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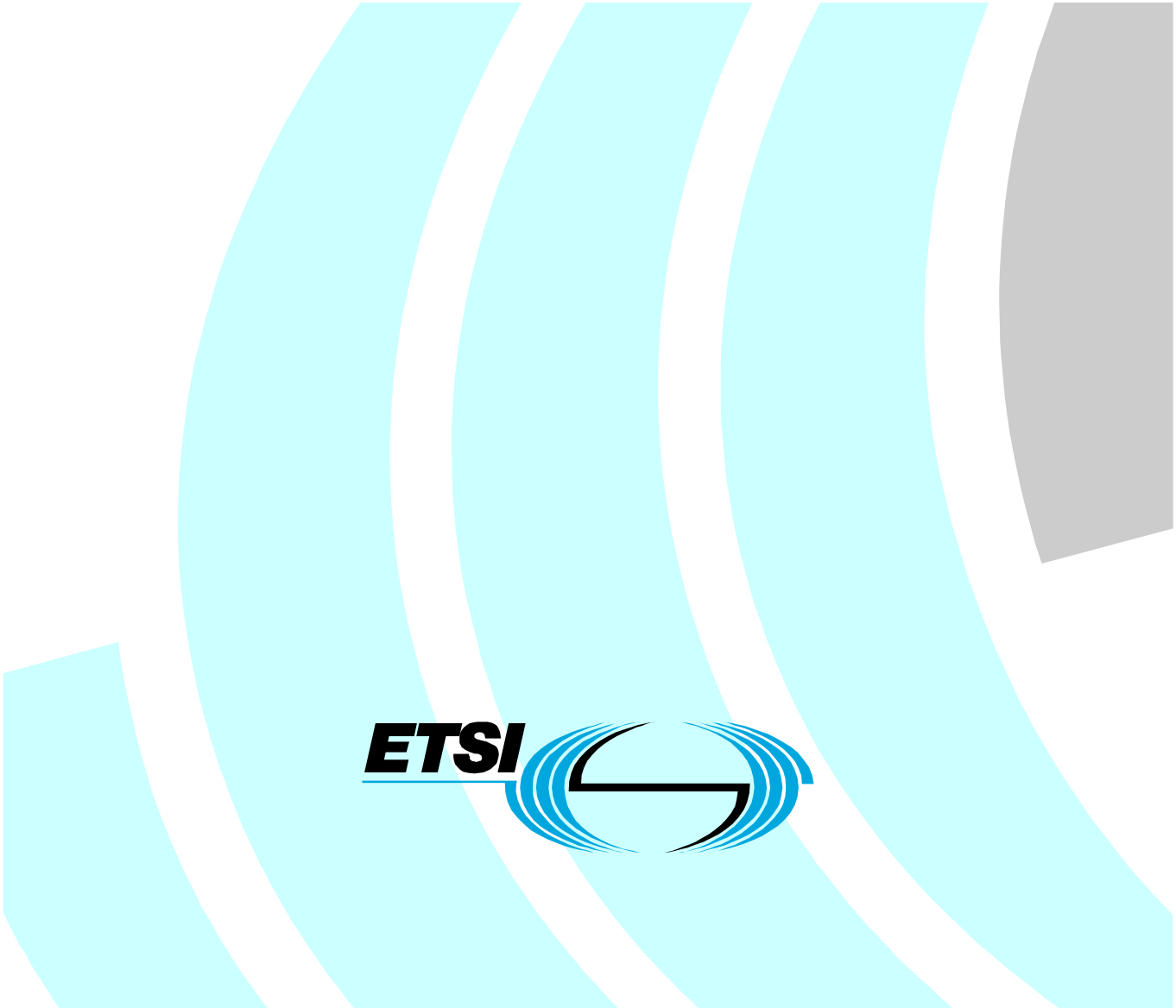
Technical Specification

**Speech Processing, Transmission and Quality Aspects (STQ);
QoS aspects for popular services in GSM and 3G networks;
Part 2: Definition of Quality of Service parameters
and their computation**



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Speech Processing, Transmission and Quality Aspects (STQ).

The present document is part 2 of a multi-part deliverable covering the QoS aspects for popular services in GSM and 3G networks, as identified below:

Part 1: "Identification of Quality of Service aspects";

Part 2: "Definition of Quality of Service parameters and their computation";

Part 3: "Typical procedures for Quality of Service measurement equipment";

Part 4: "Requirements for Quality of Service measurement equipment";

Part 5: "Definition of typical measurement profiles";

Part 6: "Post processing and statistical methods".

Part 1 identifies QoS aspects for popular services in GSM and 3G networks. For each service chosen QoS indicators are listed. They are considered to be suitable for the quantitatively characterization of the dominant technical QoS aspects as experienced from the end-customer perspective.

Part 2 defines QoS parameters and their computation for popular services in GSM and 3G networks. The technical QoS indicators, listed in part 1, are the basis for the parameter set chosen. The parameter definition is split into two parts: the abstract definition and the generic description of the measurement method with the respective trigger points. Only measurement methods not dependent on any infrastructure provided are described in the present document. The harmonized definitions given in the present document are considered as the prerequisites for comparison of QoS measurements and measurement results.

Part 3 describes typical procedures used for QoS measurements over GSM, along with settings and parameters for such measurements.

Part 4 defines the minimum requirements of QoS measurement equipment for GSM and 3G networks in the way that the values and trigger-points needed to compute the QoS parameter as defined in part 2 can be measured following the procedures defined in part 3. Test-equipment fulfilling the specified minimum requirements, will allow to perform the proposed measurements in a reliable and reproducible way.

Part 5 specifies test profiles which are required to enable benchmarking of different GSM or 3G networks both within and outside national boundaries. It is necessary to have these profiles so that when a specific set of tests are carried out then customers are comparing "like for like" performance.

Part 6 describes procedures to be used for statistical calculations in the field of QoS measurement of GSM and 3G networks using probing systems.

Introduction

All the defined quality of service parameters and their computations are based on field measurements. That indicates that the measurements were made from customers point of view (full End-to-end perspective, taking into account the needs of testing).

It is assumed that the end-customer can handle his mobile and the services he wants to use (operability is not evaluated at this time). For the purpose of measurement it is assumed that:

- the service is available and not barred for any reason;
- routing is defined correctly without errors; and
- the target subscriber equipment is ready to answer the call.

Voice quality values measured should only be employed by calls ended successfully for statistical analysis.

However, measured values from calls ended unsuccessfully (e.g. dropped) should be available for additional evaluations and therefore, must be stored.

Further preconditions may apply when reasonable.

1 Scope

The present document defines QoS parameters and their computation for popular services in GSM and 3G networks.

The technical QoS indicators, listed in TS 102 250-1 [5], are the basis for the parameter set chosen. The parameter definition is split into two parts: the abstract definition and the generic description of the measurement method with the respective trigger points. Only measurement methods not dependent on any infrastructure provided are described in the present document.

NOTE: Computation of certain parameters may depend in the vary cellular system, i.e. GSM or 3GPP specified 3G system. In this case respective notification is provided.

The harmonized definitions given in the present document are considered as the prerequisites for comparison of QoS measurements and measurement results.

2 References

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

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ITU-T Recommendation P.862: "Perceptual evaluation of speech quality (PESQ), an objective method for end-to-end speech quality assessment of narrowband telephone networks and speech codecs".

[2] ETSI TS 123 107: "Universal Mobile Telecommunications System (UMTS); Quality of Service (QoS) concept and architecture (3GPP TS 23.107 Release 5)".

[3] WAP Forum: "Multimedia Messaging Service Client Transaction Specification", WAP-206-MMSCTR-20020115-a.

[4] PRD IR.43: "Typical procedures for QoS measurement equipment".

[5] ETSI TS 102 250-1: "Speech Processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 1: Identification of Quality of Service aspects".

[6] ETSI TS 102 250-3: "Speech processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 3: Typical procedures for Quality of Service measurement equipment".

3 Abbreviations

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

3G	3rd Generation
3GPP	3rd Generation Partnership Project
AD	Access Delay
ATDT	ATtention Dial Tone
CCR	Call Completion Ratio

CR	Completion Ratio
CSD	Circuit Switched Data
DQ	Data Quality
DT	Delivery Time
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
MMS	Multimedia Messaging Service
MMSC	Multimedia Messaging Service Centre
MO	Mobile Originated
MOS	Mean Opinion Score
MS	Mobile Station
MT	Mobile Terminated
NA	Network Access
NA-CS	Network Access Circuit switched
NA-PS	Network Access Packet switched
NNA	Network Non Accessibility
PDP	Packet Data Protocol
PESQ	Perceptual Evaluation of Speech Quality
PSD	Packet Switched Data
QoS	Quality of Service
RT	Real Time
SA	Service Access
SA-T	Service Accessibility-Telephony
SMC	Short Message Centre
SMS	Short Message Service
SMSC	Short Message Service Centre
SpQ	Speech Quality
ST-T	Setup Time Telephony
ST	Setup Time
WAP	Wireless Application Protocol
WGR	WAP Get Request

4 QoS Parameter

4.1 Overview

Figure 1 shows a model for quality of service parameters. This model has three layers.

The first layer is the Network Access, the basic requirement for all the other QoS aspects and QoS parameters. The outcome of this layer is the QoS parameter Network Accessibility

The second layer contains the other three QoS aspects Service Access, Service Integrity and Service Retainability.

The different services are located in the third layer. Their outcome are the QoS parameters.

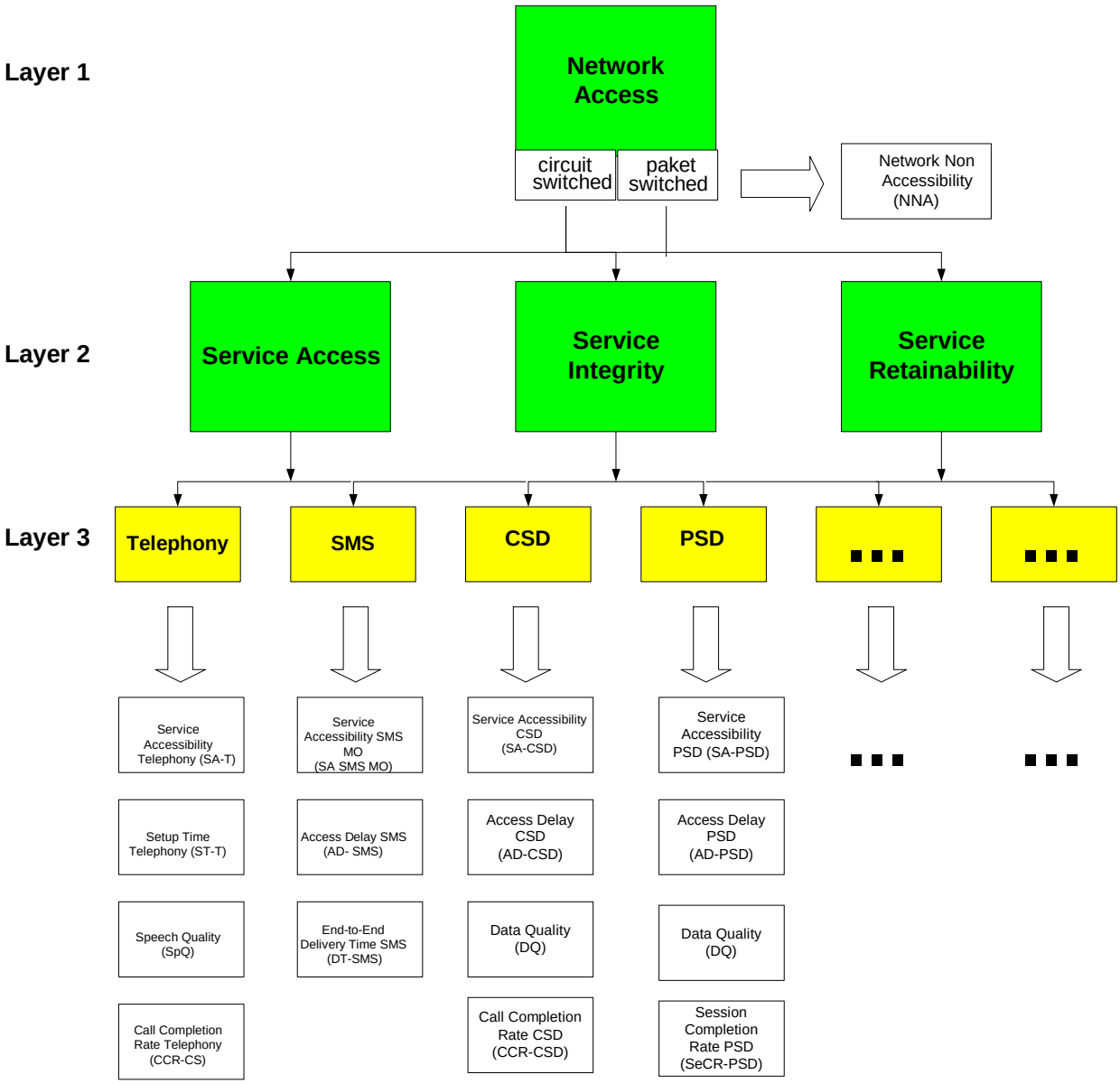

Figure 1: QoS aspects and the corresponding QoS parameters

4.2 Service independent

4.2.1 Network Accessibility Circuit Switched (NA - CS)

4.2.1.1 Abstract definition

Probability that the Mobile Services are offered to an end-customer by the target network indicators on the Mobile Equipment in idle mode.

4.2.1.2 Computation

Abstract formula:

$$\text{NA - CS}_{\text{gsm}}[\%] = \frac{\text{Number of measurement samples with C1} > 0}{\text{Number of all measurement samples}} \times 100\ \%$$

Trigger points:

GSM: C1-Criteria > 0. Any emergency camping on any other than the target networks is considered as no network.

The target networks could constitute more than one network, e.g. to cover national or international roaming.

The sampling rate should be the same or a multiple of the Service Accessibility sampling rate. In order to compare the Network Accessibility with the Service Accessibility the sampling rate must be the same.

4.2.2 Network Accessibility Packet Switched (NA - PS)

4.2.2.1 Abstract definition

Probability that the Mobile Services are offered to an end-customer by the target network indicators on the Mobile Equipment in Standby mode.

4.2.2.2 Computation

Abstract formula:

$$\text{NA - PS}[\%] = \frac{\text{Number of measurement samples with C1} > 0 \text{ and GPRS enabled for Cell}}{\text{Number of all measurement samples}} \times 100\ \%$$

Trigger points:

GSM: C1-Criteria > 0. And GPRS available in cell as designated in System Information Type 4 message or System Information Type 7 and 8 messages. The target networks could constitute more than one network, e.g. to cover national or international roaming.

The sampling rate should be the same or a multiple of the Service Accessibility sampling rate. In order to compare the Network Accessibility with the Service Accessibility the sampling rate must be the same.

4.3 Telephony

4.3.1 Service Accessibility-Telephony (SA-T)

4.3.1.1 Abstract definition

Probability that the end-customer can access the Mobile Telephony Service when requested if it is offered by display of the network indicator on the Mobile Equipment.

4.3.1.2 Computation

There are two possibilities for a successful call attempt:

- The customer hears the alerting
- B-party is busy

It is assumed that the routing to the destination is successful (without any failures).

Abstract formula:

$$\text{Service Accessibility Telephony}[\%] = \frac{\text{Number of successful call attempts}}{\text{Number of call attempts}} \times 100\ \%$$

Trigger points:

Beginning of the call attempt:	successful pressing send button (it is important to check, if coverage has been given when send button is pressed, otherwise this Call Attempt counts to Network Non Accessibility (NNA)).
Successful call attempt:	connect measurement (e.g. alerting or busy heard by A-party).

4.3.2 Setup Time Telephony (ST-T)

4.3.2.1 Abstract definition

Time between sending of complete address information and receipt of call set-up notification.

4.3.2.2 Computation

Abstract formula:

$$\text{Setup Time Telephony } [s] = t_2 - t_1$$

t_2: point of time where connect is established (e.g. alerting or subscriber busy is detected by test equipment)) see note

t_1: point of time where the customer presses the send button on mobile equipment

NOTE: If you do not establish an end to end connection afterwards you must ignore this measurement. It is assumed that early traffic channel assignment is used.

Trigger points:

Beginning of the Setup Time measurement:	Successful pressing send button (it is important to check, if coverage has been given, otherwise this Call Attempt counts to Network Non Accessibility (NNA)).
Successful connection:	Connect measurement (e.g. alerting or busy heard by A-party).

4.3.3 Speech Quality (SpQ)

4.3.3.1 Abstract definition

Indicator representing the quantification of the end-to-end speech transmission quality of the Mobile Telephony Service.

4.3.3.2 Computation

The validation of the end-to-end quality is made using the MOS scale. This scale describes the opinion of customers with voice transmission and its troubles (noise, robot voice, echo, dropouts etc). The speech quality measurement is taken per call.

Reference: (PESQ Algorithm) ITU-T Recommendation P.862 [1].

Abstract formula:

$$\text{SpQ(received A - side)} = f(\text{MOS})$$
$$\text{SpQ(received B - side)} = f(\text{MOS})$$

Optionally it might be useful to aggregate both speech quality values into one. In this case the worst of both shall be used. This aggregated speech quality value shall be called SpQ (min).

Trigger points:

Beginning of connection: Interchange speech samples between a-party and b-party

End of connection: Release of connection

NOTE: The acoustic behaviour of terminals is not part of this speech quality measurement.

4.3.4 Call Completion Rate Circuit Switched Telephony (CCR-CS-T)

4.3.4.1 Abstract definition

Probability that a successful call attempt is maintained for a predetermined time until it is released intentionally by A- or B-party.

4.3.4.2 Computation

Abstract formula:

$$\text{CCR - CS - T}[\%] = \frac{\text{Number of intentionally terminated telephony calls}}{\text{Number of successful telephony call attempts}} \times 100\ \%$$

Trigger points:

Successful call attempt: Connect measurement (e.g. "alerting" or "busy" detected by A-party)

Terminated call: Release of connection directly by A- or B-party

4.4 Short Message Service (SMS)

4.4.1 Service Accessibility SMS MO (SA SMS MO)

4.4.1.1 Abstract definition

Probability that the end-customer can access the Short Message Service when requested while it is offered by display of the network indicator on the Mobile Equipment. In this case the customer wants to send a Short Message.

4.4.1.2 Computation

NOTE: For the trigger point explained here, the connection over the air interface must be measured (e.g. Layer-3) and the answers of the SMSC must be counted statistically. The protocol for every connection shows the deviation from the successful service access.

Only the first try should be measured. If the Short Message is established with the second try this should not be counted.

Abstract formula:

$$\text{Service Accessibility SMS MO}[\%] = \frac{\text{Number of successful SMS service attempts}}{\text{Number of all SMS service attempts}}$$

Trigger points [e.g. Layer-3 messages]:

Start SMS service attempt: Initiate sending a SMS.

Successful SMS service attempt: Receiving acknowledgement of the SMSC.

4.4.2 Access Delay SMS MO (AD SMS-MO)

4.4.2.1 Abstract definition

Time between sending a Short Message to a Short Message Centre (SMC) and receiving the notification from the Short Message Centre.

4.4.2.2 Computation

Abstract formula:

$$\text{Access Delay SMS MO}[s] = t_{\text{receive}} - t_{\text{send SMS}}$$

$t_{receive}$: point of time the mobile equipment receives the confirmation from the SMS Centre

$t_{send\ SMS}$: point of time the customer sends his SMS to the SMS Centre

Trigger points [e.g. Layer-3 messages]:

Start SMS service attempt: Initiate sending a SMS.

Successful SMS service attempt: Receiving acknowledgement of the SMSC.

4.4.3 End-to-end Delivery Time SMS (DT SMS)

4.4.3.1 Abstract definition

Time between sending a Short Message to a Short Message Centre and receiving the very same Short Message on another mobile equipment.

4.4.3.2 Computation

Abstract formula:

$$\text{End-to-End Delivery Time SMS}[s] = t_{\text{receive SMS}} - t_{\text{send SMS}}$$

$t_{receive\ SMS}$: point of time the mobile equipment 2 receives the Short Message from mobile equipment 1

$t_{send\ SMS}$: point of time the customer sends his Short Message to the SMS Centre

Trigger points:

Start SMS service attempt: Initiate sending a SMS

End SMS service attempt: Receiving SMS on Mobile Equipment 2

4.4.4 Completion Rate SMS Circuit Switched (CR SMS CS)

4.4.4.1 Abstract definition

Ratio of received and send Test SMS from one mobile to another mobile part, excluding duplicate received and corrupted Test SMS.

A corrupted Test SMS is a SMS with at least one bit error.

For test and measurement purposes a message is considered valid if it is delivered successfully within a time window defined (see PRD IR.43 [4]).

4.4.4.2 Computation

Abstract formula:

$$\text{CR SMS CS } [\%] = \frac{\text{successful received Test SMS - duplicate received Test SMS - corrupted Test SMS}}{\text{Number of all send Test SMS}}$$

Trigger points:

Successfully send and received SMS via SMSC.

Time window of measurements according to customer profile.

4.5 Circuit Switched Data Service

4.5.1 Service Accessibility, Circuit Switched Data (SA - CSD)

4.5.1.1 Abstract definition

Probability that the end-customer's DTE can access the Mobile Data Service when requested. This will be indicated by the DTE receiving the valid connect message from the distant DTE.

Probability that the end-customer's DTE can access the Mobile Data Service when requested.

There are 2 layers of accessibility for CSD:

- Access to the target network DCE;
- Access to the required data service provided by a data server.

To a customer, these 2 events would be seamless and therefore the calculation for the service access should be a composite of these 2 activities. The field test system therefore must automate and combine the two layers to provide a single SA-CSD metric.

To combine the 2 layers should involve calculation of the success of the following actions:

- ATDT command including target number;
- Receive Connect from target network DCE;
- Send relevant command to target Data Server;
- Receive valid response from Data Server.

The specific commands and responses from data servers will be detailed in TS 102 250-3 [6].

4.5.1.2 Computation

A successful call attempt is when the A-party DTE receives valid response from test server. This can either be a dedicated data test server or a data server accessed when testing functionality via the public internet.

Abstract formula:

$$\text{Service Accessibility CSD} = \frac{\text{Number of successful call attempts}}{\text{Number of call attempts}}$$

Trigger points:

Beginning of the call attempt: ATDT command with dialled number sent by A-party DTE.

Successful call attempt: Valid response received from Data Server.

4.5.2 Set-up Time (ST - CSD)

4.5.2.1 Abstract definition

Time between sending of complete address information in ATDT command by A-party and receipt of valid response from data server.

4.5.2.2 Computation

Abstract formula:

$$\text{Set - up Time Circuit Switched Data [s]} = t_2 - t_1$$

t_1: point of time where A-party DTE sends ATDT command

t_2: point of time where connect is established (valid response received by A-party from data server)

Trigger points:

Beginning of the Set-up time measurement: Sending of ATDT command by A-party.

Successful connection: Valid response received from Data Server.

4.5.3 Data Quality (DQ-CSD)

For definitions of Data Quality Parameters refer to clause 4.7.

4.5.4 Completion Rate Circuit Switched Data (CR-CSD)

4.5.4.1 Abstract definition

Probability that a successful call attempt is not released except when intended by any of the parties involved in the call.

4.5.4.2 Computation

Abstract formula:

$$\text{Call completion Ratio CSD} = \frac{\text{Number of calls terminated by end users}}{\text{Number of successful data call attempts}}$$

Trigger points:

Successful call attempt: Valid response received by A-party DTE.

Completed call: DTE "ready" only when call ended by either party intentionally.

4.6 Packet Switched Data Service (General Packet Radio Service)

4.6.1 Key Performance Indicators method A

Tbd.

4.6.2 Key Performance Indicators method B

Tbd.

4.6.3 Performance Indicators

Tbd.

4.7 Data Service Class definitions and measurements

The following definitions for data services and data quality DQ are relevant for both circuit switched and packet switched data as, the different classes of data service will be applied identically irrespective of the data bearer system.

Session /call duration for individual data service class definitions are specified in TS 102 250-5.

Note that data quality will be a result of an overall call or session. For test purposes it may be desirable to break this down into geographically distinct measurements but for QoS reporting should be kept to call or session lengths.

Data classes are defined in TS 123107 [2], see table 1.

Table 1: UMTS QoS classes

Traffic class	Conversational class conversational RT	Streaming class streaming RT	Interactive class Interactive best effort	Background Background best effort
Fundamental characteristics	Preserve time relation (variation) between information entities of the stream Conversational pattern (stringent and low delay)	Preserve time relation (variation) between information entities of the stream	Request response pattern Preserve payload content	Destination is not expecting the data within a certain time Preserve payload content
Example of the application	Voice	Streaming video	Web browsing	Background download of emails

4.7.1 Conversational class data

4.7.1.1 Abstract definition

Indicator representing the end-to-end data transmission quality of the Conversational Class Data Service. This represents full duplex transfer of data in near real time.

4.7.1.2 Computation

The end-to-end data quality is validated by measuring the average data throughput in both up-link and down link direction on a best effort basis. The data throughput measurement will be computed and averaged over the duration of the session/call and reported in bits per second. Additionally the minimum throughput averaged over 10 % of the overall call/session length, the maximum throughput over 10 % of the overall call/session length and worst. The worst delay time for the call/session should also be reported.

Abstract formula:

$$\boxed{\begin{aligned}&DQ(\text{received A - side}) = X \text{ bits/sec}\\&DQ(\text{received B - side}) = X \text{ bits/sec}\end{aligned}}$$

Trigger points:

Beginning of call/session data sample: Interchange data frames of predefined data between A and B-party DTE.

End of call/session data sample: Calculation of average data throughput for Call/session data sample.

4.7.2 Streaming class

4.7.2.1 Abstract definition

Indicator representing the end-to-end data transmission quality of the mobile, circuit switched, streaming class data service. This measure represents a delivery of data in one direction (up-link or down-link) in near real time e.g. video broadcast.

Additionally the minimum throughput averaged over 10 % of the call/session duration, the maximum throughput averaged over 10 % of the call/session duration and the worst block error rate. The worst delay time for the call/session should also be reported.

Note for streaming class service only the down link direction is considered, but if service applications are introduced for uplink streaming then this can be added for calculation for data received by B-party.

4.7.2.2 Computation

The end-to-end data quality is validated by measuring the data throughput in down link direction on a best effort basis. The data throughput measurement will be computed and averaged over the duration of the call/session and be reported in bits/sec.

Abstract formula:

$$\boxed{DQ\left(\text{received A}-\text{side}\right)=X\text{bits/sec}}$$

Trigger points:

Beginning of Call/session data sample: Transmission of data frames of indexed predefined data B-party to A-party.

End of Call/session data sample: Calculation of average data throughput for call/session data sample.

4.7.3 Interactive Class

4.7.3.1 Abstract definition

Indicator representing the end-to-end data transmission quality of the Mobile Circuit Switched Interactive class data service. This represents duplex transfer of data in non real-time.

4.7.3.2 Computation

The validation of the end-to-end data quality is made by the time taken to download specified files of fixed data size to the A-party DTE when, requested by the A-party sending a request to the data server.

Assumption: The A-party DTE has already been connected to the data server as part of the call set-up process.

Abstract formula:

$$\boxed{\text{DQ download time } [s] = t_2 - t_1}$$

t1: point of time where A-party DTE sends data request

t2: point of time where A-party receives complete uncorrupted requested file/s

Trigger points:

Beginning of request for download: Data request sent by A-party DTE.

Download of file/s complete: Uncorrupted file/s received by A-party DTE.

4.7.4 Background class

4.7.4.1 Abstract definition

Indicator representing the end-to-end data transmission quality of the Mobile Circuit Switched Background Class Data Service. This represents data transfer with no real-time dependency (although for QoS testing, data transfer time is measured).

4.7.4.2 Computation

The validation of the end-to-end data quality is made by the time taken to download a file/s of fixed data size to the A-party DTE when, requested by the A-party sending a request to the target server.

Assumption: The A-party DTE has already been connected to the data server as part of call set-up process.

Abstract formula:

$$\boxed{\text{DQ File download time } [s] = t_2 - t_1}$$

t_1: point of time where A-party DTE sends data transfer request

t_2: point of time where A-party receives complete uncorrupted file/s

Trigger points:

Beginning of request for download: Request sent by A-party DTE.

Download of file/s complete: Uncorrupted file/s received by A-party DTE.

4.8 Multimedia Messaging Service (MMS)

NOTE: It is important to keep in mind that measurement equipment and techniques used can affect the data collected. The measurement equipment and techniques should be defined and their effects documented for all tests. One example of this is the effect of Windows RAS on the setup of PDP Context. (See TS 102 250-3 [6]).

4.8.1 MMS send failure ratio (MO) [%]

4.8.1.1 Abstract definition

The parameter MMS Send Failure Ratio (MO) describes the probability that a MMS-message can not be send by the subscriber, although he has requested to do so by pushing the "send button".

4.8.1.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
MMS Send Attempt (MO)	Pushing of send button	The send button initiates the *PDP context activation* of the MS (MO), followed by a connection to the WAP Gateway, and to the MMSC. (See trigger 1 in figure 2).
Unsuccessful MMS Send Attempt (MO)	Do not see "Message sent"	The *m-send.conf* (see [3]) is not received by the MS(MO). (See trigger 18 in figure 2). NOTE 1: The phase where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly. NOTE 2: The forwarding of a MMS by the MMSC to the MS (MT) might be possible without the reception of the *m-send.conf* MS (MO). MMS unsuccessful send attempt timeout as specified in TS 102 250-5 (see bibliography).

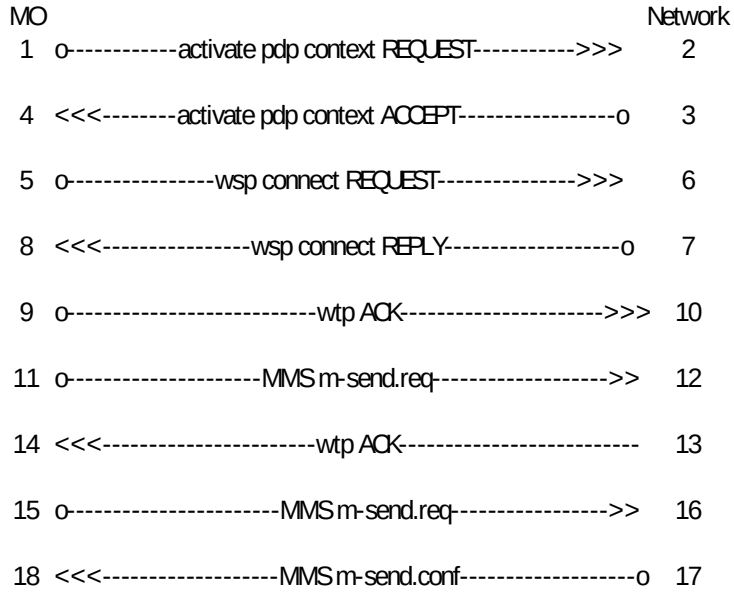

Figure 2: MMS Transaction flow

Abstract formula:

$$\text{MMS Send Failure Ratio (MO)}[\%] = \frac{\text{Number of unsuccessful MMS Send Attempts (MO)}}{\text{Number of All MMS Send Attempts (MO)}} \times 100\ \%$$

4.8.2 MMS retrieval failure ratio (MT) [%]

4.8.2.1 Abstract definition

The parameter MMS Retrieval Failure Ratio (MT) describes the probability that the MMS-message can not be downloaded by the MT mobile, which received a MMS Notification before.

Remark: The MMS Notification is a push-message. This message either initiates the download of the MMS content by starting a "WAP Get Request" (when the mobile is switched to automatic mode) or enables the User to manually start this "Wap Get Request" (when the mobile is switched to manual mode). All the measurements will be done using the setting "Automatic Download".

4.8.2.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
MMS Retrieval Attempt (MT)	Initiation of the Wap Get Request MT	After the *m-Notification.ind*. (see [3]) has been sent to the MS (MT), this mobile activates a PDP-context and contacts the MMSC via the WAP Gateway (See trigger 29 in figure 3).
Unsuccessful MMS Retrieval Attempt (MT)	No MMS-message is received	The *m-notifyResp.ind* (see [3]) is not sent by the MS (MT). (See trigger 49 in figure 3). NOTE: The phase where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly. MMS unsuccessful Retrieval timeout as specified in TS 102 250-5 (see bibliography).

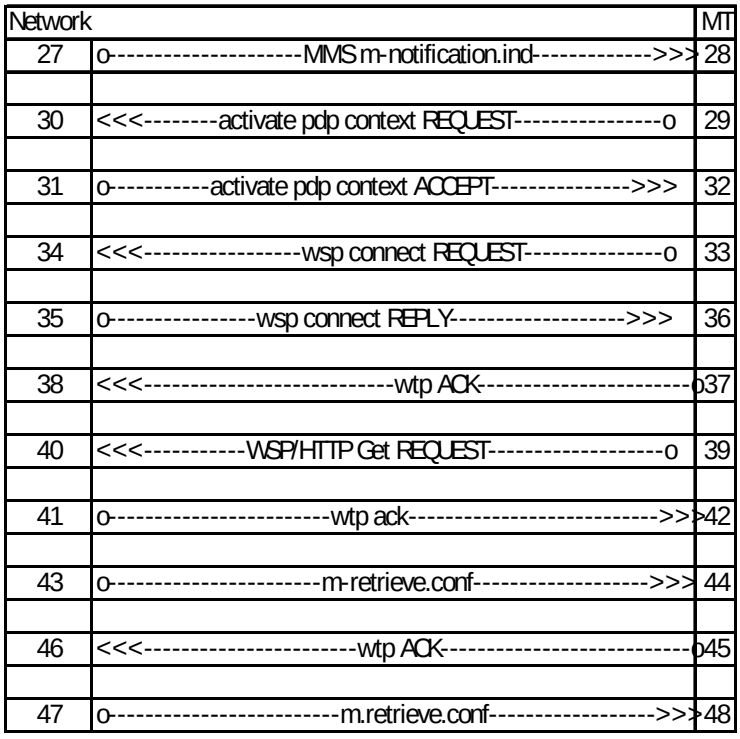

Figure 3: MMS Transaction flow

Abstract formula:

$$\text{MMS Delivery Failure Ratio (MT)}\,[\%] = \frac{\text{Number of unsuccessful MMS Delivery Attempts MT}}{\text{Number of All MMS Delivery Attempts (MT)}} \times 100\,\%$$

4.8.3 MMS send time (MO) [s]

4.8.3.1 Abstract definition

A subscriber uses the Multimedia Messaging Service (as indicated by the network ID in his mobile phone display). The time elapsing from pushing the send button after the editing of a MMS-message to the completion of the data transfer is described by this parameter.

NOTE: Possible measurement scenarios for time indicators of MMS may vary in the number of involved MMSCs. With increasing MMS-traffic or internetwork-traffic surveillance, the number of MMSCs involved will increase also. Number of MMSCs involved is therefore a measurement condition to be discussed.

4.8.3.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
$t_{MMStoMMSCcomplete}$	MMS-message is completely transmitted to MMS-C	The *m-send.conf* (see [3] is received by the MS(MO). (See Trigger 18 in figure 4). NOTE: The phase, where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly.
$t_{sendbutton}$	Send button is pushed	The send button initiates the *PDP context activation* of the MS(MT), followed by a connection to the WAP Gateway (See trigger 1 in figure 4). MMS unsuccessful send transfer timeout as specified in TS 102 250-5 (see bibliography).

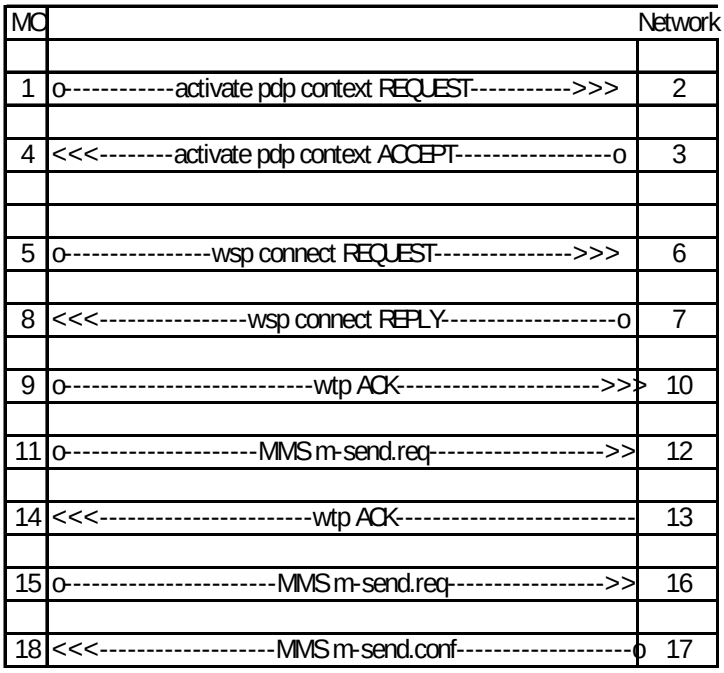

Figure 4: MMS Transaction flow

Abstract formula:

$$\text{MMS Send Time}\left[\text{seconds}\right] = t_{MMStoMMSCcomplete} - t_{sendbutton}$$

4.8.4 MMS retrieval time (MT) [s]

4.8.4.1 Abstract definition

The reception of a MMS-message works as follows: A push-sms is sent to the receiver's mobile. In automatic mode, the push sms initiates a WAP-connection to download the MMS from the MMS-C. The initiation of the WAP connection is called the WAP GET REQUEST (WGR). The time elapsing between the WGR and the completion of the download of the MMS will be described by the parameter MMS Retrieval Time (MT).

Possible measurement scenarios for time indicators of MMS may vary in the number of involved MMSCs. With increasing MMS-traffic or internetwork-traffic surveillance, the number of MMSCs involved will increase also. Number of MMSCs involved is therefore a measurement condition to be discussed.

4.8.4.2 Computation

Trigger Points:

Event	Trigger Point	Technical description/protocol part
$t_{MMSfromMMSCcomplete}$	MMS-message is received completely	The *m-notifyResp.Ind* (see [3] is sent by the MS (MT). (See trigger 49 in figure 5). NOTE: The phase, where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly. MMS successful retrieval timeout as specified in TS 102 250-5 (see bibliography).
$t_{initWGR}$	Time when WAP Get Request is initiated	The *m-Notification.ind* (see [3] is delivered to the MS (MT). This initiates the *PDP context activation.* (See trigger 29 in figure 5).

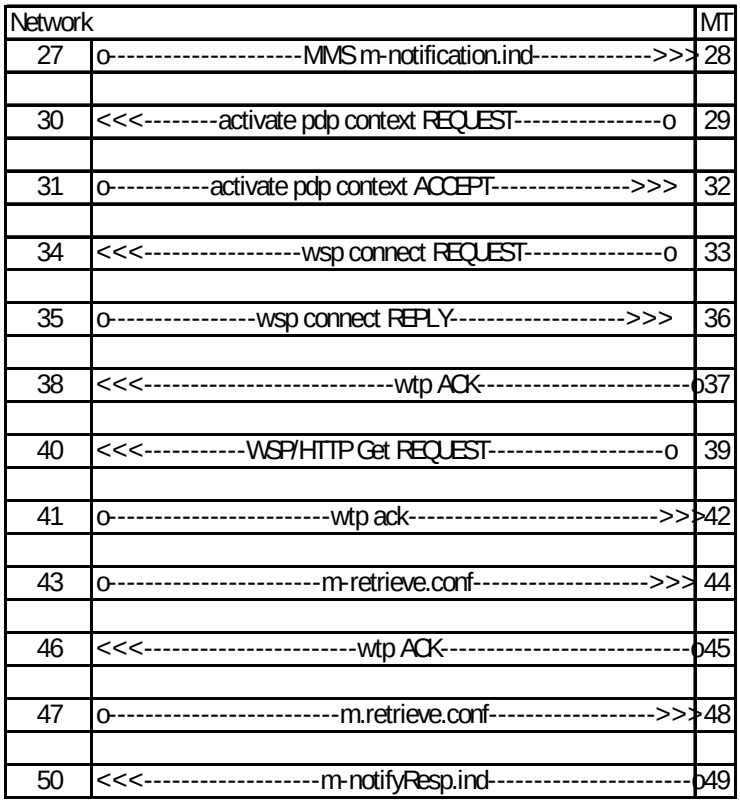

Figure 5: MMS Transaction flow

Abstract equation:

$$\text{MMS Delivery Time MT } [\text{seconds}] = t_{\text{MMSfromMMSCcomplete}} - t_{\text{initWGR}}$$

4.8.5 MMS notification failure ratio [%]

4.8.5.1 Abstract definition

The parameter MMS Notification Failure Ratio [%] describes the probability that the Multimedia Messaging Service (MMS) is not able to deliver the Notification of a MMS-message to the b-parties mobile.

4.8.5.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
Successful submitted MMS MO	Reception of the acknowledgement from the MMS-C MO (i.e. "Message sent")	*m-send.conf* (see [3]) is received by MS (MO) (See trigger 18 in figure 6). NOTE: The phase where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly. MMS successful Retrieval timeout as specified in TS 102 250-5 (see bibliography).
Failed MMS-Notifications	Failure delivery (non-delivery) of the Notification – SMS.	*m- notification.ind* (see [3]) is not delivered to the MS(MT). (See trigger 28 in figure 6). MMS successful notification timeout as specified in TS 102 250-5 (see bibliography).

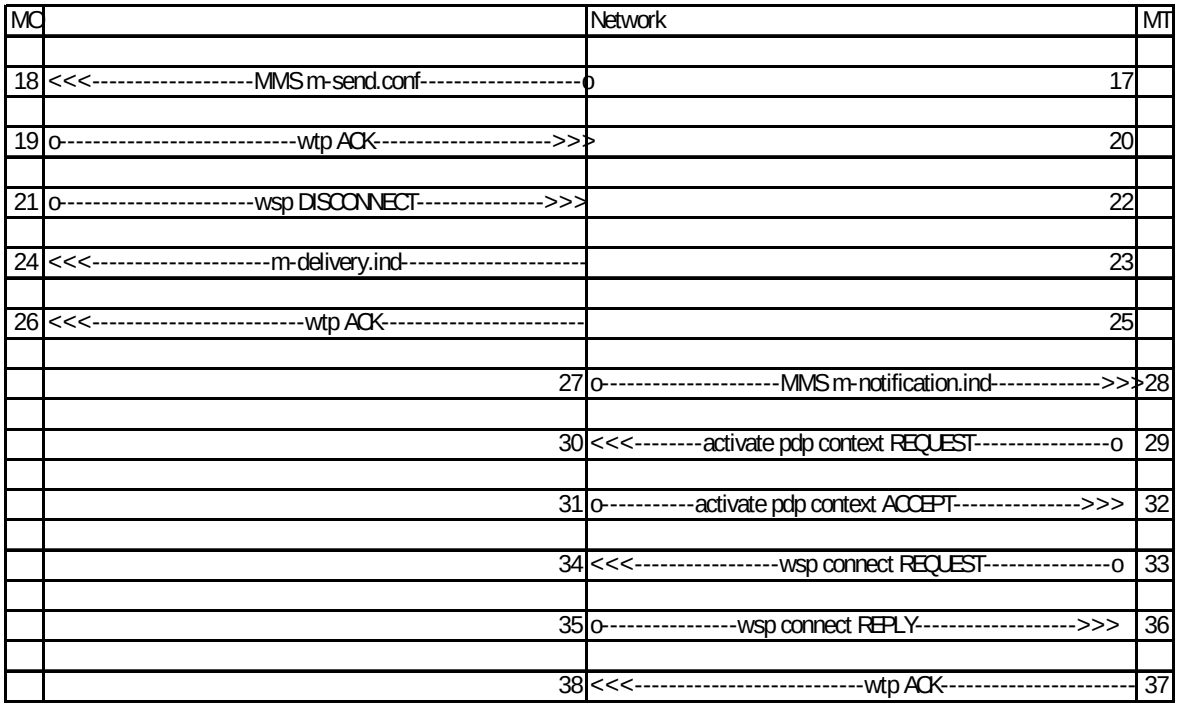

Figure 6: MMS Transaction flow

Abstract formula:

$$\text{MMS Notification Failure Ratio}\,[\%] = \frac{\text{Number of failed MMS - Notifications}}{\text{Number of successful submitted MMS (MO)}} \times 100\ \%$$

4.8.6 MMS notification time [s]

4.8.6.1 Abstract definition

A subscriber uses the Multimedia Messaging Service. The time elapsing from the complete submission of the Multimedia-Message to the MMSC to the reception of the Notification (MT) is the *MMS Notification Delay.*

Possible measurement scenarios for time indicators of MMS may vary in the number of involved MMSCs. With increasing MMS-traffic or internetwork-traffic surveillance, the number of MMSCs involved will increase also. Number of MMSCs involved is therefore a measurement condition to be discussed.

4.8.6.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
$t_{MMSsubmit}$	The MMS is submitted successfully	*m-send.conf* (see [3]) is completely transmitted to the MS (MO) (See trigger 18 in figure 7). NOTE: The phase, where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly.
$t_{recNotif}$	Time when the Notification is received (MT)	*m-Notif.ind* (see [3]) is received by MS (MT) (See trigger 28 in figure 7). MMS successful notification timeout as specified in TS 102 250-5 (see bibliography).

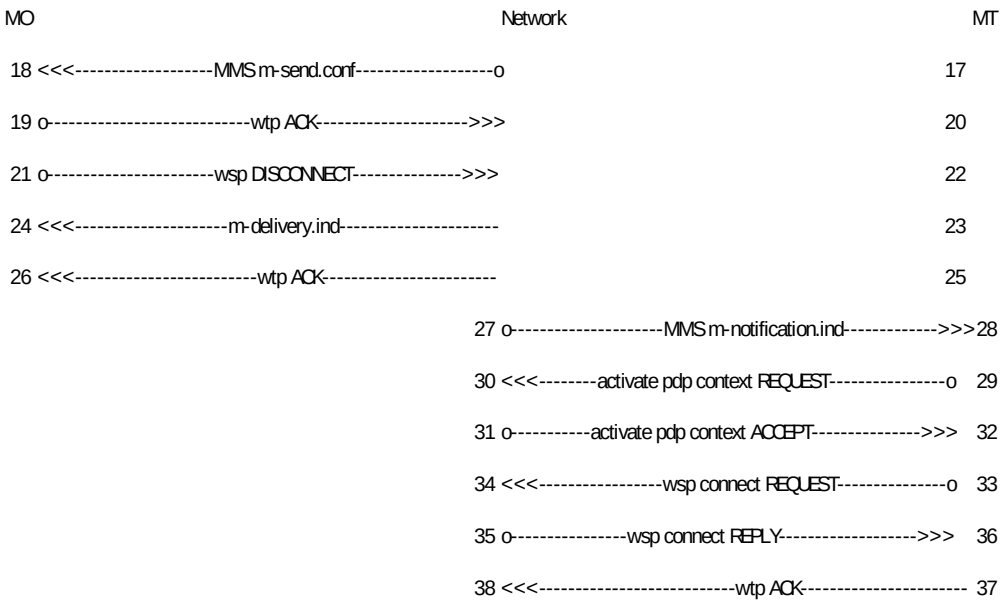

Figure 7: MMS Transaction flow

Abstract equation:

$$\text{MMS Notification Time MO/MT } [\text{seconds}] = t_{\text{recNotif}} - t_{\text{MMSsubmit}}$$

4.8.7 MMS end-to-end failure ratio [%]

4.8.7.1 Abstract definition

The parameter MMS end-to-end failure ratio describes the probability that the Multimedia Messaging Service (MMS) is not able to deliver a MMS-message after the "send button" has been pushed or the MO party has not received an acknowledgement of the successful transmission from the MMSC.

4.8.7.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
MMS Send Attempt by MS(MO)	Pushing of send button	The send button initiates the *PDP context activation* of the MS, followed by a connection to the WAP Gateway (See trigger 1 in figure 8). NOTE: The forwarding of a MMS by the MMSC to the MS (MT) might be possible without the reception of the *m-send.conf* MS (MO).
Unsuccessful MMS Retrieval Attempt of MS(MT)	No MMS-message is received (MT) or no acknowledgement from the MMSC is received at MS (MO).	*m- send.conf* is not received by MO or The *m-notifyResp. ind* (see [3]) is not sent by the MS (MT) (See trigger 18 and 49 in figure 8). NOTE: The phase where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly. MMS unsuccessful Retrieval timeout as specified in TS 102 250-5 (see bibliography).

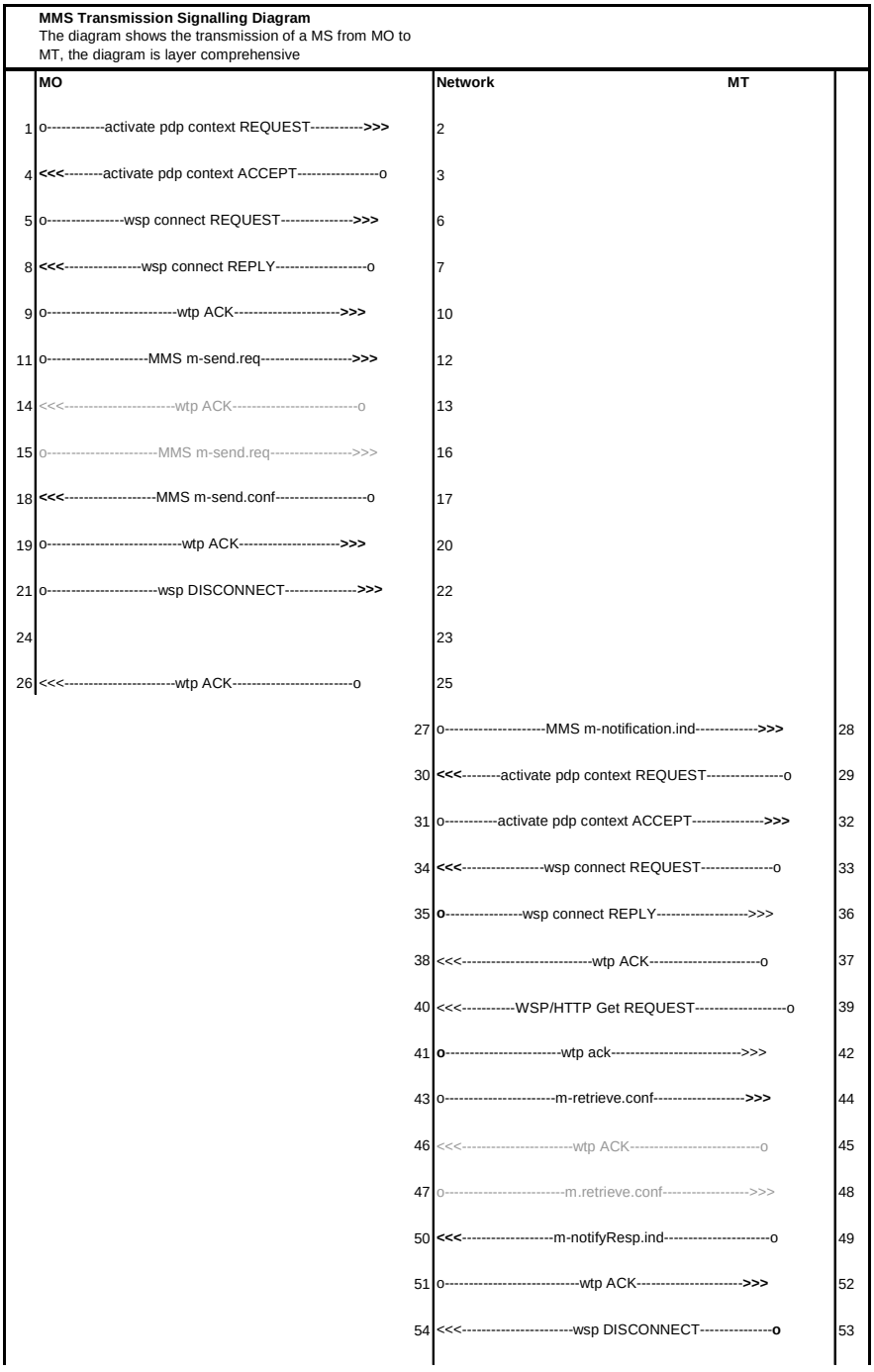

Figure 8: MMS transaction flow

Abstract equation:

$$\text{MMS End - to - end Failure Ratio}[\%] = \frac{\text{Number of unsuccessful delivered MMS - messages}}{\text{Number of all MMS send attempts}} \times 100\ \%$$

The auxiliary Parameter MMS Average Size delivers the MMS - size, which is going to be used while measuring this parameter.

End-to-end parameter measurement may optionally be derived by concatenating the component measurements.

4.8.8 MMS End-to-end Delivery Time (MO/MT) [s]

4.8.8.1 Abstract definition

A subscriber uses the Multimedia Messaging Service (as indicated by the network ID in his mobile phone display). The time elapsing from pushing of the "send button" to the reception of the MMS by the b-parties mobile is the MMS End-to-end Delivery Time MO/MT.

This parameter is not calculated if the MO party has not received an acknowledgement of the successful transmission from the MMSC.

The size of a MMS varies. In comparison to SMS, the size has noticeable impact on the submission time. So, a typical sized MM is used for this measurement. See Auxiliary (Network Performance-) Parameter "MMS Average Size".

NOTE 1: Possible measurement scenarios for time indicators of MMS may vary in the number of involved MMSCs. With increasing MMS-traffic or internetwork-traffic surveillance, the number of MMSCs involved will increase also. Number of MMSCs involved is therefore a measurement condition to be discussed.

NOTE 2: End-to-end parameter measurement may optionally be derived by concatenating the component measurements.

4.8.8.2 Computation

Trigger Points:

Event	Trigger Point	Technical description / protocol part
$t_{sendattemot}$	Time when the "send button" is pushed (when m-send.conf is received at the MO side)	The send button initiates the *PDP context activation* of the MS (MO), followed by a connection to the WAP Gateway (See trigger 1 in figure 9). NOTE: The forwarding of a MMS by the MMSC to the MS (MT) might be possible without the reception of the *m-send.conf* MS (MO).
t_{MMSrec}	Time when the MMS is received at the b-parties mobile	The M-resp.ind (see [3] is received completely by the MS (MT), and the MS (MT) sends the m-notify-resp.ind (See trigger 49 in figure 9). NOTE 1: Parameter not calculated if the m-send.conf is not received by MS (MO) (See trigger 18 in figure 9). NOTE 2: The phase where the WAP session will be deactivated is not covered by this indicator. Some mobiles might not support the sending/receiving of the next MMS unless the WAP session is disconnected properly. MMS successful retrieval timeout as specified in TS 102 250-5 (see bibliography).

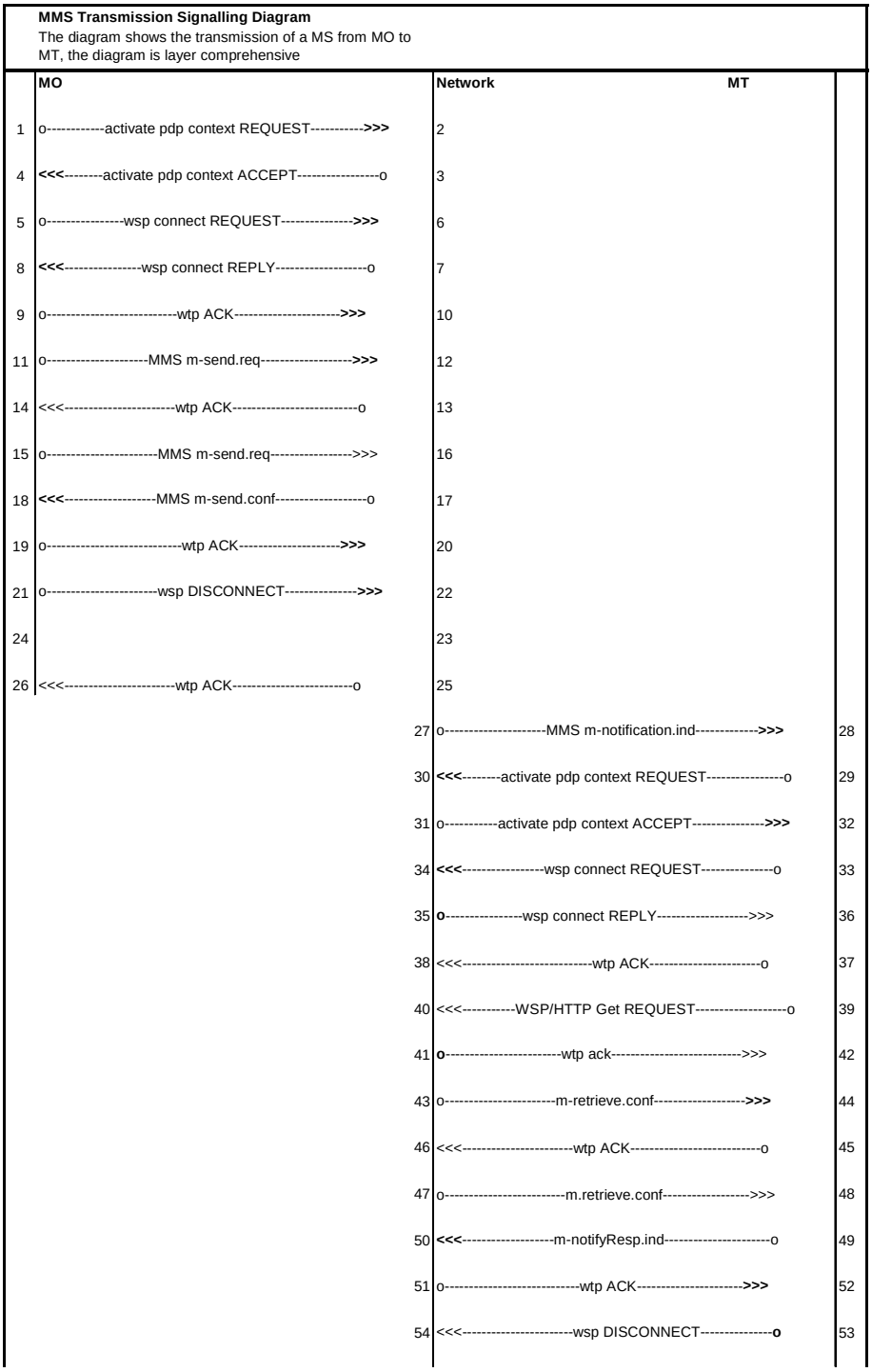

Figure 9: MMS Signalling Diagram

Abstract equation:

$$\text{MMS End - to - end Delivery Time (MO/MT)}\left[\text{seconds}\right] = t_{MMSrec} - t_{sendAttempt}$$

Annex A (informative): Examples for measuring trigger points

SMS-Service:

Layer 3 Messages:

Start SMS Service Attempt:	generating random access (chan_request SDCCH) at mobile equipment
Successful SMS Service Attempt	receiving cp_data (rp_ack) at mobile equipment
Receiving SMS on Mobile Equipment 2:	receiving cp_data (rp_ack) at mobile equipment

Annex B (informative): Bibliography

ETSI TS 102 250-5: " Speech Processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 5: Definition of typical measurement profiles".

History

Document history		
V1.1.1	October 2003	Publication