Cell Object is re-named or deleted during the lifetime of the internalHdoMeasurementFunction of its associated internalHdoMeasurementFunction then the corresponding internalHdoMeasurementFunction(s) is/are automatically deleted, as the adjacent Cell Attribute of the measurementFunction shall not be changeable. The scanner may scan attributes of the object class in various combinations and permutations of packages, and further may scan simultaneously as many times as necessary within the processing limits of the network."

## C.1.5 mscMeasurementFunction

mscMeasurementFunction **MANAGED OBJECT CLASS****DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**classMarkPackage  
supports it",**PRESENT IF** "an instance

mobileOriginatingCallsPackage supports it", **PRESENT IF** "an instance  
mobileTerminatingCallsPackage supports it", **PRESENT IF** "an instance  
mobileEmergencyCallsPackage supports it", **PRESENT IF** "an instance  
cipheringModePackage supports it", **PRESENT IF** "an instance  
interrogatingHLRPackage supports it", **PRESENT IF** "an instance  
mobileOriginatingPointToPointSMPackage supports it", **PRESENT IF** "an instance  
mobileTerminatingPointToPointSMPackage supports it", **PRESENT IF** "an instance  
imeiRequestPackage supports it", **PRESENT IF** "an instance  
whiteAnswersInMSCPackage supports it", **PRESENT IF** "an instance  
greyAnswersInMSCPackage supports it", **PRESENT IF** "an instance  
blackAnswersInMSCPackage supports it", **PRESENT IF** "an instance  
unknownIMEIAnswersInMSCPackage supports it", **PRESENT IF** "an instance  
callSetupServicePackage supports it", **PRESENT IF** "an instance  
locationUpdatingServicePackage supports it", **PRESENT IF** "an instance  
subscriberIdentifiedWithTMSIPackage supports it", **PRESENT IF** "an instance  
subscriberIdentifiedWithIMSIPackage supports it", **PRESENT IF** "an instance  
tmsiReallocationsPackage supports it", **PRESENT IF** "an instance  
imsiDetachAttachProceduresPackage supports it", **PRESENT IF** "an instance  
incomingExternalIntraMSCHandoversPackage supports it", **PRESENT IF** "an instance  
outgoingExternalIntraMSCHandoversPackage supports it", **PRESENT IF** "an instance  
incomingInterMSCHandoversPackage supports it", **PRESENT IF** "an instance  
outgoingInterMSCHandoversPackage supports it", **PRESENT IF** "an instance  
subsequentInterMSCHandoversToMACaPackage supports it", **PRESENT IF** "an instance  
subsequentInterMSCHandoversToMACcPackage supports it", **PRESENT IF** "an instance  
externalHandoversPackage supports it", **PRESENT IF** "an instance  
externalHandoversPerCausePackage supports it", **PRESENT IF** "an instance  
externalHandoverFailurePerMSCPackage supports it"; **PRESENT IF** "an instance  
**REGISTERED AS** {gsm1204managedobjectClass 150};

## C.1.6 externalHdoMeasurementFunction

externalHdoMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage,  
externalHdoMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

incomingExternalIntraMSCHandoversPerCellPackage **PRESENT IF** "an instance supports it",  
outgoingExternalIntraMSCHandoversPerCellPackage **PRESENT IF** "an instance supports it",  
incomingExternalInterMSCHandoversPerCellPackage **PRESENT IF** "an instance supports it",  
outgoingExternalInterMSCHandoversPerCellPackage **PRESENT IF** "an instance supports it";

**REGISTERED AS** {gsm1204managedobjectClass 160};

externalHdoMeasurementFunctionPackage **PACKAGE**

**BEHAVIOUR**

externalHdoMeasurementFunctionBehaviour;

**ATTRIBUTES**

observedCell **GET**,  
adjacentCell **GET**;

**REGISTERED AS** {gsm1204package 160} ;

externalHdoMeasurementFunctionBehaviour **BEHAVIOUR**

**DEFINED AS**

"This object is defined to contain the various optional measurement packages and will exist in multiple instances. It can only be instantiated if the cell attribute belongs to the msc area which is served by the msc function that contain the external HDO measurement function. The scanner may scan attributes of the object class in various combinations and permutations of packages, and further may scan simultaneously as many times as necessary within the processing limits of the network.";

## C.1.7 hlrMeasurementFunction

hlrMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

msRoamingOutsideHPLMNPpackage **PRESENT IF** "an instance supports it",  
authenticationSetsHLRToVLRPackage **PRESENT IF** "an instance supports it",  
insertSubscriberDataServicePackage **PRESENT IF** "an instance supports it",  
locationUpdatePackage **PRESENT IF** "an instance supports it",  
ssRelatedOperationsInHLRPackage **PRESENT IF** "an instance supports it",

requestForSMRoutingPackage supports it",  
 smDeliveryStatusReportProceduresPackage supports it",  
 sendAlertsPackage supports it",  
 requestForMSRNPackage supports it";  
**REGISTERED AS** {gsm1204managedobjectClass 170};

**PRESENT IF** "an instance**PRESENT IF** "an instance**PRESENT IF** "an instance**PRESENT IF** "an instance

## C.1.8 vlrMeasurementFunction

vlrMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

msMemoryAvailableNotificationsPackage supports it",

**PRESENT IF** "an instance

identificationRequestToPVLRPackage supports it",

**PRESENT IF** "an instance

pageRequestPackage supports it",

**PRESENT IF** "an instance

pageRequestPerLocationAreaPackage supports it",

**PRESENT IF** "an instance

authenticationSetsVLRToHLRPackage supports it",

**PRESENT IF** "an instance

authenticationInVLRPackage supports it",

**PRESENT IF** "an instance

intraVLRLocationUpdatePackage supports it",

**PRESENT IF** "an instance

interVLRLocationUpdatePackage supports it",

**PRESENT IF** "an instance

visitorsFromOtherPLMNPackge supports it";

**PRESENT IF** "an instance

**REGISTERED AS** {gsm1204managedobjectClass 180};

## C.1.9 eirMeasurementFunction

eirMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

receivedIMEIcheckRequestPackage

**PRESENT IF** "an instance supports it",

whiteAnswersInEIRPackage

**PRESENT IF** "an instance supports it",

greyAnswersInEIRPackage

**PRESENT IF** "an instance supports it",

blackAnswersInEIRPackage

**PRESENT IF** "an instance supports it",

unknownIMEIAnswersInEIRPackage

**PRESENT IF** "an instance supports it";

**REGISTERED AS** {gsm1204managedobjectClass 190};



## C.1.10 smsMeasurementFunction

smsMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

mobileOriginatingSMForwardingPackage  
supports it",

**PRESENT IF** "an instance

mobileTerminatingSMForwardingPackage  
supports it";

**PRESENT IF** "an instance

**REGISTERED AS** {gsm1204managedobjectClass 1101};

## C.1.11 sgsnMeasurementFunction

sgsnMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

sgsnLLCPackage  
supports it",

**PRESENT IF** "an instance

sgsnSNDCCPPackage  
supports it",

**PRESENT IF** "an instance

gprsAttachPackage  
supports it",

**PRESENT IF** "an instance

gprsIMSIAttachPackage  
supports it",

**PRESENT IF** "an instance

gprsIMSIAreadyAttachedPackage  
supports it",

**PRESENT IF** "an instance

gprsAttachedSubscribersPackage  
supports it",

**PRESENT IF** "an instance

gprsMSDetachPackage  
supports it",

**PRESENT IF** "an instance

gprsSGSNDetachPackage  
supports it",

**PRESENT IF** "an instance

gprsRoutingAreaUpdatePackage  
supports it",

**PRESENT IF** "an instance

pTMSIReallocationPackage  
supports it",

**PRESENT IF** "an instance

sgsnHLRAuthenticationPackage  
supports it",

**PRESENT IF** "an instance

sgsnAuthenticationProcPackage  
supports it",

**PRESENT IF** "an instance

sgsnIdentityRequestPackage  
supports it",

**PRESENT IF** "an instance

sgsnCipherringModePackage  
supports it",

**PRESENT IF** "an instance

gprsSubsStandbyStatePackage  
supports it",

**PRESENT IF** "an instance

gprsSubsReadyStatePackage  
supports it",

**PRESENT IF** "an instance

sgsnIMEICheckRequestsPackage  
supports it",

**PRESENT IF** "an instance

whiteAnswersInSGSNPackage supports it",	<b>PRESENT IF</b> "an instance
greyAnswersInSGSNPackage supports it",	<b>PRESENT IF</b> "an instance
blackAnswersInSGSNPackage supports it",	<b>PRESENT IF</b> "an instance
unknownIMEIAnswersInSGSNPackage supports it",	<b>PRESENT IF</b> "an instance
sgsnPacketSwitched PagingPackage supports it",	<b>PRESENT IF</b> "an instance
sgsnPacketSwitched PagingPerRAPackage supports it",	<b>PRESENT IF</b> "an instance
sgsnPDPContextActivationByMSPackage supports it",	<b>PRESENT IF</b> "an instance
sgsnDynamicPDPContextActivationByMSPackage supports it",	<b>PRESENT IF</b> "an instance
sgsnPDPContextDeactivationByMSPackage supports it",	<b>PRESENT IF</b> "an instance
sgsnPDPContextDeactivationByGGSNPackage supports it",	<b>PRESENT IF</b> "an instance
subscriberPDPContextsInSGSNPackage supports it";	<b>PRESENT IF</b> "an instance

**REGISTERED AS** {gsm1204managedobjectClass 1110};

## C.1.12 ggsnMeasurementFunction

ggsnMeasurementFunction **MANAGED OBJECT CLASS**

**DERIVED FROM**

"Recommendation X.721: 1992": top;

**CHARACTERIZED BY**

basicMeasurementFunctionPackage;

**CONDITIONAL PACKAGES**

ggsnPDPContextActivationByMSPackage supports it",	<b>PRESENT IF</b> "an instance
ggsnDynamicPDPContextActivationByMSPackage supports it",	<b>PRESENT IF</b> "an instance
ggsnPDPContextDeactivationByMSPackage supports it",	<b>PRESENT IF</b> "an instance
ggsnPDPContextDeactivationByGGSNPackage supports it",	<b>PRESENT IF</b> "an instance
ActivePDPContextsAtGGSNPackage supports it";	<b>PRESENT IF</b> "an instance

**REGISTERED AS** {gsm1204managedobjectClass 1120}

## C.2 Measurement Package Definitions

The following describes the individual measurements defined in GSM 12.04, annex B, as packages of attributes to be referenced by the appropriate managed object class.

### C.2.1 General Measurement Function Packages

#### C.2.1.1 basicMeasurementFunctionPackage

```

basicMeasurementFunctionPackage PACKAGE
  BEHAVIOUR
    generalMeasurementFunctionBehaviour;
  ATTRIBUTES
    measurementFunctionId GET;
  NOTIFICATIONS
    "Recommendation X.721: 1992": objectCreation,
    "Recommendation X.721: 1992": objectDeletion;
REGISTERED AS {gsm1204package 211};

```

### C.2.2 BSC Measurement Function Related Packages

#### C.2.2.1 requestForServicePackage

```

requestForServicePackage PACKAGE
  BEHAVIOUR
    generalMeasurementPackageBehaviour;
  ATTRIBUTES
    unsuccReqsForService GET;
REGISTERED AS {gsm1204package 221};

```

#### C.2.2.2 requestForServicePerCausePackage

```

requestForServicePerCausePackage PACKAGE
  BEHAVIOUR
    generalMeasurementPackageBehaviour;
  ATTRIBUTES
    unsuccReqsForServicePerCause GET;
REGISTERED AS {gsm1204package 222};

```

#### C.2.2.3 interArrivalTimePackage

```

interArrivalTimePackage PACKAGE
  BEHAVIOUR
    generalMeasurementPackageBehaviour;
  ATTRIBUTES
    meanInterArrivalTime GET;
REGISTERED AS {gsm1204package 223};

```

### C.2.2.4 pagingMessagePerBSCPackage

pagingMessagePerBSCPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attTransOfPagingMessagesPerBSC **GET**;  
 unsuccTransOfPagingMessagesPerBSC **GET**;  
**REGISTERED AS** {gsm1204package 224};

### C.2.2.5 immediateAssignmentProceduresPerBSCPackage

immediateAssignmentProceduresPerBSCPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attImmediateAssingProcsPerBSC **GET**;  
 succlImmediateAssingProcsPerBSC **GET**;  
**REGISTERED AS** {gsm1204package 225};

### C.2.2.6 internalHandoversIntraCellPerBSCPackage

internalHandoversIntraCellPerBSCPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 succlInternalHDOsIntraCellPerBSC **GET**;  
 unsucclInternalHDOsIntraCellPerBSC **GET**;  
**REGISTERED AS** {gsm1204package 226};

### C.2.2.7 internalHandoversPerBSCPackage

internalHandoversPerBSCPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 succlInternalHDOsPerBSC **GET**;  
**REGISTERED AS** {gsm1204package 227};

### C.2.2.8 internalHandoversPerCausePackage

internalHandoversPerCausePackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 succlInternalHDOsPerCause **GET**;  
**REGISTERED AS** {gsm1204package 228};

### C.2.2.9 internalHandoverFailuresPerBSCPackage

internalHandoverFailuresPerBSCPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;

**ATTRIBUTES**

unsuccInternalHDOsWithReconnectionPerBSC **GET**,

unsuccInternalHDOsWithLossOfConnectionPerBSC **GET**;

**REGISTERED AS** {gsm1204package 229};

**C.2.2.10 gprsPDUFlushReqPackage**

gprsPDUFlushReqPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

FlushReqReceived **GET**;

**REGISTERED AS** {gsm1204package 2210};

**C.2.2.11 gprsPagingRequestPackage**

gprsPagingRequestPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

pagingReqReceivedfromSGSN **GET**;

**REGISTERED AS** {gsm1204package 2211};

**C.2.2.12 gprsInterArrivalPackage**

gprsInterArrivalPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanPSInterArrivalTime **GET**;

**REGISTERED AS** {gsm1204package 2212};

**C.2.3 CELL Measurement Function Related Packages****C.2.3.1 pchagchQueuePackage**

pchagchQueuePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanPCHAGCHQueueLength **GET**;

**REGISTERED AS** {gsm1204package 231};

**C.2.3.2 pagingMessagePackage**

pagingMessagePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attTransOfPagingMessagesThePCH **GET**,

unsuccTransOfPagingMessagesThePCH **GET**;

**REGISTERED AS** {gsm1204package 232};

### C.2.3.3 immediateAssignmentProceduresPackage

immediateAssignmentProceduresPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attImmediateAssingProcs **GET,**

succlImmediateAssingProcs **GET;**

**REGISTERED AS** {gsm1204package 233};

### C.2.3.4 immediateAssignmentProceduresPerCausePackage

immediateAssignmentProceduresPerCausePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attImmediateAssingProcsPerCause **GET,**

succlImmediateAssingProcsPerCause **GET;**

**REGISTERED AS** {gsm1204package 234};

### C.2.3.5 pageDiscardPackage

pageDiscardPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfPagesDiscardedFromPCHQueue **GET;**

**REGISTERED AS** {gsm1204package 235};

### C.2.3.6 durationOfPagingProceduresPackage

durationOfPagingProceduresPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanDurationOfSuccPagingProcs **GET;**

**REGISTERED AS** {gsm1204package 236};

### C.2.3.7 tchAvailablePackage

tchAvailablePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfAvailableTCHs **GET;**

**REGISTERED AS** {gsm1204package 237};

### C.2.3.8 tchBusyPackage

tchBusyPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanNbrOfBusyTCHs

**GET,**

maxNbrOfBusyTCHs

**GET;****REGISTERED AS** {gsm1204package 238};**C.2.3.9 idleTCHsPerInterferenceBandPackage**idleTCHPerInterferenceBandPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanNbrOfIdleTCHsPerInterferenceBand

**GET;****REGISTERED AS** {gsm1204package 239};**C.2.3.10 tchSeizuresPackage**tchSeizuresPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attTCHSeizures

**GET,**

succTCHSeizures

**GET,**

attTCHSeizuresMeetingTCHBlockedState

**GET;****REGISTERED AS** {gsm1204package 2310};**C.2.3.11 tchAllocatedTimePackage**tchAllocatedTimePackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

allAvailableTCHAllocatedTime

**GET;****REGISTERED AS** {gsm1204package 2311};**C.2.3.12 tchBusyTimePackage**tchBusyTimePackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanTCHBusyTime

**GET;****REGISTERED AS** {gsm1204package 2312};**C.2.3.13 tchQueuePackage**tchQueuePackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanTCHQueueLength

**GET;****REGISTERED AS** {gsm1204package 2313};

### C.2.3.14 lostRadioLinksPerTCHPackage

lostRadioLinksPerTCHPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfLostRadioLinksTCH **GET**;  
**REGISTERED AS** {gsm1204package 2314};

### C.2.3.15 sdcchAvailablePackage

sdcchAvailablePackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfAvailableSDCCHs **GET**;  
**REGISTERED AS** {gsm1204package 2315};

### C.2.3.16 sdcchBusyPackage

sdcchBusyPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
meanNbrOfBusySDCCHs **GET**;  
maxNbrOfBusySDCCHs **GET**;  
**REGISTERED AS** {gsm1204package 2316};

### C.2.3.17 sdcchSeizuresPackage

sdcchSeizuresPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
attSDCCHSeizuresMeetingSDCCHBlockedState **GET**;  
**REGISTERED AS** {gsm1204package 2317};

### C.2.3.18 sdcchAllocatedTimePackage

sdcchAllocatedTimePackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
allAvailableSDCCHAllocatedTime **GET**;  
**REGISTERED AS** {gsm1204package 2318};

### C.2.3.19 sdcchQueuePackage

sdcchQueuePackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;



**ATTRIBUTES**

meanSDCCHQueueLength

**GET;****REGISTERED AS** {gsm1204package 2319};**C.2.3.20 lostRadioLinksPerSDCCHPackage**lostRadioLinksPerSDCCHPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfLostRadioLinksSDCCH

**GET;****REGISTERED AS** {gsm1204package 2320};**C.2.3.21 downlinkPowerControlPackage**downlinkPowerControlPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

relativeTimeDLPowerControlAtMax

**GET;****REGISTERED AS** {gsm1204package 2321};**C.2.3.22 uplinkPowerControlPackage**uplinkPowerControlPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

relativeTimeULPowerControlAtMax

**GET;****REGISTERED AS** {gsm1204package 2322};**C.2.3.23 internalHandoversIntraCellPackage**internalHandoversIntraCellPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

succInternalHDOsIntraCell

**GET,**

unsuccInternalHDOsIntraCell

**GET;****REGISTERED AS** {gsm1204package 2323};**C.2.3.24 incomingInternalInterCellHandoversPackage**incomingInternalInterCellHandoversPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIncomingInternalInterCellHDOs

**GET,**

succIncomingInternalInterCellHDOs

**GET;****REGISTERED AS** {gsm1204package 2324};

### C.2.3.25 outgoingInternalInterCellHandoversPackage

outgoingInternalInterCellHandoversPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attOutgoingInternalInterCellHDOs **GET,**  
 succOutgoingInternalInterCellHDOs **GET;**  
**REGISTERED AS** {gsm1204package 2325};

### C.2.3.26 internalHandoverFailurePackage

internalHandoverFailurePackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 unsuccHDOsWithReconnection **GET,**  
 unsuccHDOsWithLossOfConnection **GET;**  
**REGISTERED AS** {gsm1204package 2326};

### C.2.3.27 gprsPDCHAvailablePackage

gprsPDCHAvailablePackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 availablePDCH **GET,**  
 meanNbrAvailablePDCH **GET,**  
 maxNbrAvailablePDCH **GET,**  
 minNbrAvailablePDCH **GET;**  
**REGISTERED AS** {gsm1204package 2327};

### C.2.3.28 gprsPDCHOccupiedPackage

gprsPDCHOccupiedPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 meanNbrOfOccPDCH **GET,**  
 maxNbrOfOccPDCH **GET,**  
 minNbrOfOccPDCH **GET;**  
**REGISTERED AS** {gsm1204package 2328};

### C.2.3.29 gprsPDCHAllocatedPackage

gprsPDCHAllocatedPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 availablePDCH AllocatedTime **GET;**  
**REGISTERED AS** {gsm1204package 2329};

### C.2.3.30 gprsPCCCHPagingPackage

gprsPCCCHPagingPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrPacketPagingMessagesPCHOnPCCCH

**GET;**

**REGISTERED AS** {gsm1204package 2330};

### C.2.3.31 gprsPPCHQueueOnPCCCHPackage

gprsPPCHQueueOnPCCCHPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanPPCHPAGCHQueueLengthOnPCCCH

**GET,**

nbrOfPSPagesDiscardedFromPPCHQueueOnPCCCH

**GET;**

**REGISTERED AS** {gsm1204package 2331};

### C.2.3.32 gprsPDTCHAssignmentPackage

gprsPDTCHAssignmentPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attPCReqAssPerCause

**GET,**

succPDTCHAssProcsPerCause

**GET,**

succPDTCHSeizures

**GET;**

**REGISTERED AS** {gsm1204package 2332};

### C.2.3.33 gprsPDTCHQueuePackage

gprsPDTCHQueuePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanPacketQueueLength

**GET;**

**REGISTERED AS** {gsm1204package 2333};

### C.2.3.34 gprsCSChangePackage

gprsCSChangePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfServiceChanges

**GET;**

**REGISTERED AS** {gsm1204package 2334};

## C.2.4 internal HDO Measurement Function Related Packages

### C.2.4.1 incomingInternalInterCellPerCellHandoversPackage

incomingInternalInterCellPerCellHandoversPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIncomingInternalInterCellHDOsPerOriginatingCell **GET,**

succIncomingInternalInterCellHDOsPerOriginatingCell **GET;**

**REGISTERED AS** {gsm1204package 241};

### C.2.4.2 outgoingInternalInterCellPerCellHandoversPackage

outgoingInternalInterCellPerCellHandoversPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attOutgoingInternalInterCellHDOsPerTargetCell **GET,**

succOutgoingInternalInterCellHDOsPerTargetCell **GET;**

**REGISTERED AS** {gsm1204package 242};

## C.2.5 MSC Measurement Function Related Packages

### C.2.5.1 classMarkPackage

classMarkPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfClassMarkUpdates **GET;**

**REGISTERED AS** {gsm1204package 251};

### C.2.5.2 mobileOriginatingCallsPackage

mobileOriginatingCallsPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attMobileOriginatingCalls **GET,**

succMobileOriginatingCalls **GET,**

ansMobileOriginatingCalls **GET;**

**REGISTERED AS** {gsm1204package 252};

### C.2.5.3 mobileTerminatingCallsPackage

mobileTerminatingCallsPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attMobileTerminatingCalls **GET,**

succMobileTerminatingCalls **GET,**

ansMobileTerminatingCalls **GET**;  
**REGISTERED AS** {gsm1204package 253};

#### C.2.5.4 mobileEmergencyCallsPackage

mobileEmergencyCallsPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attMobileEmergencyCalls **GET**,  
 succMobileEmergencyCalls **GET**,  
 ansMobileEmergencyCalls **GET**;  
**REGISTERED AS** {gsm1204package 254};

#### C.2.5.5 cipherringModePackage

cipherringModePackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attCipherringModeControlProcs **GET**,  
 succCipherringModeControlProcs **GET**;  
**REGISTERED AS** {gsm1204package 255};

#### C.2.5.6 interrogatingHLRPackage

interrogatingHLRPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attInterrogationOfHLRsForRouting **GET**,  
 succInterrogationOfHLRsMSRNObtained **GET**,  
 succInterrogationOfHLRsCallForwarding **GET**;  
**REGISTERED AS** {gsm1204package 256};

#### C.2.5.7 mobileOriginatingPointToPointSMPackage

mobileOriginatingPointToPointSMPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attOpForMobileOriginatingPointToPointSMs **GET**,  
 succOpForMobileOriginatingPointToPointSMs **GET**;  
**REGISTERED AS** {gsm1204package 257};

#### C.2.5.8 mobileTerminatingPointToPointSMPackage

mobileTerminatingPointToPointSMPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attOpForMobileTerminatingPointToPointSMs **GET**,  
 succOpForMobileTerminatingPointToPointSMs **GET**;

**REGISTERED AS** {gsm1204package 258};

### C.2.5.9 imeiRequestPackage

imeiRequestPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfTransCheckIMEIRequests **GET**;

**REGISTERED AS** {gsm1204package 259};

### C.2.5.10 whiteAnswersInMSCPackage

whiteAnswersInMSCPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfWhiteAnsInMSC

**GET**;

**REGISTERED AS** {gsm1204package 2510};

### C.2.5.11 greyAnswersInMSCPackage

greyAnswersInMSCPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfGreyAnsInMSC

**GET**;

**REGISTERED AS** {gsm1204package 2511};

### C.2.5.12 blackAnswersInMSCPackage

blackAnswersInMSCPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfBlackAnsInMSC

**GET**;

**REGISTERED AS** {gsm1204package 2512};

### C.2.5.13 unknownIMEIAnswersInMSCPackage

unknownIMEIAnswersInMSCPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfUnknownIMEIAnsInMSC

**GET**;

**REGISTERED AS** {gsm1204package 2513};

### C.2.5.14 callSetupServicePackage

callSetupServicePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanTimeToCallSetupService

**GET;****REGISTERED AS** {gsm1204package 2514};**C.2.5.15 locationUpdatingServicePackage**locationUpdatingServicePackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

meanTimeToLocationUpdateService

**GET;****REGISTERED AS** {gsm1204package 2515};**C.2.5.16 subscriberIdentifiedWithTMSIPackage**subscriberIdentifiedWithTMSIPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

transSubIdentifiedWithTMSI

**GET;****REGISTERED AS** {gsm1204package 2516};**C.2.5.17 subscriberIdentifiedWithIMSIPackage**subscriberIdentifiedWithIMSIPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

transSubIdentifiedWithIMSI

**GET;****REGISTERED AS** {gsm1204package 2517};**C.2.5.18 tmsiReallocationsPackage**tmsiReallocationsPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attTMSIReallocations

**GET,**

succTMSIReallocations

**GET;****REGISTERED AS** {gsm1204package 2518};**C.2.5.19 imsiDetachProceduresPackage**imsiDetachProceduresPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

imsiDetachProcs

**GET,**

imsiAttachProcs

**GET;****REGISTERED AS** {gsm1204package 2519};

### C.2.5.20 incomingExternalIntraMSCHandoversPackage

incomingExternalIntraMSCHandoversPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIncomingExternalIntraMSCHDOs

GET,

succIncomingExternalIntraMSCHDOs

GET;

**REGISTERED AS** {gsm1204package 2520};

### C.2.5.21 outgoingExternalIntraMSCHandoversPackage

outgoingExternalIntraMSCHandoversPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attOutgoingExternalIntraMSCHDOs

GET,

succOutgoingExternalIntraMSCHDOs

GET;

**REGISTERED AS** {gsm1204package 2521};

### C.2.5.22 incomingInterMSCHandoversPackage

incomingInterMSCHandoversPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIncomingInterMSCHDOs

GET,

succIncomingInterMSCHDOs

GET;

**REGISTERED AS** {gsm1204package 2522};

### C.2.5.23 outgoingInterMSCHandoversPackage

outgoingInterMSCHandoversPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attOutgoingInterMSCHDOs

GET,

succOutgoingInterMSCHDOs

GET;

**REGISTERED AS** {gsm1204package 2523};

### C.2.5.24 subsequentInterMSCHandoversToMACaPackage

subsequentInterMSCHandoversToMACaPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attSubsequentInterMSCHDOsMSCa

GET,

succSubsequentInterMSCHDOsMSCa

GET;

**REGISTERED AS** {gsm1204package 2524};

### C.2.5.25 subsequentInterMSCHandoversToMACcPackage

subsequentInterMSCHandoversToMACcPackage **PACKAGE**



**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attSubsequentInterMSCHDOsMSCc

**GET,**

succSubsequentInterMSCHDOsMSCc

**GET;****REGISTERED AS** {gsm1204package 2525};**C.2.5.26 externalHandoversPackage**externalHandoversPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

externalHDOs

**GET;****REGISTERED AS** {gsm1204package 2526};**C.2.5.27 externalHandoversPerCausePackage**externalHandoversPerCausePackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

externalHDOsPerCause

**GET;****REGISTERED AS** {gsm1204package 2527};**C.2.5.28 externalHandoverFailurePerMSCPackage**externalHandoverFailurePerMSCPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**unsuccExternHDOsWithReconnectionPerMSC **GET,**unsuccExternHDOsWithLossOfConnectionPerMSC **GET;****REGISTERED AS** {gsm1204package 2528};**C.2.6 external HDO Measurement Function Related Packages****C.2.6.1 incomingExternalIntraMSCHandoversPerCellPackage**incomingExternalIntraMSCHandoversPerCellPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attIncomingExternalIntraMSCHDOsPerOriginatingCell **GET,**succIncomingExternalIntraMSCHDOsPerOriginatingCell **GET;****REGISTERED AS** {gsm1204package 261};**C.2.6.2 outgoingExternalIntraMSCHandoversPerCellPackage**outgoingExternalIntraMSCHandoversPerCellPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attOutgoingExternalIntraMSCHDOsPerTargetCell **GET**,  
succOutgoingExternalIntraMSCHDOsPerTargetCell **GET**;  
**REGISTERED AS** {gsm1204package 262};

**C.2.6.3 incomingExternalInterMSCHandoversPerCellPackage**

incomingExternalInterMSCHandoversPerCellPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIncomingInterMSCHDOsPerOriginatingCell **GET**,  
succIncomingInterMSCHDOsPerOriginatingCell **GET**;  
**REGISTERED AS** {gsm1204package 263};

**C.2.6.4 outgoingExternalInterMSCHandoversPerCellPackage**

outgoingExternalInterMSCHandoversPerCellPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attOutgoingInterMSCHDOsPerTargetCell **GET**,  
succOutgoingInterMSCHDOsPerTargetCell **GET**;  
**REGISTERED AS** {gsm1204package 264};

**C.2.7 HLR Measurement Function Related Packages****C.2.7.1 msRoamingOutsideHPLMNPackage**

msRoamingOutsideHPLMNPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

nbrOfCurrentMSsRoamingOutsideHPLMN **GET**;  
**REGISTERED AS** {gsm1204package 271};

**C.2.7.2 authenticationSetsHLRToVLRPackage**

authenticationSetsHLRToVLRPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attReqForAuthSetsReceivedByHLRFromVLRs **GET**,  
succReturnedAuthSetsFromHLRToVLRs **GET**,  
emptyResponsesForAuthSetsFromHLRToVLRs **GET**;  
**REGISTERED AS** {gsm1204package 272};

**C.2.7.3 insertSubscriberDataServicePackage**

insertSubscriberDataServicePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attInsertSubDataService **GET,**  
succInsertSubDataService **GET;**  
**REGISTERED AS** {gsm1204package 273};

**C.2.7.4 locationUpdatePackage**

locationUpdatePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attLocationUpdate **GET,**  
succLocationUpdate **GET;**  
**REGISTERED AS** {gsm1204package 274};

**C.2.7.5 ssRelatedOperationsInHLRPackage**

ssRelatedOperationsInHLRPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attSSRelatedOperationsInHLR **GET,**  
succSSRelatedOperationsInHLR **GET;**  
**REGISTERED AS** {gsm1204package 275};

**C.2.7.6 requestForSMRoutingPackage**

requestForSMRoutingPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attReqForSMRoutingInfo **GET,**  
succReqForSMRoutingInfo **GET;**  
**REGISTERED AS** {gsm1204package 276};

**C.2.7.7 smDeliveryStatusReportProceduresPackage**

smDeliveryStatusReportProceduresPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attSMDeliveryStatusReportProcs **GET,**  
succSMDeliveryStatusReportProcs **GET;**  
**REGISTERED AS** {gsm1204package 277};

**C.2.7.8 sendAlertsPackage**

sendAlertsPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attNbrOfSendAlerts **GET,**  
succNbrOfSendAlerts **GET;**

**REGISTERED AS** {gsm1204package 278};

### C.2.7.9 requestForMSRNPackage

requestForMSRNPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attReqForMSRN

**GET,**

succReqForMSRN

**GET;**

**REGISTERED AS** {gsm1204package 279};

## C.2.8 VLR Measurement Function Related Packages

### C.2.8.1 msMemoryAvailableNotificationsPackage

msMemoryAvailableNotificationsPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attMSMemoryAvailableNotifications

**GET,**

succMSMemoryAvailableNotifications

**GET;**

**REGISTERED AS** {gsm1204package 281};

### C.2.8.2 identificationRequestToPVLRPackage

identificationRequestToPVLRPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIdentificationReqToPVLRs

**GET,**

succIdentificationReqToPVLRs

**GET;**

**REGISTERED AS** {gsm1204package 282};

### C.2.8.3 pageRequestPackage

pageRequestPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attPageReqs

**GET,**

succPageReqs

**GET;**

**REGISTERED AS** {gsm1204package 283};

### C.2.8.4 pageRequestPerLocationAreaPackage

pageRequestPerLocationAreaPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attPageReqsPerLocationArea

**GET,**

succPageReqsPerLocationArea

**GET;**

**REGISTERED AS** {gsm1204package 284};

### C.2.8.5 authenticationSetsVLRToHLRPackage

authenticationSetsVLRToHLRPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attReqForAuthSetsSentToHLR

**GET,**

succReceivedAuthSetsFromHLR

**GET,**

emptyResponsesForAuthFromHLR

**GET;**

**REGISTERED AS** {gsm1204package 285};

### C.2.8.6 authenticationInVLRPackage

authenticationInVLRPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attAuthProcsInVLR

**GET,**

succAuthProcsInVLR

**GET;**

**REGISTERED AS** {gsm1204package 286};

### C.2.8.7 intraVLRLocationUpdatePackage

intraVLRLocationUpdatePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attIntraVLRLocationUpdates

**GET,**

succIntraVLRLocationUpdates

**GET;**

**REGISTERED AS** {gsm1204package 287};

### C.2.8.8 interVLRLocationUpdatePackage

interVLRLocationUpdatePackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

attInterVLRLocationUpdates

**GET,**

succInterVLRLocationUpdates

**GET;**

**REGISTERED AS** {gsm1204package 288};

### C.2.8.9 visitorsFromOtherPLMNPackage

visitorsFromOtherPLMNPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**

arrivalOfVisitorsFromOtherPLMNs

**GET;**

**REGISTERED AS** {gsm1204package 289};

## C.2.9 EIR Measurement Function Related Packages

### C.2.9.1 receivedIMEIcheckRequestPackage

receivedIMEIcheckRequestPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfReceivedIMEIcheckReqs **GET**;  
**REGISTERED AS** {gsm1204package 291};

### C.2.9.2 whiteAnswersInEIRPackage

whiteAnswersInEIRPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfWhiteAnsInEIR **GET**;  
**REGISTERED AS** {gsm1204package 292};

### C.2.9.3 greyAnswersInEIRPackage

greyAnswersInEIRPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfGreyAnsInEIR **GET**;  
**REGISTERED AS** {gsm1204package 293};

### C.2.9.4 blackAnswersInEIRPackage

blackAnswersInEIRPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfBlackAnsInEIR **GET**;  
**REGISTERED AS** {gsm1204package 294};

### C.2.9.5 unknownIMEIAnswersInEIRPackage

unknownIMEIAnswersInEIRPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfUnknownIMEIAnsInEIR **GET**;  
**REGISTERED AS** {gsm1204package 295};

## C.2.10 SMS Measurement Function Related Packages

### C.2.10.1 mobileOriginatingSMForwardingPackage

mobileOriginatingSMForwardingPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attMobileOriginatingSMForwardings **GET,**succMobileOriginatingSMForwardings **GET;****REGISTERED AS** {gsm1204package 2101};**C.2.10.2 mobileTerminatingSMForwardingPackage**mobileTerminatingSMForwardingPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attMobileTerminatingSMForwardings **GET,**succMobileTerminatingSMForwardings **GET;****REGISTERED AS** {gsm1204package 2102};**C.2.11 SGSN Measurement Function Related Packages****C.2.11.1 sgsnLLCPackage**sgsnLLCPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**nbrLlcFramesSent **GET,**nbrLlcFramesReceived **GET,**errLlcFramesDetectedBySgsn **GET,**retransmittedLlcFramestoMs **GET;****REGISTERED AS** {gsm1204package 2111};**C.2.11.2 sgsnSNDCPPackage**sgsnSNDCPPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**uplinkSndcpNpduReceived **GET,**uplinkSndcpOctetReceivedMode **GET,**downlinkSndcpNpdusent **GET,**downlinkSndcpOctetSent **GET;****REGISTERED AS** {gsm1204package 2112};**C.2.11.3 gprsAttachPackage**gprsAttachPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attGprsAttach **GET,**succGprsAttach **GET;****REGISTERED AS** {gsm1204package 2113};

#### C.2.11.4 gprsIMSIAttachPackage

gprsIMSIAttachPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
attCombiAttach **GET**,  
succCombiAttach **GET**;  
**REGISTERED AS** {gsm1204package 2114};

#### C.2.11.5 gprsIMSIAreadyAttachedPackage

gprsIMSIAreadyAttachedPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
attImsiAttach **GET**,  
succImsiAttach **GET**;  
**REGISTERED AS** {gsm1204package 2115};

#### C.2.11.6 gprsAttachedSubscribersPackage

gprsAttachedSubscribersPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfAttachedSub **GET**,  
meanNbrOfAttachedSub **GET**,  
maxNbrOfAttachedSub **GET**;  
**REGISTERED AS** {gsm1204package 2116};

#### C.2.11.7 gprsMSDetachPackage

gprsMSDetachPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
attGprsDetachMs **GET**,  
attCombiDetachMs **GET**,  
attImsiDetachMs **GET**;  
**REGISTERED AS** {gsm1204package 2117};

#### C.2.11.8 gprsSGSNDetachPackage

gprsSGSNDetachPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
attGprsdetachSgsn **GET**,  
succGprsdetachSgsn **GET**;  
**REGISTERED AS** {gsm1204package 2118};



### C.2.11.9 gprsRouting AreaUpdatePackage

gprsRouting AreaUpdatePackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attIntraSgsnRaUpdate **GET**,  
 succIntraSgsnRaUpdate **GET**,  
 attInterSgsnRaUpdate **GET**,  
 succInterSgsnRaUpdate **GET**;  
**REGISTERED AS** {gsm1204package 2119};

### C.2.11.10 pTMSIReallocationPackage

pTMSIReallocationPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attPTMSIRealloc **GET**,  
 succPTMSIrealloc **GET**;  
**REGISTERED AS** {gsm1204package 21110};

### C.2.11.11 sgsnHLRAuthenticationPackage

sgsnHLRAuthenticationPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attreqAuthSetsSentToHlrBySgsn **GET**,  
 succReqAuthSetsHlr **GET**,  
 emptyResponsesForAuthSetsFromHlr **GET**;  
**REGISTERED AS** {gsm1204package 21111};

### C.2.11.12 sgsnAuthenticationProcPackage

sgsnAuthenticationProcPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attAuthInSgsn **GET**,  
 succAuthInSgsn **GET**;  
**REGISTERED AS** {gsm1204package 21112};

### C.2.11.13 sgsnIdentityRequestPackage

sgsnIdentityRequestPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attIdentityReq **GET**,  
 succIdentityReq **GET**;  
**REGISTERED AS** {gsm1204package 21113};

### C.2.11.14 sgsnCipheringModePackage

sgsnCipheringModePackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
attCipheringModeControlPerSgsn **GET**,  
succCipheringModeControlPerSgsn **GET**;  
**REGISTERED AS** {gsm1204package 21114};

### C.2.11.15 gprsSubsStandbyStatePackage

gprsSubsStandbyStatePackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfSubStandby **GET**,  
meanNbrOfSubStandby **GET**,  
maxNbrOfSubStandby **GET**;  
**REGISTERED AS** {gsm1204package 21115};

### C.2.11.16 gprsSubsReadyStatePackage

gprsSubsReadyStatePackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfSubReady **GET**,  
meanNbrOfSubReady **GET**,  
maxNbrOfSubReady **GET**;  
**REGISTERED AS** {gsm1204package 21116};

### C.2.11.17 sgsnIMEICheckRequestsPackage

sgsnIMEICheckRequestsPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfCheckIMEIRequests **GET**;  
**REGISTERED AS** {gsm1204package 21117};

### C.2.11.18 whiteAnswersInSGSNPackage

whiteAnswersInSGSNPackage **PACKAGE**  
**BEHAVIOUR**  
generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
nbrOfWhiteAnswerInSgsn **GET**;  
**REGISTERED AS** {gsm1204package 21118};

### C.2.11.19 greyAnswersInSGSNPackage

greyAnswersInSGSNPackage **PACKAGE**

**BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**nbrOfGreyAnswerInSgsn **GET;****REGISTERED AS** {gsm1204package 21119};

## C.2.11.20 blackAnswersInSGSNPackage

blackAnswersInSGSNPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**nbrOfBlackAnswerInSgsn **GET;****REGISTERED AS** {gsm1204package 21120};

## C.2.11.21 unknownIMEIAnswersInSGSNPackage

unknownIMEIAnswersInSGSNPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**nbrOfUnknownAnswerInSgsn **GET;****REGISTERED AS** {gsm1204package 21121};

## C.2.11.22 sgsnPacketSwitched PagingPackage

sgsnPacketSwitched PagingPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attPacketSwitchedPaging **GET,**unsuccPacketSwitchedPaging **GET;****REGISTERED AS** {gsm1204package 21122};

## C.2.11.23 sgsnPacketSwitched PagingPerRAPackage

sgsnPacketSwitched PagingPerRAPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attPsPagingPerRoutingArea **GET,**unsuccPsPagingPerRoutingArea **GET;****REGISTERED AS** {gsm1204package 21123};

## C.2.11.24 sgsnPDPContextActivationByMSPackage

sgsnPDPContextActivationByMSPackage **PACKAGE****BEHAVIOUR**

generalMeasurementPackageBehaviour;

**ATTRIBUTES**attActPdpContextMSPerSgsn **GET,**succActPdpContextMSPerSgsn **GET;****REGISTERED AS** {gsm1204package 21124};



succActPdpContextPerApnOfGgsn **GET**;  
**REGISTERED AS** {gsm1204package 2121}

### C.2.12.2 ggsnDynamicPDPContextActivationByMSPackage

ggsnDynamicPDPContextActivationByMSPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attActPdpContextDnyPerApnOfGgsn **GET**,  
 succActPdpContextDnyPerApnOfGgsn **GET**;  
**REGISTERED AS** {gsm1204package 2122};

### C.2.12.3 ggsnPDPContextDeactivationByMSPackage

ggsnPDPContextDeactivationByMSPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attDeactPdpContextMsPerApnOfGgsn **GET**,  
 succDeactPdpContextMsPerApnOfGgsn **GET**;  
**REGISTERED AS** {gsm1204package 2123};

### C.2.12.4 ggsnPDPContextDeactivationByGGSNPackage

ggsnPDPContextDeactivationByGGSNPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 attDeactPdpContextByGgsnPerApn **GET**,  
 succDeactPdpContextByGgsnMsPerApn **GET**;  
**REGISTERED AS** {gsm1204package 2124};

### C.2.12.5 ActivePDPContextsAtGGSNPackage

ActivePDPContextsAtGGSNPackage **PACKAGE**  
**BEHAVIOUR**  
 generalMeasurementPackageBehaviour;  
**ATTRIBUTES**  
 nbrOfActivePdpContextsPerApnAtGgsn **GET**,  
 meanNbrOfActivePdpContextsPerApnAtGgsn **GET**,  
 maxNbrOfActivePdpContextsPerApnAtGgsn **GET**;  
**REGISTERED AS** {gsm1204package 2125};

---

## C.3 Measurement Attribute Definitions

### C.3.1 General Measurement Function Related Attributes

#### C.3.1.1 measurementFunctionId

measurementFunctionId **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementFunctionId;  
**BEHAVIOUR**  
measurementFunctionIdBehaviour;  
**REGISTERED AS** {gsm1204attribute 311};

measurementFunctionIdBehaviour **BEHAVIOUR**  
**DEFINED AS**  
"This is the identity of the measurement function";

#### C.3.1.2 observedCell

observedCell **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMCellName;  
**BEHAVIOUR**  
observedCellBehaviour;  
**REGISTERED AS** {gsm1204attribute 312};

observedCellBehaviour **BEHAVIOUR**  
**DEFINED AS**  
"This is the Cell that is to be observed for this measurement";

#### C.3.1.3 adjacentCell

adjacentCell **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMCellName;  
**BEHAVIOUR**  
adjacentCellBehaviour;  
**REGISTERED AS** {gsm1204attribute 313};

adjacentCellBehaviour **BEHAVIOUR**  
**DEFINED AS**  
"This is the Cell that is adjacent to the observed cell for this measurement";

### C.3.2 BSC Measurement Function Related Attributes

#### C.3.2.1 unsuccReqsForService

unsuccReqsForService **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 321};

### C.3.2.2 unsuccReqsForServicePerCause

unsuccReqsForServicePerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType3;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 322};

### C.3.2.3 meanInterArrivalTime

meanInterArrivalTime **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 323};

### C.3.2.4 attTransOfPagingMessagesPerBSC

attTransOfPagingMessagesPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 324};  
77

### C.3.2.5 unsuccTransOfPagingMessagesPerBSC

unsuccTransOfPagingMessagesPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 325};

### C.3.2.6 attImmediateAssingProcsPerBSC

attImmediateAssingProcsPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 326};

### C.3.2.7 succlmmediateAssingProcsPerBSC

succlmmediateAssingProcsPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 327};

### C.3.2.8 succlInternalHDOsIntraCellPerBSC

succlInternalHDOsIntraCellPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 328};

### C.3.2.9 unsucclInternalHDOsIntraCellPerBSC

unsucclInternalHDOsIntraCellPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 329};

### C.3.2.10 succlInternalHDOsPerBSC

succlInternalHDOsPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3210};

### C.3.2.11 succlInternalHDOsPerCause

succlInternalHDOsPerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType3;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3211};

### C.3.2.12 unsucclInternalHDOsWithReconnectionPerBSC

unsucclInternalHDOsWithReconnectionPerBSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3212};



### C.3.2.13 unsuccInternalHDOsWithLossOfConnectionPerBSC

unsuccInternalHDOsWithLossOfConnectionPerBSC **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3213};

### C.3.2.14 flushRequestReceived

flushRequestReceived **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3214};

### C.3.2.15 pagingReqReceivedfromSgsn

pagingReqReceivedfromSgsn **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3215};

### C.3.2.16 meanPSInterArrivalTime

meanPSInterArrivalTime **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3216};

## C.3.3 CELL Measurement Function Related Attributes

### C.3.3.1 meanPCHAGCHQueueLength

meanPCHAGCHQueueLength **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType2;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 331};

### C.3.3.2 attTransOfPagingMessagesThePCH

attTransOfPagingMessagesThePCH **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 332};

### C.3.3.3 unsuccTransOfPagingMessagesThePCH

unsuccTransOfPagingMessagesThePCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 333};

### C.3.3.4 attImmediateAssingProcs

attImmediateAssingProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 334};

### C.3.3.5 succlImmediateAssingProcs

succlImmediateAssingProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 335};

### C.3.3.6 attImmediateAssingProcsPerCause

attImmediateAssingProcsPerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType3;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 336};

### C.3.3.7 succlImmediateAssingProcsPerCause

succlImmediateAssingProcsPerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType3;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 337};

### C.3.3.8 nbrOfPagesDiscardedFromPCHQueue

nbrOfPagesDiscardedFromPCHQueue **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 338};**C.3.3.9 meanDurationOfSuccPagingProcs**meanDurationOfSuccPagingProcs **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType2;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 339};**C.3.3.10 nbrOfAvailableTCHs**nbrOfAvailableTCHs **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3310};**C.3.3.11 meanNbrOfBusyTCHs**meanNbrOfBusyTCHs **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType2;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3311};**C.3.3.12 maxNbrOfBusyTCHs**maxNbrOfBusyTCHs **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3312};**C.3.3.13 meanNbrOfIdleTCHsPerInterferenceBand**meanNbrOfIdleTCHsPerInterferenceBand **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType4;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3313};**C.3.3.14 attTCHSeizures**attTCHSeizures **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3314};

### C.3.3.15 succTCHSeizures

succTCHSeizures **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3315};

### C.3.3.16 attTCHSeizuresMeetingTCHBlockedState

attTCHSeizuresMeetingTCHBlockedState **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3316};

### C.3.3.17 allAvailableTCHAllocatedTime

allAvailableTCHAllocatedTime **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType2;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3317};

### C.3.3.18 meanTCHBusyTime

meanTCHBusyTime **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType2;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3318};

### C.3.3.19 meanTCHQueueLength

meanTCHQueueLength **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType2;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3319};

### C.3.3.20 nbrOfLostRadioLinksTCH

nbrOfLostRadioLinksTCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3320};

### C.3.3.21 nbrOfAvailableSDCCHs

nbrOfAvailableSDCCHs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3321};

### C.3.3.22 meanNbrOfBusySDCCHs

meanNbrOfBusySDCCHs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3322};

### C.3.3.23 maxNbrOfBusySDCCHs

maxNbrOfBusySDCCHs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3323};

### C.3.3.24 attSDCCHSeizuresMeetingSDCCHBlockedState

attSDCCHSeizuresMeetingSDCCHBlockedState **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3324};

### C.3.3.25 allAvailableSDCCHAllocatedTime

allAvailableSDCCHAllocatedTime **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3325};

### C.3.3.26 meanSDCCHQueueLength

meanSDCCHQueueLength **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3326};

### C.3.3.27 nbrOfLostRadioLinksSDCCH

nbrOfLostRadioLinksSDCCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3327};

### C.3.3.28 relativeTimeDLPowerControlAtMax

relativeTimeDLPowerControlAtMax **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3328};

### C.3.3.29 relativeTimeULPowerControlAtMax

relativeTimeULPowerControlAtMax **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3329};

### C.3.3.30 succInternalHDOsIntraCell

succInternalHDOsIntraCell **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3330};

### C.3.3.31 unsuccInternalHDOsIntraCell

unsuccInternalHDOsIntraCell **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3331};

### C.3.3.32 attIncomingInternalInterCellHDOs

attIncomingInternalInterCellHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3332};

### C.3.3.33 succIncomingInternalInterCellHDOs

succIncomingInternalInterCellHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3333};

### C.3.3.34 attOutgoingInternalInterCellHDOs

attOutgoingInternalInterCellHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3334};

### C.3.3.35 succOutgoingInternalInterCellHDOs

succOutgoingInternalInterCellHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3335};

### C.3.3.36 unsuccHDOsWithReconnection

unsuccHDOsWithReconnection **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3336};

### C.3.3.37 unsuccHDOsWithLossOfConnection

unsuccHDOsWithLossOfConnection **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3337};

### C.3.3.38 availablePDCH

availablePDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3338};

### C.3.3.39 meanNbrAvailablePDCH

meanNbrAvailablePDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3339};

### C.3.3.40 maxNbrAvailablePDCH

maxNbrAvailablePDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3340};

### C.3.3.41 minNbrAvailablePDCH

minNbrAvailablePDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3341};

### C.3.3.42 meanNbrOfOccPDCH

meanNbrOfOccPDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3342};



### C.3.3.43 maxNbrOfOccPDCH

maxNbrOfOccPDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3343};

### C.3.3.44 minNbrOfOccPDCH

minNbrOfOccPDCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3344};

### C.3.3.45 availablePDCHAllocatedTime

availablePDCHAllocatedTime **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3345};

### C.3.3.46 nbrPacketPagingMessagesPCHOnPCCCH

nbrPacketPagingMessagesPCHOnPCCCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3346};

### C.3.3.47 meanPPCHPAGCHQueueLengthOnPCCCH

meanPPCHPAGCHQueueLengthOnPCCCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3347};

### C.3.3.48 nbrOfPSPagesDiscardedFromPPCHQueueOnPCCCH

nbrOfPSPagesDiscardedFromPPCHQueueOnPCCCH **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3348};

### C.3.3.49 attPCReqAssPerCause

attPCReqAssPerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3349};

### C.3.3.50 succPDTCHAssProcsPerCause

succPDTCHAssProcsPerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3350};

### C.3.3.51 succPDTCHSeizures

succPDTCHSeizures **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3351};

### C.3.3.52 meanPacketQueueLength

meanPacketQueueLength **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3352};

### C.3.3.53 nbrOfServiceChanges

nbrOfServiceChanges **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3353};

## C.3.4 internal HDO Measurement Function Related Attributes

### C.3.4.1 attIncomingInternalInterCellHDOsPerOriginatingCell

attIncomingInternalInterCellHDOsPerOriginatingCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 341};

### C.3.4.2 succIncomingInternalInterCellHDOsPerOriginatingCell

succIncomingInternalInterCellHDOsPerOriginatingCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 342};

### C.3.4.3 attOutgoingInternalInterCellHDOsPerTargetCell

attOutgoingInternalInterCellHDOsPerTargetCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 343};

### C.3.4.4 succOutgoingInternalInterCellHDOsPerTargetCell

succOutgoingInternalInterCellHDOsPerTargetCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 344};

## C.3.5 MSC Measurement Function Related Attributes

### C.3.5.1 nbrOfClassMarkUpdates

nbrOfClassMarkUpdates **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 351};

### C.3.5.2 attMobileOriginatingCalls

attMobileOriginatingCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 352};

### C.3.5.3 succMobileOriginatingCalls

succMobileOriginatingCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 353};

### C.3.5.4 ansMobileOriginatingCalls

ansMobileOriginatingCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 354};

### C.3.5.5 attMobileTerminatingCalls

attMobileTerminatingCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 355};

### C.3.5.6 succMobileTerminatingCalls

succMobileTerminatingCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 356};

### C.3.5.7 ansMobileTerminatingCalls

ansMobileTerminatingCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 357};

### C.3.5.8 attMobileEmergencyCalls

attMobileEmergencyCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 358};

### C.3.5.9 succMobileEmergencyCalls

succMobileEmergencyCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 359};

### C.3.5.10 ansMobileEmergencyCalls

ansMobileEmergencyCalls **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3510};

### C.3.5.11 attCipherringModeControlProcs

attCipherringModeControlProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3511};

### C.3.5.12 succCipherringModeControlProcs

succCipherringModeControlProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3512};

### C.3.5.13 attInterrogationOfHLRsForRouting

attInterrogationOfHLRsForRouting **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3513};

#### C.3.5.14 succInterrogationOfHLRsMSRNObtained

succInterrogationOfHLRsMSRNObtained **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3514};

#### C.3.5.15 succInterrogationOfHLRsCallForwarding

succInterrogationOfHLRsCallForwarding **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3515};

#### C.3.5.16 attOpForMobileOriginatingPointToPointSMs

attOpForMobileOriginatingPointToPointSMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3516};

#### C.3.5.17 succOpForMobileOriginatingPointToPointSMs

succOpForMobileOriginatingPointToPointSMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3517};

#### C.3.5.18 attOpForMobileTerminatingPointToPointSMs

attOpForMobileTerminatingPointToPointSMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3518};

#### C.3.5.19 succOpForMobileTerminatingPointToPointSMs

succOpForMobileTerminatingPointToPointSMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3519};

### C.3.5.20 nbrOfTransCheckIMEIRequests

nbrOfTransCheckIMEIRequests **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3520};

### C.3.5.21 nbrOfWhiteAnsInMSC

nbrOfWhiteAnsInMSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3521};

### C.3.5.22 nbrOfGreyAnsInMSC

nbrOfGreyAnsInMSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3522};

### C.3.5.23 nbrOfBlackAnsInMSC

nbrOfBlackAnsInMSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3523};

### C.3.5.24 nbrOfUnknownIMEIAnsInMSC

nbrOfUnknownIMEIAnsInMSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3524};

### C.3.5.25 meanTimeToCallSetupService

meanTimeToCallSetupService **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3525};

### C.3.5.26 meanTimeToLocationUpdateService

meanTimeToLocationUpdateService **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType2;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3526};

### C.3.5.27 transSubIdentifiedWithTMSI

transSubIdentifiedWithTMSI **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3527};

### C.3.5.28 transSubIdentifiedWithIMSI

transSubIdentifiedWithIMSI **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3528};

### C.3.5.29 attTMSIReallocations

attTMSIReallocations **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3529};

### C.3.5.30 succTMSIReallocations

succTMSIReallocations **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3530};



### C.3.5.31 imsiDetachProcs

imsiDetachProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3531};

### C.3.5.32 imsiAttachProcs

imsiAttachProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3532};

### C.3.5.33 attIncomingExternalIntraMSCHDOs

attIncomingExternalIntraMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3533};

### C.3.5.34 succIncomingExternalIntraMSCHDOs

succIncomingExternalIntraMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3534};

### C.3.5.35 attOutgoingExternalIntraMSCHDOs

attOutgoingExternalIntraMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3535};

### C.3.5.36 succOutgoingExternalIntraMSCHDOs

succOutgoingExternalIntraMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3536};

### C.3.5.37 attIncomingInterMSCHDOs

attIncomingInterMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3537};

### C.3.5.38 succIncomingInterMSCHDOs

succIncomingInterMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3538};

### C.3.5.39 attOutgoingInterMSCHDOs

attOutgoingInterMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3539};

### C.3.5.40 succOutgoingInterMSCHDOs

succOutgoingInterMSCHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3540};

### C.3.5.41 attSubsequentInterMSCHDOsMSCa

attSubsequentInterMSCHDOsMSCa **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3541};

### C.3.5.42 succSubsequentInterMSCHDOsMSCa

succSubsequentInterMSCHDOsMSCa **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3542};

#### C.3.5.43 attSubsequentInterMSCHDOsMSCc

attSubsequentInterMSCHDOsMSCc **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3543};

#### C.3.5.44 succSubsequentInterMSCHDOsMSCc

succSubsequentInterMSCHDOsMSCc **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3544};

#### C.3.5.45 externalHDOs

externalHDOs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3545};

#### C.3.5.46 externalHDOsPerCause

externalHDOsPerCause **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType3;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3546};

#### C.3.5.47 unsuccExternHDOsWithReconnectionPerMSC

unsuccExternHDOsWithReconnectionPerMSC **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3547};

### C.3.5.48 unsuccExternHDOsWithLossOfConnectionPerMSC

unsuccExternHDOsWithLossOfConnectionPerMSC **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3548};

## C.3.6 external HDO Measurement Function Related Attributes

### C.3.6.1 attIncomingExternalIntraMSCHDOsPerOriginatingCell

attIncomingExternalIntraMSCHDOsPerOriginatingCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 361};

### C.3.6.2 succIncomingExternalIntraMSCHDOsPerOriginatingCell

succIncomingExternalIntraMSCHDOsPerOriginatingCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 362};

### C.3.6.3 attOutgoingExternalIntraMSCHDOsPerTargetCell

attOutgoingExternalIntraMSCHDOsPerTargetCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 363};

### C.3.6.4 succOutgoingExternalIntraMSCHDOsPerTargetCell

succOutgoingExternalIntraMSCHDOsPerTargetCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 364};

### C.3.6.5 attIncomingInterMSCHDOsPerOriginatingCell

attIncomingInterMSCHDOsPerOriginatingCell **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 365};**C.3.6.6 succIncomingInterMSCHDOsPerOriginatingCell**succIncomingInterMSCHDOsPerOriginatingCell **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 366};**C.3.6.7 attOutgoingInterMSCHDOsPerTargetCell**attOutgoingInterMSCHDOsPerTargetCell **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 367};**C.3.6.8 succOutgoingInterMSCHDOsPerTargetCell**succOutgoingInterMSCHDOsPerTargetCell **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 368};**C.3.7 HLR Measurement Function Related Attributes****C.3.7.1 nbrOfCurrentMSsRoamingOutsideHPLMN**nbrOfCurrentMSsRoamingOutsideHPLMN **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 371};**C.3.7.2 attReqForAuthSetsReceivedByHLRFromVLRs**attReqForAuthSetsReceivedByHLRFromVLRs **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 372};

### C.3.7.3 succReturnedAuthSetsFromHLRToVLRs

succReturnedAuthSetsFromHLRToVLRs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 373};

### C.3.7.4 emptyResponsesForAuthSetsFromHLRToVLRs

emptyResponsesForAuthSetsFromHLRToVLRs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 374};

### C.3.7.5 attInsertSubDataService

attInsertSubDataService **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 375};

### C.3.7.6 succInsertSubDataService

succInsertSubDataService **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 376};

### C.3.7.7 attLocationUpdate

attLocationUpdate **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 377};

### C.3.7.8 succLocationUpdate

succLocationUpdate **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 378};

### C.3.7.9 attSSRelatedOperationsInHLR

attSSRelatedOperationsInHLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType5;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 379};

### C.3.7.10 succSSRelatedOperationsInHLR

succSSRelatedOperationsInHLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType5;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3710};

### C.3.7.11 attReqForSMRoutingInfo

attReqForSMRoutingInfo **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3711};

### C.3.7.12 succReqForSMRoutingInfo

succReqForSMRoutingInfo **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3712};

### C.3.7.13 attSMDeliveryStatusReportProcs

attSMDeliveryStatusReportProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3713};

### C.3.7.14 succSMDeliveryStatusReportProcs

succSMDeliveryStatusReportProcs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3714};

### C.3.7.15 attNbrOfSendAlerts

attNbrOfSendAlerts **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3715};

### C.3.7.16 succNbrOfSendAlerts

succNbrOfSendAlerts **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3716};

### C.3.7.17 attReqForMSRN

attReqForMSRN **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3717};

### C.3.7.18 succReqForMSRN

succReqForMSRN **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3718};

## C.3.8 VLR Measurement Function Related Attributes

### C.3.8.1 attMSMemoryAvailableNotifications

attMSMemoryAvailableNotifications **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 381};

### C.3.8.2 succMSMemoryAvailableNotifications

succMSMemoryAvailableNotifications **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**



GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 382};

### C.3.8.3 attIdentificationReqToPVLRS

attIdentificationReqToPVLRS **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 383};

### C.3.8.4 succIdentificationReqToPVLRS

succIdentificationReqToPVLRS **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 384};

### C.3.8.5 attPageReqs

attPageReqs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 385};

### C.3.8.6 succPageReqs

succPageReqs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 386};

### C.3.8.7 attPageReqsPerLocationArea

attPageReqsPerLocationArea **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType6;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 387};

### C.3.8.8 succPageReqsPerLocationArea

succPageReqsPerLocationArea **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType6;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 388};

### C.3.8.9 attReqForAuthSetsSentToHLR

attReqForAuthSetsSentToHLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 389};

### C.3.8.10 succReceivedAuthSetsFromHLR

succReceivedAuthSetsFromHLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3810};

### C.3.8.11 emptyResponsesForAuthFromHLR

emptyResponsesForAuthFromHLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3811};

### C.3.8.12 attAuthProcsInVLR

attAuthProcsInVLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3812};

### C.3.8.13 succAuthProcsInVLR

succAuthProcsInVLR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3813};

### C.3.8.14 attIntraVLRLocationUpdates

attIntraVLRLocationUpdates **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3814};

### C.3.8.15 sucIntraVLRLocationUpdates

sucIntraVLRLocationUpdates **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3815};

### C.3.8.16 attInterVLRLocationUpdates

attInterVLRLocationUpdates **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3816};

### C.3.8.17 sucInterVLRLocationUpdates

sucInterVLRLocationUpdates **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3817};

### C.3.8.18 arrivalOfVisitorsFromOtherPLMNs

arrivalOfVisitorsFromOtherPLMNs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3818};

## C.3.9 EIR Measurement Function Related Attributes

### C.3.9.1 nbrOfReceivedIMEICheckReqs

nbrOfReceivedIMEICheckReqs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 391};

### C.3.9.2 nbrOfWhiteAnsInEIR

nbrOfWhiteAnsInEIR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 392};

### C.3.9.3 nbrOfGreyAnsInEIR

nbrOfGreyAnsInEIR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 393};

### C.3.9.4 nbrOfBlackAnsInEIR

nbrOfBlackAnsInEIR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 394};

### C.3.9.5 nbrOfUnknownIMEIAnsInEIR

nbrOfUnknownIMEIAnsInEIR **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 395};

## C.3.10 SMS Measurement Function Related Attributes

### C.3.10.1 attMobileOriginatingSMForwardings

attMobileOriginatingSMForwardings **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3101};

### C.3.10.2 succMobileOriginatingSMForwardings

succMobileOriginatingSMForwardings **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3102};

### C.3.10.3 attMobileTerminatingSMForwardings

attMobileTerminatingSMForwardings **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3103};

### C.3.10.4 succMobileTerminatingSMForwardings

succMobileTerminatingSMForwardings **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3104};

### C.3.10.5 attMobileTerminatingSMForwardingsSgsn

attMobileTerminatingSMForwardingsSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3104};

### C.3.10.6 succMobileTerminatingSMForwardingsSgsn

succMobileTerminatingSMForwardingsSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3106};

## C.3.11 SGSN Measurement Function Related Attributes

### C.3.11.1 nbrLlcFramesSent

nbrLlcFramesSent **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3111};**C.3.11.2 nbrllcFramesReceived**nbrllcFramesReceived **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3112};**C.3.11.3 errLlcFramesDetectedBySgsn**errLlcFramesDetectedBySgsn **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3113};**C.3.11.4 retransmittedLlcFramestoMs**retransmittedLlcFramestoMs **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3114};**C.3.11.5 uplinkSndcpNpduReceived**uplinkSndcpNpduReceived **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3115};**C.3.11.6 uplinkSndcpOctetReceivedMode**uplinkSndcpOctetReceivedMode **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3116};**C.3.11.7 downlinkSndcpNpdusent**downlinkSndcpNpdusent **ATTRIBUTE**

**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3117};

### C.3.11.8 downlinkSndcpOctetSent

downlinkSndcpOctetSent **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3118};

### C.3.11.9 attGprsAttach

attGprsAttach **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 3119};

### C.3.11.10 succGprsAttach

succGprsAttach **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 31110};

### C.3.11.11 attCombiAttach

attCombiAttach **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 31111};

### C.3.11.12 succCombiAttach

succCombiAttach **ATTRIBUTE****WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;

**BEHAVIOUR**

generalMeasurementAttributeBehaviour;

**REGISTERED AS** {gsm1204attribute 31112};

### C.3.11.13 attImcsiAttach

attImcsiAttach **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31113};

### C.3.11.14 succlmsiAttach

succlmsiAttach **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31114};

### C.3.11.15 nbrOfAttachedSub

nbrOfAttachedSub **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31115};

### C.3.11.16 meanNbrOfAttachedSub

meanNbrOfAttachedSub **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31116};

### C.3.11.17 maxNbrOfAttachedSub

maxNbrOfAttachedSub **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31117};

### C.3.11.18 attGprsDetachMs

attGprsDetachMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31118};



### C.3.11.19 attCombiDetachMs

attCombiDetachMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31119};

### C.3.11.20 attImsiDetachMs

attImsiDetachMs **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31120};

### C.3.11.21 attGprsdetachSgsn

attGprsdetachSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31121};

### C.3.11.22 succGprsdetachSgsn

succGprsdetachSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31122};

### C.3.11.23 attltraSgsnRaUpdate

attltraSgsnRaUpdate **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31123};

### C.3.11.24 succIntraSgsnRaUpdate

succIntraSgsnRaUpdate **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31124};

### C.3.11.25 attInterSgsnRaUpdate

attInterSgsnRaUpdate **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31125};

### C.3.11.26 succInterSgsnRaUpdate

succInterSgsnRaUpdate **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31126};

### C.3.11.27 attPTMSIRealloc

attPTMSIRealloc **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31127};

### C.3.11.28 succPTMSIrealloc

succPTMSIrealloc **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31128};

### C.3.11.29 attreqAuthSetsSentToHlrBySgsn

attreqAuthSetsSentToHlrBySgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31129};

### C.3.11.30 succReqAuthSetsHlr

SuccReqAuthSetsHlr **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31130};

### C.3.11.31 emptyResponsesForAuthSetsFromHlr

emptyResponsesForAuthSetsFromHlr **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31131};

### C.3.11.32 attAuthInSgsn

attAuthInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31132};

### C.3.11.33 succAuthInSgsn

succAuthInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31133};

### C.3.11.34 attIdentityReq

attIdentityReq **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31134};

### C.3.11.35 succIdentityReq

succIdentityReq **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31135};

### C.3.11.36 attCipheringModeControlPerSgsn

attCipheringModeControlPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31136};

### C.3.11.37 succCipheringModeControlPerSgsn

succCipheringModeControlPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31138};

### C.3.11.38 nbrOfSubStandby

nbrOfSubStandby **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31138};

### C.3.11.39 meanNbrOfSubStandby

meanNbrOfSubStandby **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31139};

### C.3.11.40 maxNbrOfSubStandby

maxNbrOfSubStandby **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31140};

### C.3.11.41 nbrOfSubReady

nbrOfSubReady **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31141};

### C.3.11.42 meanNbrOfSubReady

meanNbrOfSubReady **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31142};

### C.3.11.43 maxNbrOfSubReady

maxNbrOfSubReady **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31143};

### C.3.11.44 nbrOfCheckIMEIRequests

nbrOfCheckIMEIRequests **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31144};

### C.3.11.45 nbrOfWhiteAnswerInSgsn

nbrOfWhiteAnswerInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31145};

### C.3.11.46 nbrOfGreyAnswerInSgsn

nbrOfGreyAnswerInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31146};

### C.3.11.47 nbrOfBlackAnswerInSgsn

nbrOfBlackAnswerInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31147};

### C.3.11.48 nbrOfUnknownAnswerInSgsn

nbrOfUnknownAnswerInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31148};

### C.3.11.49 attPacketSwitchedPaging

attPacketSwitchedPaging **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31149};

### C.3.11.50 unsuccPacketSwitchedPaging

unsuccPacketSwitchedPaging **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31150};

### C.3.11.51 attPsPagingPerRoutingArea

attPsPagingPerRoutingArea **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType7;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31151};

### C.3.11.52 unsuccPsPagingPerRoutingArea

unsuccPsPagingPerRoutingArea **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType7;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31152};

### C.3.11.53 attActPdpContextMSPerSgsn

attActPdpContextMSPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**

GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31153};

### C.3.11.54 succActPdpContextMSPerSgsn

succActPdpContextMSPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31154};

### C.3.11.55 attActPdpContextDynMSPerSgsn

attActPdpContextDynMSPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31155};

### C.3.11.56 succActPdpContextDynMSPerSgsn

succActPdpContextDynMSPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31156};

### C.3.11.57 attDeactPdpContextMsPerSgsn

attDeactPdpContextMsPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31157};

### C.3.11.58 succDeactPdpContextMsPerSgsn

succDeactPdpContextMsPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31158};

### C.3.11.59 attDeactPdpContextGgsnPerSgsn

attDeactPdpContextGgsnPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31159};

### C.3.11.60 succDeactPdpContextGgsnPerSgsn

succDeactPdpContextGgsnPerSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31160};

### C.3.11.61 nbrSubsWithActivePdpInSgsn

nbrSubsWithActivePdpInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31161};

### C.3.11.62 meanSubsWithActivePdpInSgsn

meanSubsWithActivePdpInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31162};

### C.3.11.63 nmaxSubsWithActivePdpInSgsn

nmaxSubsWithActivePdpInSgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31163};

## C.3.12 GGSN Measurement Function Related Attributes

### C.3.12.1 attActPdpContextPerApnOfGgsn

attActPdpContextPerApnOfGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;



**REGISTERED AS** {gsm1204attribute 3121};

### C.3.12.2 succActPdpContextPerApnOfGgsn

succActPdpContextPerApnOfGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3122};

### C.3.12.3 attActPdpContextDnyPerApnOfGgsn

attActPdpContextDnyPerApnOfGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3123};

### C.3.12.4 succActPdpContextDnyPerApnOfGgsn

succActPdpContextDnyPerApnOfGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3124};

### C.3.12.5 attDeactPdpContextMsPerApnOfGgsn

attDeactPdpContextMsPerApnOfGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3125};

### C.3.12.6 succDeactPdpContextMsPerApnOfGgsn

succDeactPdpContextMsPerApnOfGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3126};

### C.3.12.7 attDeactPdpContextByGgsnPerApn

attDeactPdpContextByGgsnPerApn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**

generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3127};

### C.3.12.8 succDeactPdpContextByGgsnMsPerApn

succDeactPdpContextByGgsnMsPerApn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3128};

### C.3.12.9 nbrOfActivePdpContextsPerApnAtGgsn

nbrOfActivePdpContextsPerApnAtGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType1;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 3129};

### C.3.12.10 meanNbrOfActivePdpContextsPerApnAtGgsn

meanNbrOfActivePdpContextsPerApnAtGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31210};

### C.3.12.11 maxNbrOfActivePdpContextsPerApnAtGgsn

maxNbrOfActivePdpContextsPerApnAtGgsn **ATTRIBUTE**  
**WITH ATTRIBUTE SYNTAX**  
GSM1204TypeModule.GSMMeasurementType8;  
**BEHAVIOUR**  
generalMeasurementAttributeBehaviour;  
**REGISTERED AS** {gsm1204attribute 31211};

---

## C.4 Name Bindings

### C.4.1 BSS Name Binding

#### C.4.1.1 simpleScanner-bssFunction

simpleScanner-bssFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": bssFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 411};

### C.4.2 BSC Name Binding

#### C.4.2.1 bscMeasurementFunction-bsc

bscMeasurementFunction-bsc **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** bscMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1220: 1993": bsc;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 421};

### C.4.3 BTS Name Binding

#### C.4.3.1 cellMeasurementFunction-bts

cellMeasurementFunction-bts **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** cellMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1220: 1993": bts;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 431};

#### C.4.3.2 internalHdoMeasurementFunction-bts

internalHdoMeasurementFunction-bts **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** internalHdoMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1220: 1993": bts;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 432};

## C.4.4 MSC Name Binding

### C.4.4.1 mscMeasurementFunction-mscFunction

mscMeasurementFunction-mscFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** mscMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": mscFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 441};

### C.4.4.2 externalHdoMeasurementFunction-mscFunction

externalHdoMeasurementFunction-mscFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** externalHdoMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": mscFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 442};

### C.4.4.3 simpleScanner-mscFunction

simpleScanner mscFunction-**NAME BINDING**  
**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": mscFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 443};

## C.4.5 HLR Name Binding

### C.4.5.1 hlrMeasurementFunction-hlrFunction

hlrMeasurementFunction-hlrFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** hlrMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": hlrFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 451};

## C.4.5.2 simpleScanner-hlrFunction

simpleScanner-hlrFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": hlrFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 452};

## C.4.6 VLR Name Binding

### C.4.6.1 vlrMeasurementFunction-vlrFunction

vlrMeasurementFunction-vlrFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** vlrMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": vlrFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 461};

### C.4.6.2 simpleScanner-vlrFunction

simpleScanner-vlrFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": vlrFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 462};

## C.4.7 EIR Name Binding

### C.4.7.1 eirMeasurementFunction-eirFunction

eirMeasurementFunction-eirFunction **NAME BINDING**  
  
**SUBORDINATE OBJECT CLASS** eirMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": eirFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 471};

### C.4.7.2 simpleScanner-eirFunction

simpleScanner-eirFunction **NAME BINDING**

**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": eirFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 472};

## C.4.8 SMS Name Binding

### C.4.8.1 smsMeasurementFunction-smsGIWFunction

smsMeasurementFunction-smsGIWFunction **NAME BINDING**

**SUBORDINATE OBJECT CLASS** smsMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": smsGIWFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 481};

### C.4.8.2 simpleScanner-smsGIWFunction

simpleScanner-smsGIWFunction **NAME BINDING**

**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": smsGIWFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 482};

## C.4.9 SGSN Name Binding

Enter sgsn Name binding to network element function

### C.4.9.1 sgsnMeasurementFunction-sgsnFunction

sgsnMeasurementFunction-sgsnFunction **NAME BINDING**

**SUBORDINATE OBJECT CLASS** sgsnMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": sgsnFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE;**  
**DELETE;**

**REGISTERED AS** {gsm1204nameBinding 491};

### C.4.9.2 simpleScanner-sgsnFunction

simpleScanner-sgsnFunction **NAME BINDING**

**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": sgsnFunction;

**WITH ATTRIBUTE** scannerId;  
**CREATE**;  
**DELETE**;

**REGISTERED AS** {gsm1204nameBinding 492};

## C.4.10 GGSN Name Binding

Enter ggsn Name binding to network element function

### C.4.10.1 ggsnMeasurementFunction-vlrFunction

ggsnMeasurementFunction-ggsnFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** ggsnMeasurementFunction;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": vlrFunction;  
**WITH ATTRIBUTE** measurementFunctionId;  
**CREATE**;  
**DELETE**;

**REGISTERED AS** {gsm1204nameBinding 4101};

### C.4.10.2 simpleScanner-ggsnFunction

simpleScanner-ggsnFunction **NAME BINDING**  
**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": simpleScanner;  
**NAMED BY SUPERIOR OBJECT CLASS** "gsm1200: 1993": ggsnFunction;  
**WITH ATTRIBUTE** scannerId;  
**CREATE**;  
**DELETE**;

**REGISTERED AS** {gsm1204nameBinding 4102};

---

## C.5 Behaviour Definitions

### C.5.1 simple scanner behaviour

The behaviour of the simple scanner is defined in [ISO 10164-13] clause 8.1.1.3.

### C.5.2 general measurement function behaviour

generalMeasurementFunctionBehaviour **BEHAVIOUR**

**DEFINED AS**

"This object is defined to contain the various optional measurement packages, and one or more instances of this class may exist in the scope of the containing object. The scanner may scan the attributes of the object class in various combinations and permutations of packages, and further may scan simultaneously as many times as necessary within the processing limits of the network."

;

### C.5.3 general measurement package behaviour

generalMeasurementPackageBehaviour **BEHAVIOUR**

**DEFINED AS**

"Measurement packages are present in the Measurement Function Object (e.g. BSC Measurement Function), if the Network Element Function (e.g. BSC) containing the Measurement Function Object supports the required number of instances of the measurement included in the package according to the number of instances of the Measurement Function. The simple scanner has been designed to read the values of the attributes according to a given schedule."

;

### C.5.4 general measurement attribute behaviour

generalMeasurementAttributeBehaviour **BEHAVIOUR**

**DEFINED AS**

"The measurement that corresponds to this attribute, is described in annex B. The name of this attribute is given in the description part (D) of each measurement definition contained in annex B."

NOTE: To enable this attribute to be easily located, an index of these attributes is listed at the end of the present document.

;



## C.6 Abstract syntax definitions

This clause contains the ASN.1 module defining the attribute, Action and notification syntax's referenced by the attribute, Action and notification templates.

```
GSM1204TypeModule{
  ITU-T (0) identified-organization (4) etsi (0) mobileDomain (0)
  gsm-Operation-Maintenance (3)
  gsm-12-04 (4) informationModel (0) asn1Module (2)
  asn1TypeModule (0) }

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

IMPORTS
  gsm-12-04
  FROM GSM-DomainDefinitions{
  ITU-T (0) identified-organisation (4) etsi (0) mobileDomain (0)
  gsm-Operation-Maintenance (3) gsm-12-30 (30) informationModel (0)
  asn1Module (2) gsm-OM-DomainDefinitions (0) version1 (1)}
;

-- Object Identifiers.

-- Abstract Syntax

gsm1204abstractSyntax OBJECT IDENTIFIER ::= {gsm-12-04 protocolSupport (1) abstractSyntax (1)}
--

-- Information Model Related Identifiers
gsm1204informationModel OBJECT IDENTIFIER ::= {gsm-12-04 informationModel (0)}
gsm1204managedObjectClass OBJECT IDENTIFIER ::= {gsm1204informationModel managedObjectClass (3)}
gsm1204package OBJECT IDENTIFIER ::= {gsm1204informationModel package (4)}
gsm1204nameBinding OBJECT IDENTIFIER ::= {gsm1204informationModel nameBinding (6)}
gsm1204attribute OBJECT IDENTIFIER ::= {gsm1204informationModel attribute (7)}

-- Application Contexts
gsm1204ApplicationContext OBJECT IDENTIFIER ::= {gsm-12-04 protocolSupport (1) applicationContext
(0) gsm-Management (0)}

-- The following measurement types are defined.

GSMMeasurementType1 ::= INTEGER
GSMMeasurementType2 ::= REAL

GSMMeasurementType3 ::= SET OF SEQUENCE{
  cause Cause,
  value INTEGER }

Cause ::= INTEGER{

-- CM_SERVICE REJECT causes (GSM 04.08 [2]):

  imsiUnknownInHlr ( 1),
  illegalMs ( 2),
  imsiUnknownInVlr ( 3),
  imeiNotAccepted ( 4),
  illegalMe ( 5),
  plmnNotAllowed ( 6),
  locationAreaNotAllowed ( 7),
  nationalRoamingNotAllowedInLocationArea ( 8),
  networkFailure ( 9),
  congestion (10),
  serviceOptionNotSupported (11),
  requestedServiceOptionNotSubscribed (12),
  serviceOptionTemporarilyOutOfOrder (13),
  callCannotBeIdentified (14),
  semanticallyIncorrectMessage (15),
  invalidMandatoryInformation (16),
  messageTypeNonExistentOrNotImplemented (17),
  messageTypeNotCompatibleWithProtocolState (18),
  informationElementNonExistentOrNotImplemented (19),
  conditionalIeError (20),
  messageNotCompatibleWithProtocolState (21),
```

```

    protocolError (22),
    reservedRejectCause (23),

-- Internal and external Handover causes (GSM 08.08 [5]):

    uplinkQuality (24),
    uplinkStrength (25),
    downlinkQuality (26),
    downlinkStrenght (27),
    distance (28),
    betterCell (29),
    operationAndMaintenanceIntervention (30),
    directedRetry (31),
    -- valid for external handovers only:
    responseToMscInvocation (32),

-- Immediate assignment procedure causes (GSM 04.08 [2]):

    emergencyCall (33),
    callReEstablishment (34),
    answerToPaging (35),
    originatingCall (36),
    locationUpdating (37),
    otherProcedures (38),
    reservedEstablishmentCause (39) }

-- Interference band definitions (GSM 04.08 [2]):

GSMMeasurementType4 ::= SEQUENCE{
    channelsPerInterferenceBand1 REAL,
    channelsPerInterferenceBand2 REAL,
    channelsPerInterferenceBand3 REAL,
    channelsPerInterferenceBand4 REAL,
    channelsPerInterferenceBand5 REAL }

GSMMeasurementType5 ::= SET OF SEQUENCE{
    ssOperation SSOperation,
    value INTEGER
}

-- SS operation definitions(GSM 09.02 [7]):

SSOperation ::= INTEGER{
    register (0),
    erase (1),
    activate (2),
    deactivate (3),
    registerPassword (4),
    interrogateSSOperation (5),
    processRequest (6) }

GSMMeasurementType6 ::= SET OF SEQUENCE{
    locationAreaCode LAC,
    value INTEGER }

LAC ::= INTEGER (0..65535)
GSMMeasurementFunctionId ::= INTEGER

GSMCellName ::= SEQUENCE{
    cellId INTEGER(0..65535),
    locatioAreaCode LAC }

GSMMeasurementType7 ::= SET OF SEQUENCE{
    routingAreaCode RAC,
    value INTEGER }

RAC ::= INTEGER (0..255)

GSMMeasurementType8 ::= SET OF SEQUENCE{
    AccessPoint NameLogicalLinkID APNID,
    value INTEGER }

APNID ::= INTEGER (0..65535)

```

NOTE: The APN Logical Link ID, is a numeric value for the assigned to each APN link in the GGSN. The ID is only unique when presented together with the GGSN address.

END

---

## Annex D (normative): Data Transfer Requirements

This annex defines the data transfer requirements from the NE to the OS for the present document. The present document makes use of the generic approach to EFD, Log and File transfer facility as defined in GSM 12.00 [8].

---

### D.1 Data Transfer Requirements

#### D.1.1 General

The GSM 12.04 defines how statistical information concerning various aspects of the NE's can be collected. Once this data is collected and available in the NE, it shall be possible to transfer it to the OS. The way in which this can be achieved is described in GSM 12.00 [8].

GSM 12.00 [8] describes the generic solutions to data transfer requirements which are used by GSM 12.04. This annex describes the additional information required to fully satisfy the data transfer requirements of GSM 12.04, containment of which is described in annex C.

Of the data transfer functions described in GSM 12.00 [8], GSM 12.04 requires the upload function, i.e. OS controlled data transfer from NE to OS.

---

### D.2 Object Model

#### D.2.1 Managed Object Classes

##### D.2.1.1 "Recommendation X.721: 1992": log

Object instances of this class are used to store incoming event reports. An instance of this class can be created to store specifically scan report notifications (in form of "scanReportRecords" managed objects). This is achieved by using the discriminator construct and filtering on the event type information.

##### D.2.1.2 "Recommendation X.738: 1993": scanReportRecord

Objects of this class are used to represent logged information that resulted from Attribute Value Change Notifications and are contained in a 'log' instance.

#### D.2.2 Name Bindings

##### D.2.2.1 log-managedElement

log-managedElement **NAME BINDING**

**SUBORDINATE OBJECT CLASS** "Recommendation X.721: 1992": log;

**NAMED BY SUPERIOR OBJECT CLASS** "Recommendation M.3100: 1992": managedElement;

**WITH ATTRIBUTE** "Recommendation X.721: 1992": logId;

**CREATE**;

**DELETE**;

**REGISTERED AS** { gsm1204NameBinding 221 };

## D.2.2.2 scanReportRecord-log

scanReportRecord-log **NAME BINDING**

**SUBORDINATE OBJECT CLASS** "Recommendation X.738: 1993": scanReportRecord;

**NAMED BY SUPERIOR OBJECT CLASS** "Recommendation X.721: 1992": log;

**WITH ATTRIBUTE** "Recommendation X.721: 1992": logRecordId;

**DELETE**;

**REGISTERED AS** { gsm1204NameBinding 222 };

---

## Annex E (informative): Non Standardised Measurements of Interest to PLMN Management

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

### A. Description

- A short explanation of the measurement operation.

### B. Collection Method

- The form in which this measurement data is obtained:
  - **CC** (Cumulative Counter).
  - **GAUGE** (dynamic variable), used when data being measured can vary up or down during the period of measurement.
  - **DER** (Discrete Event Registration), when data related to a particular event are captured every nth event is registered, where n can be 1 or larger.
  - **SI** (Status Inspection).

### Inception of annex E

The annex E has been created to contain all the measurements that are **NOT** candidates for standardisation, (indication that they have been considered).

At the end of the annex there are also references to the Fixed Network measurements, which have been included for completeness.

NOTE: The measurements in this annex are for information only and as a consequence are **NOT** included in the Object Model (annex C).

---

## E.1 Measurement Related to the BSC

### E.1.1 BSC Measurement Function

None.

---

## E.2 Measurement Related to the BTS

### E.2.1 BTS Measurement Function

None.

### E.2.2 CELL Measurement Function

None.

### E.2.3 Internal HDO Measurement Function

None.

---

## E.3 Measurement Related to the MSC

### E.3.1 MSC Measurement Function

#### E.3.1.1 Attempted Mobile to Mobile Calls

- A. This measurement provides the number of mobile to mobile call attempts received by the MSC.
- B. CC.

#### E.3.1.2 Successful Mobile to Mobile Calls

- A. This measurement provides the number of successful mobile to mobile calls.
- B. CC.

#### E.3.1.3 Answered Mobile to Mobile Calls

- A. This measurement counts the number of answered mobile to mobile calls.
- B. CC.

#### E.3.1.4 Attempted Mobile to Land Calls

- A. This measurement provides the number of mobile to land call attempts received by the MSC.
- B. CC.

#### E.3.1.5 Successful Mobile to Land Calls

- A. This measurement provides the number of successful mobile to land calls.
- B. CC.

#### E.3.1.6 Answered Mobile to Land Calls

- A. This measurement provides the number of answered mobile to land calls.
- B. CC.

#### E.3.1.7 Attempted Land to Mobile Calls

- A. This measurement provides the number of land to mobile call attempts received by the MSC.
- B. CC.

#### E.3.1.8 Successful Land to Mobile Calls

- A. This measurement provides the number of successful land to mobile calls.
- B. CC.

#### E.3.1.9 Answered Land to Mobile Calls

- A. This measurement indicates the number of answered land to mobile calls.
- B. CC.

### E.3.1.10 Mean Holding Time of Calls

- A. This measurement provides the mean holding time of calls.
- B. CC.

### E.3.2 External HDO Measurement Function

None.

---

## E.4 Measurements related to the HLR

### E.4.1 HLR Measurement Function

#### E.4.1.1 Instantaneous number of HLR subscribers

- A. This measurement provides a running total of the number of subscribers for whom information is currently held the HLR.
- B. SI.

#### E.4.1.2 Barred subscribers in the HLR

- A. This measurement provides the number of barred subscribers in the HLR.
- B. SI.

#### E.4.1.3 Bearer service indication

- A. This measurement provides the number of subscribers with the specified bearer service.
- B. CC.

#### E.4.1.4 SS operation indication

- A. This measurement provides the number of subscribers with the specified SS operation.
- B. CC.

#### E.4.1.5 Attempted requests for Authentication sets from the AUC by the HLR

- A. This measurement counts the number of triplets requested from the AUC by the HLR.
- B. CC.



### E.4.1.6 Successful returned Authentication sets from the AUC to the HLR

- A. This measurement counts the successfully returned triplets from the AUC to the HLR.
- B. CC.

---

## E.5 Measurements related to the VLR

### E.5.1 VLR Measurement Function

#### E.5.1.1 Subscribers from other PLMNs registered in the VLR

- A. This measurement provides the number of subscribers of other PLMNs registered in the VLR.
- B. SI.

#### E.5.1.2 Number of roamers in the VLR

- A. This measurement provides the number of roamers which are registered in the VLR.
- B. SI.

---

## E.6 Measurements related to the EIR

None.

---

## E.7 Measurements related to the SMS-IWMSC/GMSC

None.

---

## E.8 Performance Measurements on non-specific GSM Objects

### E.8.1 Measurements related to a PCM system

According to ITU-T Recommendation Q.79x.

### E.8.2 Measurements related to MTP

According to ITU-T Recommendation Q.79x.

### E.8.3 Measurements related to SCCP and TCAP

According to ITU-T Recommendation Q.79x.

### E.8.4 Measurements related to ISUP

According to ITU-T Recommendation Q.79x.

## E.8.5 Measurements related to Internet Protocols

According to IETF RFC Recommendations.

## Annex F (informative): Index of Measurement Attribute Names

The measurement description (part D of annex B) provides for each measurement the equivalent measurement attribute name. This clause provides an index of all the attribute names which are used in annex B. This index is provided to enable the reader to forward or backward reference, these attributes in annex C.

### Measurement Attribute Name: Page

allAvailableSDCCHAllocatedTime, .....	44
allAvailableTCHAllocatedTime, .....	42
ansMobileEmergencyCalls,.....	56
ansMobileOriginatingCalls, .....	54
ansMobileTerminatingCalls, .....	55
arrivalOfVisitorsFromOtherPLMNs, .....	78
attAuthProcsInVLR, .....	77
attCipherringModeControlProcs, .....	56
attIdentificationReqToPVLRs, .....	74
attImmediateAssingProcs, .....	38
attImmediateAssingProcsPerBSC, .....	34
attImmediateAssingProcsPerCause, .....	38, 51
attIncomingExternalIntraMSCHDOs, .....	62
attIncomingExternalIntraMSCHDOsPerOriginatingCell, .....	67
attIncomingInterMSCHDOs, .....	63
attIncomingInterMSCHDOsPerOriginatingCell, .....	68
attIncomingInternalInterCellHDOs, .....	46
attIncomingInternalInterCellHDOsPerOriginatingCell, .....	52
attInsertSubDataService, .....	70
attInterrogationOfHLRsForRouting, .....	57
attInterVLRLocationUpdates, .....	78
attIntraVLRLocationUpdates, .....	77
attLocationUpdate, .....	71
attMobileEmergencyCalls, .....	55
attMobileOriginatingCalls, .....	54
attMobileOriginatingSMForwardings, .....	80
attMobileTerminatingCalls, .....	55
attMobileTerminatingSMForwardings, .....	81

attMSMemoryAvailableNotifications, .....	74
attNbrOfSendAlerts, .....	73
attOpForMobileOriginatingPointToPointSMs, .....	58
attOpForMobileTerminatingPointToPointSMs, .....	58
attOutgoingExternalIntraMSCHDOs, .....	63
attOutgoingExternalIntraMSCHDOsPerTargetCell, .....	67
attOutgoingInterMSCHDOs, .....	64
attOutgoingInterMSCHDOsPerTargetCell, .....	68
attOutgoingInternalInterCellHDOs, .....	46
attOutgoingInternalInterCellHDOsPerTargetCell, .....	53
attPageReqs, .....	75
attPageReqsPerLocationArea, .....	75
attReqForAuthSetsReceivedByHLR, .....	69
attReqForAuthSetsSentToHLR, .....	76
attReqForMSRN, .....	73
attReqForSMRoutingInfo, .....	72
attSDCCHSeizuresMeetingSDCCHBlockedState, .....	44
attSMDeliveryStatusReportProcs, .....	72
attSSRelatedOperationsInHLR, .....	71
attSubsequentInterMSCHDOsMSCa, .....	65
attSubsequentInterMSCHDOsMSCc, .....	65
attTCHSeizures, .....	41
attTCHSeizuresMeetingTCHBlockedState, .....	41
attTransOfPagingMessagesPerBSC, .....	33
attTransOfPagingMessagesThePCH, .....	37, 50
emptyResponsesForAuthFromHLR, .....	77
emptyResponsesForAuthSetsFromHLR, .....	70
externalHDOs, .....	66
externalHDOsPerCause, .....	66
imsiAttachProcs, .....	62
imsiDetachProcs, .....	62
maxNbrOfBusySDCCHs, .....	43
maxNbrOfBusyTCHs, .....	40, 49
meanDurationOfSuccPagingProcs, .....	39
meanInterArrivalTime, .....	33, 37

meanNbrOfBusySDCCHs, .....	43
meanNbrOfBusyTCHs, .....	40, 49
meanNbrOfIdleTCHsPerInterferenceBand, .....	41
meanPCHAGCHQueueLength, .....	37, 50
meanSDCCHQueueLength, .....	44
meanTCHBusyTime, .....	42
meanTCHQueueLength, .....	42
meanTimeToCallSetupService, .....	60
meanTimeToLocationUpdateService, .....	60
nbrOfAvailableSDCCHs, .....	43
nbrOfAvailableTCHs, .....	40
nbrOfBlackAnsInEIR, .....	80
nbrOfBlackAnsInMSC, .....	59
nbrOfClassMarkUpdates, .....	54
nbrOfCurrentMSsRoamingOutsideHPLMN, .....	69
nbrOfGreyAnsInEIR, .....	79
nbrOfGreyAnsInMSC, .....	59
nbrOfLostRadioLinksSDCCH, .....	45
nbrOfLostRadioLinksTCH, .....	43
nbrOfPagesDiscardedFromPCHQueue, .....	39, 50
nbrOfReceivedIMEICheckReqs, .....	79
nbrOfTransCheckIMEIRequests, .....	59
nbrOfUnknownIMEIAnsInEIR, .....	80
nbrOfUnknownIMEIAnsInMSC, .....	60
nbrOfWhiteAnsInEIR, .....	79
nbrOfWhiteAnsInMSC, .....	59
relativeTimeDLPowerControlAtMax, .....	45
relativeTimeULPowerControlAtMax, .....	45
succAuthProcsInVLR, .....	77
succCipherringModeControlProcs, .....	57
succIdentificationReqToPVLRs, .....	75
succImmediateAssingProcsPerBSC, .....	34
succImmediateAssingProcsPerCause, .....	39, 51
succIncomingExternalIntraMSCHDOs, .....	63
succIncomingExternalIntraMSCHDOsPerOriginatingCell, .....	67

succIncomingInterMSCHDOs, .....	64
succIncomingInterMSCHDOsPerOriginatingCell, .....	68
succIncomingInternalInterCellHDOs, .....	46
succIncomingInternalInterCellHDOsPerOriginatingCell, .....	53
succInsertSubDataService, .....	70
succInternalHDOsIntraCell, .....	45
succInternalHDOsIntraCellPerBSC, .....	34
succInternalHDOsPerBSC, .....	35
succInternalHDOsPerCause, .....	35
succInterrogationOfHLRsCallForwarding, .....	57
succInterrogationOfHLRsMSRNObtained, .....	57
succInterVLRLocationUpdates, .....	78
succIntraVLRLocationUpdates, .....	78
succLocationUpdate, .....	71
succMobileEmergencyCalls, .....	56
succMobileOriginatingCalls, .....	54
succMobileOriginatingSMForwardings, .....	81
succMobileTerminatingCalls, .....	55
succMobileTerminatingSMForwardings, .....	81
succMSMemoryAvailableNotifications, .....	74
succNbrOfSendAlerts, .....	73
succOpForMobileOriginatingPointToPointSMs, .....	58
succOpForMobileTerminatingPointToPointSMs, .....	58
succOutgoingExternalIntraMSCHDOs, .....	63
succOutgoingExternalIntraMSCHDOsPerTargetCell, .....	68
succOutgoingInterMSCHDOs, .....	64
succOutgoingInterMSCHDOsPerTargetCell, .....	69
succOutgoingInternalInterCellHDOs, .....	47
succOutgoingInternalInterCellHDOsPerTargetCell, .....	53
succPageReqs, .....	75
succPageReqsPerLocationArea, .....	76
succReceivedAuthSetsFromHLR, .....	76
succReqForMSRN, .....	74
succReqForSMRoutingInfo, .....	72
succReturnedAuthSetsFromHLR, .....	70

succSMDeliveryStatusReportProcs, .....	73
succSSRelatedOperationsInHLR, .....	71
succSubsequentInterMSCHDOsMSCa, .....	65
succSubsequentInterMSCHDOsMSCc, .....	65
succTCHSeizures, .....	41, 51
succTMSIReallocations, .....	62
transSubIdentifiedWithIMSI, .....	61
transSubIdentifiedWithTMSI, .....	61
unsuccExternHDOsWithLossOfConnectionPerMSC, .....	66
unsuccExternHDOsWithReconnectionPerMSC, .....	66
unsuccHDOsWithLossOfConnection, .....	47
unsuccHDOsWithReconnection, .....	47
unsuccInternalHDOsIntraCell, .....	46
unsuccInternalHDOsIntraCellPerBSC, .....	35
unsuccInternalHDOsWithLossOfConnectionPerBSC, .....	36
unsuccInternalHDOsWithReconnectionPerBSC, .....	36
unsuccReqsForService, .....	33
unsuccReqsForServicePerCause, .....	33
unsuccTransOfPagingMessagesPerBSC, .....	34
unsuccTransOfPagingMessagesThePCH, .....	38

---

## Annex G (informative): Bibliography

This clause provides references to documents which are not directly referenced by the present document, but nevertheless are useful for back ground information on this subject.

- ITU-T Recommendations E.500: "Traffic intensity measurement principles".
- ITU-T Recommendation E.600: "Terms and definitions of traffic engineering".
- ITU-T Recommendation M.3010: "Principles for a Telecommunications management network".
- ITU-T Recommendation M.3200: "TMN management services and telecommunications managed areas: overview".
- ITU-T Recommendation M.3400: "TMN Management Functions".
- ITU-T Recommendation M.251: "Maintenance Functions to Be Implemented in ITU-T-MML - General Maintenance Principles - Maintenance of International Transmission Systems and Telephone Circuits (Study Group IV) 29 pp".
- ITU-T Recommendation Q.542: "Digital exchange design objectives - Operations and maintenance".
- ITU-T Recommendation Q.544: "Digital exchange measurements".
- ITU-T Recommendation Q.822: "Stage 1, stage 2 and stage 3 description for the Q3 interface – Performance management".
- ITU-T Recommendation Z.336: "Traffic measurement administration".



## Annex H (informative): Change history

Change history								
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Cat	Old	New
Jun 2001	SA_12	SP-010237	--	--	Submitted as to TSG SA #12 for Information (this part maintains the relevant clauses of GSM 12.04 for the future in 3GP)	--	1.0.0	
Sep 2001	SA_13	SP-010467	--	--	Submitted to TSG SA #13 for Approval. TS# changed from 32.402 to 52.402 as being GSM-only.	--	2.0.0	4.0.0
Jun 2002	SA_16	SP-020292	0001	--	Correction of erroneous definitions of SGSN measurements	A	4.0.0	4.1.0
Jun 2002	SA_16	SP-020293	0002	--	Remove irrelevant definitions for SGSN measurements related to Ciphering Mode	A	4.0.0	4.1.0
Mar 2003	SA_19	SP-030040	--	--	Request approved for Automatic upgrade to Rel-5 (i.e. no CR)	--	4.1.0	5.0.0
Sep 2004	SA_25	SP-040541	--	--	Automatic upgrade to Rel- 6 (no CR) as per request in SP-040541 SA5_presentation_SA_25.ppt (slide 17)	--	5.0.0	6.0.0
Dec 2005	SA_30	SP-050705	0003	--	Correct counter name nbrOfGreyAnswerInSgsn	F	6.0.0	6.1.0
Jun 2007	SA_36	--	--	--	Automatic upgrade to Rel-7 (no CR) at freeze of Rel-7. Reference [32] 3GPP TS 32.403 was "Voided". Reason: discontinued from Rel-6 onwards and the material was used in a set of new Rel-7 specifications - see [33]. Introduction updated accordingly.	--	6.1.0	7.0.0
Dec 2007	SA_38	SP-070741	0004	--	Add measurements related to number of octets of uplink and downlink BSSGP PDU	B	7.0.0	8.0.0
Dec 2007	SA_38	SP-070741	0005	--	Add measurements related to mean number of PDCH for GPRS and EGPRS	B	7.0.0	8.0.0
Dec 2007	SA_38	SP-070741	0006	--	Add measurements related to mean number of GPRS and EGPRS TBF for downlink	B	7.0.0	8.0.0
Dec 2007	SA_38	SP-070741	0007	--	Add measurements related to throughput of EGPRS RLC layer	B	7.0.0	8.0.0
Dec 2009	-	-	-	-	Update to Rel-9 version	--	8.0.0	9.0.0
2011-03	-	-	-	-	Update to Rel-10 version (MCC)	--	9.0.0	10.0.0
2012-09	-	-	-	-	Update to Rel-11 version (MCC)		10.0.0	<b>11.0.0</b>
2014-10	-	-	-	-	Update to Rel-12 version (MCC)		11.0.0	<b>12.0.0</b>
2016-01	-	-	-	-	Update to Rel-13 version (MCC)		12.0.0	<b>13.0.0</b>
2016-03	SA_71	SP-160060	0008	2	Add usage of measurements for EE	F	13.0.0	<b>13.1.0</b>
2017-04	SA#75	-	-	-	Promotion to Release 14 without technical change		13.1.0	<b>14.0.0</b>

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2018-03	SA#79	SP-180060	0009	-	B	Introduction of power, energy and environment related measurements and related use case description.	15.0.0
2020-07	-	-	-	-	-	Update to Rel-16 version (MCC)	<b>16.0.0</b>
2022-04	-	-	-	-	-	Update to Rel-17 version (MCC)	<b>17.0.0</b>

---

# History

<b>Document history</b>		
V17.0.0	May 2022	Publication