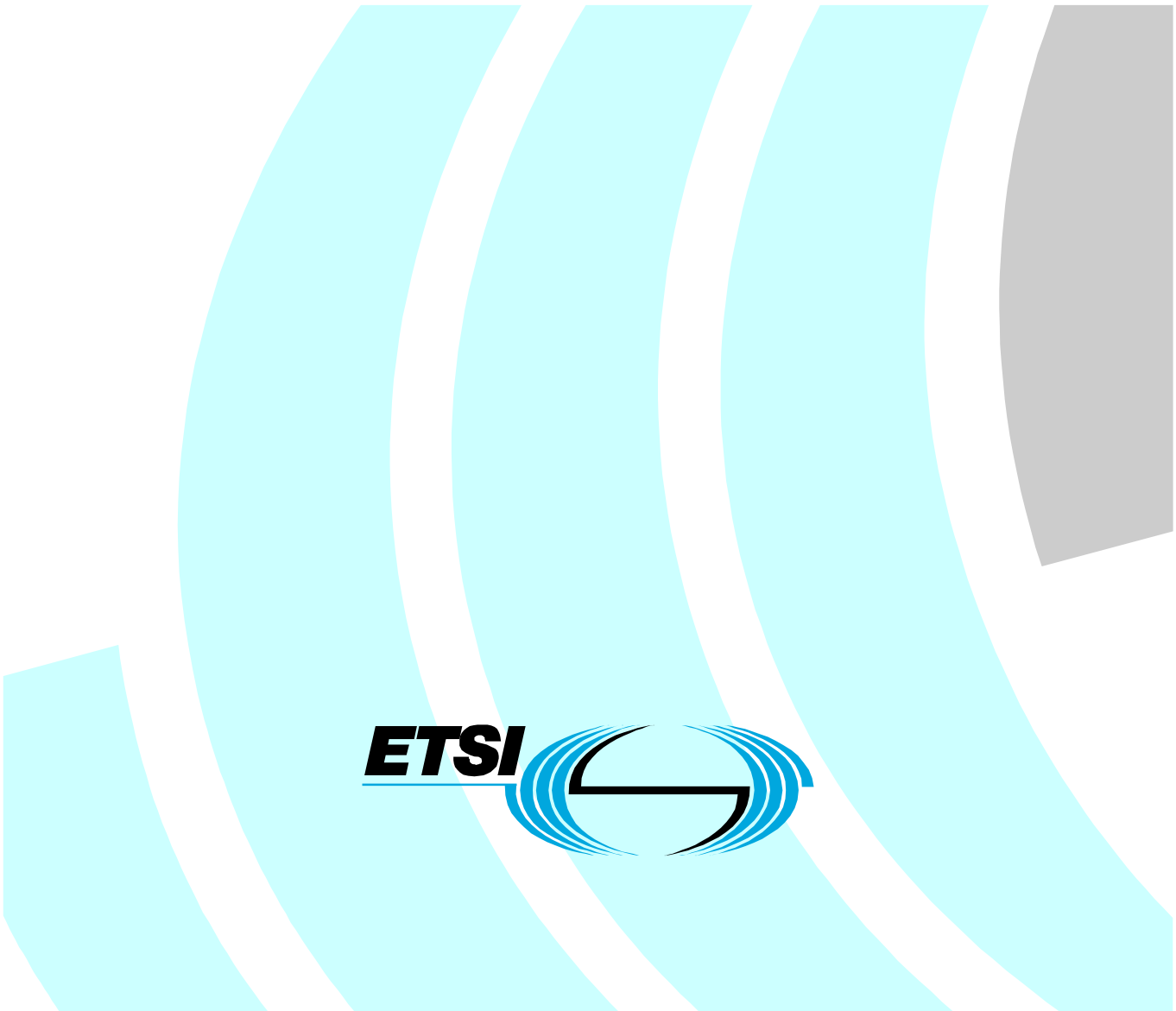
ETSI EG 202 057-1 V1.1.1 (2002-09)

ETSI Guide

Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 1: General



Reference
DEG/STQ-00022

Keywords
quality, user

ETSI

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Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights 5
Foreword 5
1 Scope 6
2 References 7
3 Definitions and abbreviations 7
3.1 Definitions 7
3.2 Abbreviations 8
4 General considerations 9
4.1 Services covered 9
4.2 Use of the parameters 9
4.3 Reporting for different classes of customers 10
4.4 Non standard levels of QoS 10
4.5 Reporting for directly- and indirectly-serviced customers 10
4.6 Data processing issues 10
4.7 Data collection period 11
4.8 Comparability of measurements 11
4.9 Publication of QoS parameters 11
5 General user-related QoS parameters 11
5.1 Supply time for fixed network access 14
5.1.1 Definition 14
5.1.2 Application 14
5.1.3 Measurement and statistics 14
5.1.4 Further considerations 15
5.2 Proportion of problems with number portability procedures 15
5.2.1 Definition 15
5.2.2 Application 15
5.2.3 Measurement and statistics 15
5.3 Fault report rate per fixed access lines 16
5.3.1 Definition 16
5.3.2 Application 16
5.3.3 Measurement and statistics 16
5.4 Fault repair time for fixed access lines 17
5.4.1 Definition 17
5.4.2 Application 17
5.4.3 Measurement and statistics 17
5.4.4 Further considerations 18
5.5 Response time for operator services 18
5.5.1 Definition 18
5.5.2 Application 18
5.5.3 Measurement and statistics 18
5.5.4 Further considerations 19
5.6 Response time for directory enquiry services 19
5.6.1 Definition 19
5.6.2 Application 19
5.6.3 Measurement and statistics 19
5.6.4 Further considerations 20
5.7 Response time for admin/billing enquiries 20
5.7.1 Definition 20
5.7.2 Application 20
5.7.3 Measurement and statistics 20
5.7.4 Further considerations 21
5.8 Frequency of customer complaints 21
5.8.1 Definition 21

5.8.2 Application 21
5.8.3 Measurement and statistics 21
5.9 Bill correctness complaints....21
5.9.1 Definition....21
5.9.2 Application 21
5.9.3 Measurement and statistics 22
5.9.4 Further considerations....22
5.10 Bill presentation quality 22
5.10.1 Definition....22
5.10.2 Application 22
5.10.3 Measurement and statistics 23
5.11 Customer relations....24
5.11.1 Definition....24
5.11.2 Application 24
5.11.3 Measurement and statistics 24

Annex A (informative): Combination of weekly or monthly results....25

Annex B (normative): Further explanation of "fastest X %" 26

Annex C (normative): Method of calculating the number of observations required for measures of time....27

Annex D (informative): Bibliography....28

History 29

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Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Speech processing, Transmission and Quality aspects (STQ).

The present document is part 1 of a multi-part deliverable covering Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements, as identified below:

Part 1: "General";

Part 2: "Voice telephony, Group 3 fax and modem data services";

Part 3: "QoS parameters specific to mobile services".

Part 1 of the present document contains general user related QoS parameter definitions and measurement methods that can be applied to any service. Additional parts of the present document will contain service specific user related QoS parameter definitions and measurement methods.

Part 2 of the present document contains user related QoS parameter definitions and measurement methods for voice, data and fax services accessed via the public telecommunication network. The data parameters are specified for the case where an ITU-T Recommendation V.90/V.92 [6], [7] compliant modem is used since this kind of modem is in common use.

Part 3 of the present document contains user related QoS parameter definitions and measurement methods for mobile specific services.

The present document has been written to provide a balanced approach taking into account as far as practicable the following seven principles:

1) QoS parameters should be easily understood by the public, and be useful and important to them.

2) All network related parameters are applicable at the network termination point (where appropriate).

3) To be as realistic as possible, real traffic rather than test calls should be used as a basis of the measurements, wherever possible.

4) Parameters should be capable of verification by independent organizations. This verification might be made by direct measurements or by audit of service provider's measurements.

5) The accuracy of QoS values should be set to a level consistent with measurement methods being as simple as possible with costs as low as possible.

6) The parameters are designed for both statistical and individual application. The statistical values should be derived by the application of a simple statistical function to the individual values. The statistical function should be specified in the standard. The standard should also contain guidelines on how statistically significant samples should be selected.

7) The statistical functions should be designed so QoS figures from different service providers can be compared easily by users and in particular consumers.

1 Scope

The present document contains definitions and measurement methods for a range of user perceivable Quality of Service (QoS) parameters. The purpose of these parameters is to define objective and comparable measures of the QoS delivered to users/customers for use by users/customers. The present document applies to any telecommunication service, however, some parameters may have a limited application.

The present document is intended to provide a menu from which individual items can be selected. There is no obligation to use any or all of the parameters.

The QoS parameters are related primarily to services and service features and not to the technology used to provide the services. Therefore the parameters should be capable of use when the services are provided on new technologies such as IP and ATM or other packet switched technologies as well as on circuit switched technologies.

The establishment of target values for QoS is beyond the scope of the present document. The QoS parameters listed in the present document are also not intended to assess the complete QoS of a telecommunication service. The present document provides a set of QoS parameters that covers specific user related QoS aspects rather than a complete list of QoS parameters. This set has been chosen to address areas where monitoring of QoS is likely to be most worthwhile, i.e. the areas that are most likely to be affected by any QoS problems.

If stakeholders wish to examine other QoS aspects they are recommended to follow the general approach of the present document - as far as practicable - as a basis for the development of definitions and measurement methods for new specific QoS parameters.

The set of QoS parameters is designed to be understood by the users of various telecommunications services. Sub-sets of these parameters can be selected for use in different circumstances. For example a specific parameter might be relevant for many users in some countries or markets but the same parameter might not be of relevance in others. Therefore stakeholders - users, customers, regulators, service providers, network operators and other parties interested in the use of QoS parameters - should decide in co-operation, which parameters and which measures should be used in their particular situation. This decision should take account of:

- The precise purpose for which they will be used.
- The general level of quality achieved by most operators.
- The degree to which the parameters will provide a reliable comparison of performance.
- The cost of measuring and reporting each parameter.

Part 1 of the present document (this part) contains general user related QoS parameter definitions and measurement methods that can be applied to any telecommunications service. The QoS parameters in part 1 are focused on non call related QoS aspects. Additional parts of the present document will contain service specific user related QoS parameter definitions and measurement methods.

Part 2 of the present document contains user related QoS parameter definitions and measurement methods for voice, data and fax services accessed via public telecommunication networks. The QoS parameters in part 2 are focused on call related QoS aspects. The data parameters are specified for the case where an ITU-T Recommendation V.90/V.92 [6], [7] compliant modem is used.

Part 3 of the present document contains user related QoS parameter definitions and measurement methods specific to mobile access.

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.

[1] Void.

[2] Directive 98/10/EC of the European Parliament and of the Council of 26 February 1998 on the application of open network provision (ONP) to voice telephony and on universal service for telecommunications in a competitive environment.

[3] ITU-T Recommendation E.105: "International telephone service".

[4] ITU-T Recommendation E.800: "Terms and definitions related to quality of service and network performance including dependability".

[5] ITU-T Recommendation I.210: "Principles of telecommunication services supported by an ISDN and the means to describe them".

[6] ITU-T Recommendation V.90: "A digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream".

[7] ITU-T Recommendation V.92: "Enhancements to Recommendation V.90".

3 Definitions and abbreviations

3.1 Definitions

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

access line: connection from the Network Termination Point to the entry point to the local switch or remote concentrator, whichever is the nearer

NOTE: In many cases this is the main distribution frame.

access network operator: organization that provides the access line

NOTE: In many cases the access network operator will be the direct service provider, but if the line is unbundled, the direct service provider would be a separate organization

call by call carrier selection: form of carrier selection where the user dials a carrier access code to indicate which carrier is to route the call

carrier access code: code that the user may or must dial before the national (significant) number when dialling an access line in another telecommunications network, so that the call is routed by the carrier of his choice

customer: party that pays for the telecommunication service(s) provided

NOTE: Customers can generally be categorized as business or residential; the definition of business and residential customers is left to individual service providers. Service providers who receive interconnect services from other service providers are not considered to be customers for the purpose of the present document. The term "customer" is equivalent to "subscriber", which is used in Directive 98/10/EC [2].

direct service: service where the service provider that provides the telecommunication service(s) also provides the access network or rents an unswitched local loop (unbundled local loop) to use for the provision of the service to the customer

indirect service: service where the service provider that provides the telecommunication service(s) does not provide the access network but is selected by the customer or user using a form of call by call carrier selection or carrier preselection

network operator: organization that provides a network for the provision of a public telecommunication service

NOTE: If the same organization also offers services it also becomes a service provider.

Network Termination Point (PTN): physical point at which a user is provided with access to a public telecommunications network

ported number: subscriber number (directory number) where the location of the NTP and/or the identity of the service provider has changed after the number was originally allocated

preselection: form of carrier selection where the customer informs his access network operator which carrier is to route all or a particular subset of his calls, unless call by call carrier selection is used

Public Telecommunications Network: telecommunications network used wholly or partly for the provision of publicly available telecommunications services

Quality of Service (QoS): collective effect of service performance which determines the degree of satisfaction of a user of the service

NOTE: (See ITU-T Recommendation E.800 [4].)

service provider: organization that offers a telecommunication service to the customer and/or user

NOTE: A service provider need not be a network operator.

stakeholder: party having an interest in the level of quality of a service

supplementary service: additional service that modifies or supplements a basic telecommunication service

NOTE: Consequently, it cannot be offered to a customer as a stand-alone service; it has to be offered in association with a basic telecommunication service. The same supplementary service may be common to a number of basic telecommunication services. (See ITU-T Recommendation I.210 [5]).

telecommunications: technical process of sending, transmitting and receiving any kind of message in the form of signs, voice, images or sounds by means of telecommunications systems

telecommunication services: provision of telecommunications and the provision of other additional services that are closely related to the provision of telecommunications like e.g. billing, directory services

telecommunications systems: technical equipment or systems capable of sending, transmitting, switching, receiving, steering or controlling as messages identifiable electromagnetic signals

user: individuals, including consumers, or organizations using or requesting publicly available telecommunications services

NOTE: See Directive 98/10/EC [2].

3.2 Abbreviations

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

ACD	Automatic Call Distribution
ACR	Anonymous Call Rejection
AoC	Advice of Charge
ATM	Asynchronous Transfer Mode
CDR	Call Detail Record
CLIP	Calling Line Identification Presentation

CLIR	Calling Line Identification Restriction
CPE	Customer Premises Equipment (controlled and normally provided by the customer)
GSM	Global Service for Mobile communication
ISDN	Integrated Services Digital Network
MOS	Mean Opinion Score
NTP	Network Termination Point
ONP	Open Network Provision
PSTN	Public Switched Telephone Network
QoS	Quality of Service
VAT	Value Added Tax
xDSL	generic Digital Subscriber Line

4 General considerations

4.1 Services covered

The QoS parameters of the present document cover aspects of telecommunications services which are typically provided via the public telecommunications network such as voice, fax or data services. These services may be accessed via terminals connected to fixed network termination points or via mobile accesses e.g. GSM.

The definitions and measurement methods of the QoS parameters were elaborated primarily in order to assess QoS aspects of "standard" telecommunication services. Therefore mainly common aspects and applications of telecommunication services were considered and are reflected in the present parameters. In principle the QoS parameters may also be used for the investigation of special or non-standard telecommunication services but further enhancements/additions to the definitions and measurements methods may be necessary.

Most parameters are in principle applicable to any service provided via the public telecommunication network. Some parameters are however only applicable to specific services depending on technical aspects of the provision of those services, e.g. mobile, data, fixed NTP. Depending on the set of QoS parameters used by the stakeholders the scope of the services covered may vary.

The parameters are end-user/customer and end-to-end orientated and are not intended to address the quality of interconnect services explicitly. Any dependence on interconnect services is included implicitly in the measures of QoS provided to the end user. Separate Guides in this series deal with the QoS of interconnect arrangements.

In many cases the provider of telecommunications services to the customer may depend on other providers for part of the service. An example is an international call where several service providers are normally involved. In such cases the provider of the service to the customer is responsible for all elements for which it receives payment from the customer. In order to provide satisfactory QoS, this service provider will need to ensure that adequate QoS is provided by the other interconnected service providers. QoS figures for the responsible service provider will reflect both its own capability and that of the interconnected service providers.

4.2 Use of the parameters

The parameters may be used for various purposes including:

- specifying the level of quality of service in customer telecommunication service contracts or in the description or terms and conditions of the service;
- comparing the quality of service of different service providers;
- comparing the quality of service aspects of different service offers;
- preparing long term studies on the quality of service aspects of a specific service.

4.3 Reporting for different classes of customers

For each parameter, statistics may be produced or requested that are aggregated over all classes of customer or, where a distinction between different classes is desired, e.g. residential and business, separate statistics may be used, or both. This recognizes the voluntary nature of these measures and the fact that some stakeholders may only wish to target specific sections or to provide a rough overview of the market.

NOTE: Due to the fact that a variety of different service offers is available at the market, it is not always possible to clearly distinguish between classes of customers like residential or business. Furthermore it may not be fair to compare different service offers on the basis of different classes of customers because the results may be misleading. Also statistics may be falsified when aggregating over all classes of customers. (see also clause 4.9)

4.4 Non standard levels of QoS

Statistics produced should normally be based on the standard level of QoS for each telecommunication service. The standard level is defined in the terms and conditions of the services as published by the service providers. Stakeholders may choose to produce or request specific statistics for cases where customers are able to pay more for enhanced or less for lower QoS. It is recommended to provide additional information on the kind and scope of services the QoS statistics are referring to when covering non standard levels of QoS.

4.5 Reporting for directly- and indirectly-serviced customers

The principle used is that the service provider who charges the customer should be responsible for the quality of the service and for providing QoS statistics relevant to the service provided. Thus, in the case of carrier selection, the indirect service provider has the responsibility for QoS and provision of QoS statistics when it is selected to carry a call.

For each parameter in clause 5 a statement is made on whether it is applicable to indirect services.

Some service providers provide both direct and indirect services. Where there are likely to be significantly different levels of performance for these two service types or where the services are understood as being two different not comparable service offers (even though the same telecommunication service is offered), the production of separate statistics for each service type is recommended.

The treatment of direct and indirect services is summarized in the last column of table 1.

NOTE: Where only a combined statistic for both types of service is specified, separate statistics for each service type may be provided in addition if the stakeholders to do so.

4.6 Data processing issues

Where the measures are based on all actual occurrences rather than samples, the measuring party may prefer to process data on a weekly or monthly basis, discard the detailed data and use a statistical method such as that specified in annex A for combining the weekly or monthly results.

For several parameters the statistic required is "the time by which the fastest X % is.....". This statistic is explained in annex B.

In some cases disasters, freak weather, etc. may distort measured QoS figures. Such occurrences may not necessarily damage a network, but could degrade QoS by inducing exceptional traffic levels etc. In these cases, service providers should provide the measured QoS and may additionally provide a second figure which excludes the effects of the exceptional circumstances. A note clearly explaining the difference should also be provided. Service providers covering large geographical areas are likely to be more prone to these effects than service providers serving smaller areas. The effect on the reported QoS of a service provider covering a small area is likely to be more severe, however, should such an event occur.

4.7 Data collection period

Where the measurements are to be used for long term comparisons, it is recommended that QoS data should be collected and calculated on a quarterly basis starting on 1 January, 1 April, 1 July and 1 October.

Stakeholders may also decide to use longer or shorter data collection periods. For most QoS parameters a data collection period on a quarterly basis is suitable, and will provide adequately up-to-date information. But there may also be cases were a longer period is more practicable, e.g. extensive customer surveys. Shorter periods are advisable for QoS aspects where frequent and fast changes in quality are likely to occur.

4.8 Comparability of measurements

The following issues may affect the comparability of the measurement results:

- where the parameters are measured based on the number of customer complaints; service providers may have different strategies for handling customer complaints (e.g. call centres, ACD, trouble ticket systems) and these strategies will have significant influence on resulting statistics (e.g. long delays in answering calls to a customer complaint line will suppress the number of recorded complaints);
- different types of customer may react differently to quality of service problems and this will influence results (e.g. business customers have different fault report behaviour, origins and destinations of call related parameters may vary);
- fault report rates for direct and indirect services are likely to show significant differences because of the different fault report behaviour for these services;
- service offers that claim to be similar may differ in terms of significant service features/aspects.

NOTE: The parameters were elaborated with respect to "standard" service offers and so special care should be taken for non-standard services.

4.9 Publication of QoS parameters

Where measurements are made and published in accordance with the present document, it is recommended that an explicit reference to the present document should be given so that readers can be made aware of the background of the definitions and measurement methods. The reader should be enabled to understand the meaning, purpose and areas of application of the QoS parameters.

It is important that the reader is aware of the scope of the parameters and with that of the correct application of the QoS statistics, otherwise there is a high risk that the measurement results are misinterpreted. A fair and justified comparison of the published data of different service offers, i.e. quality aspects of different telecommunication services, is only possible if the data is strictly used according to the scope of the defined QoS parameters.

Stakeholders who publish QoS statistics in accordance with the present document should provide additional and explanatory text in order to facilitate the understanding of the statistics. It may be assumed that a reader who is interested in comparable QoS statistics and QoS parameters of different nature is willing and capable to understand technical and operational background information on telecommunication services. A balanced approach should be used taking into account on the one hand the need for easy understandable information and on the other hand the requirement of correctly edited data derived from the measurements.

5 General user-related QoS parameters

Table 1 summarizes the QoS parameters defined in the present document.

NOTE: Many of the parameters have several subtleties associated with their definition, applicability and measurement. The parameters are fully explained in the relevant clauses of clause 5.

Table 1: Summary of QoS parameters

Parameter	Measure	Measurement Method	Application
Supply time for fixed network access	a) the times by which the fastest 50 %, 95 % and 99 % of orders are completed; b) percentage of orders completed by the date agreed with the customer, and, where the percentage of orders completed by the date agreed with the customer is below 80 %, the average number of days, for the late orders, by which the agreed date is exceeded. separately for: a) narrowband PSTN or ISDN basic rate access where a physical change is required; b) narrowband PSTN or ISDN basic rate access where a physical change is not required; c) xDSL access provided over an existing installed access line; d) any other kind of technology in order to provide a fixed network access. standard accuracy for keeping appointments (if applicable)	all actual	providers of fixed network access, direct services only
Proportion of problems with number portability procedures	percentage of supply orders with a deviation from the normal porting procedure.	all actual	fixed and mobile direct services
Fault report rate per fixed access lines	number of fault reports separately for access and core network.	all actual	fixed access lines and fixed direct services only
Fault repair time for fixed access lines	a) the time by which the fastest 80 % and 95 % of valid faults on access lines are repaired (expressed in clock hours); b) the percentage of faults cleared any time stated as an objective by the service provider; c) provision of information on the hours during which faults may be reported.	all actual	fixed direct services for faults on local access networks
Response time for operator services	a) mean time to answer; and b) percentage of calls answered within 20 seconds.	all actual or representative sample	provider of operator services direct/indirect
Response time for directory enquiry services	a) mean time to answer; and b) percentage of calls answered within 20 seconds.	all actual or representative sample	provider of directory services direct/indirect
Response time for admin/billing enquiries	a) mean time to answer; and b) percentage of calls answered within 20 seconds	all actual or representative sample	all service providers with call centres for admin/billing enquiries
Bill correctness complaints	percentage of bills resulting in a customer complaint	all actual	all service providers
Bill presentation quality	MOS value	survey	all service providers
Customer relations	MOS value	survey	all service providers

Table 2 summarizes the information to be provided from the perspective of the user, who may have both a direct service provider (whose service includes the access line) and one or more indirect service providers that may be selected for different calls using call-by-call selection or pre-selection. For each parameter, the table shows what will be measured and which service provider will report an event covered by the parameter.

Table 2: QoS parameters from the perspective of the user

Parameter	Measure	Information provided by
Supply time for fixed network access	a) the times by which the fastest 50 %, 95 % and 99 % of orders are completed b) percentage of orders completed by the date agreed with the customer and, where the percentage of orders completed by the date agreed with the customer is below 80 %, the average number of days, for the late orders, by which the agreed date is exceeded	Provider of fixed network access
Proportion of problems with number portability procedures	number of supply orders with a deviation from the normal porting procedure divided by the total number of supply orders with number portability	Provider of fixed and mobile direct services (where number portability is used)
Fault rate per access line	number of valid fault reports per access line	provider of fixed direct services
Fault repair time for fixed access lines	a) the time by which the fastest 80 % and 95 % of valid faults on access lines are repaired b) the percentage of faults cleared any time stated as an objective by the service provider standard accuracy for keeping appointments	direct service providers for faults on local access networks direct and indirect service providers for all other faults
Response time for operator services	a) mean time to answer, and b) percentage of calls answered within 20 seconds	operator service providers
Response time for directory enquiry services	a) mean time to answer, and b) percentage of calls answered within 20 seconds	directory enquiry service providers
Response time for admin/billing enquiries	a) mean time to answer, and b) percentage of calls answered within 20 seconds	provider who is billing the customer
Bill correctness complaints	percentage of bills resulting in a customer complaint	provider who is billing the customer
Bill presentation quality	MOS value	provider who is billing the customer
Customer relations	MOS value	provider with customer relation

Table 3 lists parameters that have been considered as being useful and worthwhile QoS parameters. During discussions, however, it was decided to not include them. The following table lists those parameters and gives the reason why they were not included.

Table 3: QoS parameters considered but excluded

Parameter	Reason why not included
QoS parameters for data transmission over the local loop (CLIP, CLIR, ACR and AoC)	more a fault diagnostic than a quality report permanent survey thought to be to costly
billing problems attributable to incorrect CDR	STQ concluded that it is not necessary because the effects would be indicated by the customer complaints parameter

5.1 Supply time for fixed network access

5.1.1 Definition

The duration from the instant of a valid service order being received by a direct service provider to the instant a working service is made available for use. This should exclude cancelled orders.

A valid order may be made verbally, or in writing or in any other acceptable form.

Where a service provider and customer agree that an order for multiple connections or service instances will be completed in stages, each agreed delivery time counts as a separate customer order for measurement purposes.

Where a customer orders service to be provided at several sites the provision of service at each site counts as a separate customer order for measurement purposes.

5.1.2 Application

The QoS parameter is applicable to fixed direct services only.

5.1.3 Measurement and statistics

The following statistics should be provided:

a) the times by which the fastest 50 %, 95 % and 99 % of orders are completed; or

b) percentage of orders completed by the date agreed with the customer,
and, where the percentage of orders completed by the date agreed with the customer is below 80 %, the average number of days, for the late orders, by which the agreed date is exceeded.

NOTE: Throughout the present document, this is an inclusive "OR"; both statistics may be provided.

These statistics should be provided separately for the following cases:

a) Narrowband PSTN or ISDN basic rate access where a physical change is required to the access line or associated equipment such as the NTP or the line card. This includes the installation of a new access line and an upgrade from analogue to ISDN access;

b) Narrowband PSTN or ISDN basic rate access where a physical change is not required. An example is a customer taking over an existing installed access line;

c) xDSL access provided over an existing installed access line;

d) any other kind of technology in order to provide a fixed network access.

NOTE 1: The installation of supplementary services is excluded from the measurement.

In each case, figures should be given separately for cases with and without service provider number portability.

The time should be measured in elapsed days (including all public holidays etc).

Service providers may exclude from a) cases where delays to provision are requested by the customer.

Service providers may exclude from "a" and "b" cases where essential access to customer premises is not provided by the customer on the agreed date and time.

NOTE 2: Supply time and its agreement with the customer is a complex process and it is impossible to find a single measure that adequately reflects all aspects of the interactions. Statistic a) is meant to cover the majority of cases except where delays are specifically requested by the customer. It includes cases where the service provider offers one or more closely spaced possible appointment times. Only cases where the customer actively rejects an appointment time and asks for a later time because, for example, other essential work will not be ready, should be excluded. The time for completing 99 % of the orders may be influenced quite strongly by the extent to which customer requested delays are excluded, and so this measure may be less reliable for comparison purposes than the 95 % figure.

NOTE 3: Elapsed days are used instead of working days because:

- elapsed time better reflects the user experience and ensures that overall improvements in service are adequately reflected in the results;
- users increasingly require telecommunications outside traditional working hours (move to the 24 hour society);
- differences in working hours can introduce anomalies into measures of performance based on working hours and so elapsed time provides better comparability of results between service providers.

Where service providers quote a standard accuracy for keeping appointments (e.g. they quote anytime within an hour or a half day) this period should also be provided.

NOTE 4: This requirement has been added to provide greater visibility of improvements in the QoS perceived by customers. This is necessary because a reduction in window for keeping appointments, which improves the service to the customer, may lead to a decreased number of cases where the narrower appointment window is met.

Measurements apply only to fixed direct services. The provision of service on an unswitched unbundled local loop should count as a direct service and be reported by the direct service provider, which in this case is different from the access network operator.

NOTE 5: Measurements of the provision of service for indirectly provided services are covered in clause 5.2.

The provision of service on ISDN basic access should count as a single network access even though two separate connections can be built up at the same time.

Statistics should include all network accesses supplied in the data collection period.

5.1.4 Further considerations

The supply of any customer premises equipment as part of or in conjunction with the order may be excluded from the measurement.

5.2 Proportion of problems with number portability procedures

5.2.1 Definition

The ratio of the number of supply orders with number portability where there is a deviation from the normal porting procedure agreed between the operators to the total number of supply orders that include number portability. A deviation from the normal porting procedure occurs when:

- there is a gap in either or both incoming and outgoing service of over 1 hour; or
- all the service from the donor has to be restored temporarily whilst problems are resolved.

5.2.2 Application

The QoS parameter is applicable to fixed and mobile direct services.

5.2.3 Measurement and statistics

The following statistic should be provided:

The number of supply orders with a deviation from the normal porting procedure divided by the total number of supply orders with number portability.

Statistics should include all supply orders with number portability.

5.3 Fault report rate per fixed access lines

5.3.1 Definition

The number of fault reports per fixed access line.

A fault report is a report of disrupted or degraded service that is notified by the customer to the published point of contact of the service provider and is attributable to the fixed access line, and that is not found to be invalid. Faults in any equipment on the customer side of the network termination point and faults which are attributable to the core network or other networks are excluded.

Network faults reported against either basic or primary rate access, or single or multi-line analogue access, should be counted as one fault, regardless of the number of channels activated or affected. The count of the number of access lines should be one for basic or primary rate access regardless of the number of channels activated.

5.3.2 Application

The QoS parameter is applicable to fixed access lines and fixed direct services only.

5.3.3 Measurement and statistics

The number of valid fault reports per fixed access line should be provided.

This statistic should be calculated by dividing the number of valid fault reports observed during the data collection period (see clause 4.6) by the average number of access lines in the network under consideration during the same data collection period. The averaging is necessary because the number of access lines may vary during the data collection period. Service providers that cannot distinguish between:

- valid faults attributable to the fixed access line;
- faults attributable to the core network;
- faults attributable to other networks;
- faults attributable to CPE; or
- invalid faults

may use the total number of reported faults.

Fault reports should be assumed to be valid unless there is a specific reason to consider that they are invalid. Cases where a customer reports a fault that is found to be cleared when tested should be counted as a valid report unless the service provider has reason to believe that the fault did not occur.

A report that concerns more than one access line between customers and the local exchange (or remote concentrator) should be counted in terms of the number of fault reports received rather than the number of lines affected. However only one fault report should be included for each access line affected.

Statistics should include all valid fault reports in the data collection period.

5.4 Fault repair time for fixed access lines

5.4.1 Definition

The duration from the instant a fault report has been made to the instant when the service element or service has been restored to normal working order.

This measure applies only to services that offer the "standard repair" times to customers. The "standard repair" times are the times stated in the terms and conditions of the service provider. Cases where the service provider does not offer a "standard repair" time or where the service provider agrees with the customer to provide faster repair for payment of higher maintenance fees are excluded, as are cases where lower fees are charged in return for a lower level of repair service.

NOTE: "Fault reports" in this definition includes all valid reported faults as defined in clause 5.3.1.

5.4.2 Application

The QoS parameter is applicable to fixed direct services only.

5.4.3 Measurement and statistics

The following statistics should be provided:

a) the time by which the fastest 80 % and 95 % of valid faults on access lines are repaired (expressed in clock hours); or

b) the percentage of faults cleared any time stated as an objective by the service provider.

NOTE 1: The basis of measurement has been changed from working hours to elapsed clock hours because:

- elapsed time better reflects the user experience and ensures that overall improvements in service are adequately reflected in the results;
- users increasingly require telecommunications outside traditional working hours (move to the 24 hour society);
- changes in working hours can introduce anomalies into measures of performance based on working hours;
- elapsed time provides better comparability of results between service providers.

The statistics should include all fault repairs in the data collection period, but excluding those traced to other interconnected networks where the service provider does not receive information on the clearing of the fault. The statistics should be based on faults cleared in the data collection period, irrespective of when they are reported.

In addition, the service provider should provide information on the hours during which faults may be reported.

NOTE 2: This requirement has been added to provide greater visibility of improvements in the QoS perceived by customers. This is necessary because increases in the hours during which faults may be reported which improve the service to the customer may lead to an increase in the measured time to repair faults. This situation would occur if the hours for reporting faults extend beyond the hours for actioning those faults.

EXAMPLE: A fault occurs Saturday evening 8:00 p.m. At service provider A the customer can report the fault immediately. Nevertheless the service provider will start to repair at Monday morning 8:00 a.m. The fault is repaired at 12:00 o'clock. Repair time for provider A is 40 hours. At service provider B the customer has to wait till Monday morning 8:00 a.m. to report the fault. It is repaired also at 12:00 o'clock. Repair time for service provider B is 4 hours. This example shows the relationship between the time to repair faults and the significance of the time during which customers can report faults.

Where service providers quote a standard accuracy for keeping appointments (e.g. they quote anytime within an hour or a half day) this period should also be provided.

NOTE 3: This requirement has been added to provide greater visibility of improvements in the QoS perceived by customers. This is necessary because a reduction in the quoted window for keeping appointments, which improves the service to the customer, may lead to a decreased number of cases where the narrower appointment window is met.

5.4.4 Further considerations

Cases where:

- repair depends upon access to the customer premises and this access is not possible at the desired time; or
- the customer requests a delay

may be excluded from the statistics. When calculating the repair time, service providers who choose to include these cases may subtract from the measured time the delay introduced by the customer.

5.5 Response time for operator services

5.5.1 Definition

The duration from the instant when the address information required for setting up a call is received by the network (e.g. recognized on the calling user's access line) to the instant the human operator answers the calling user to provide the service requested. Services provided wholly automatically, e.g. by voice response systems, are excluded.

The services covered are the services for operator controlled and assisted calls that are accessed with special access codes. Access to emergency services is excluded.

NOTE: The period in this definition includes waiting times because operators are busy, and times for going through voice response systems to reach the operator. However it excludes the handling of the call by the operator, e.g. conversation with the operator. The reasons are that the variety of calls to operators is too wide and that it is too difficult/costly in practice to measure the operator's performance precisely.

5.5.2 Application

The QoS parameters is applicable to all operator services irrespective whether they should be provided by fixed, mobile, direct and/or indirect services. The term "operator services" is related to those services as defined in ITU-T Recommendation E.105 [3] as calls with "semi-automatic" and "manual" operation.

5.5.3 Measurement and statistics

The following statistics should be provided:

a) mean time to answer; or

b) percentage of calls answered within 20 seconds.

NOTE: The first statistic gives the more comparable measure of overall performance, and the second statistic indicates the proportion of calls where the waiting time is unacceptably long. The percentage of calls answered within 20 seconds was chosen rather than the time to answer the fastest 90 % because the calculation does not require large quantities of data to be stored.

Statistics should either:

a) include all calls to operator assisted services in the data collection period; or

b) be based on a representative sample, in which case the number of observations should be provided.

Measurements apply to both direct and indirect services. Where a service provider provides both direct and indirect services, it should provide a combined report for these service types.

Annex C gives a formula for calculating the number of observations needed.

5.5.4 Further considerations

Where a service provider re-sells to customers operator services provided by a third party, the service provider has responsibility for reporting on quality but may subcontract the measurements to the third party who will have to make separate measurements for each service provider that it supports.

Many operator call centres are equipped to measure response times locally and exclude the call set-up time. In this case, service providers should make an appropriate adjustment to the statistics to take account of the call set-up time from the NTP to the call centre.

NOTE: Call set-up times measured for national calls could be used in this adjustment if appropriate. Care should be taken to use an adequate adjustment, since calls to operator call centres are often set up by using different routing mechanisms.
For detailed information on how to measure call set-up times refer to part 2 of the present document.

5.6 Response time for directory enquiry services

5.6.1 Definition

The duration from the instant when the address information required for setting up a call is received by the network (e.g. recognized on the calling user's access line) to the instant the human operator or an equivalent voice-activated response system answers the calling user to provide the number information requested.

NOTE The period in this definition includes waiting times because attendants are busy, and times for going through voice response systems to reach the point where the enquiry can be handled. However it excludes the handling of the enquiry itself, e.g. conversation with the attendant and the response of any database used by the attendant. The reasons are that the variety of enquiries is too wide and that it is too difficult/costly in practice to measure when the answer is given.

5.6.2 Application

The QoS parameters is applicable to all directory enquiry services irrespective whether they should be provided by fixed, mobile, direct and/or indirect services.

NOTE: Normally directory enquiry services are reached via special telephone numbers allocated in the national numbering plans providing access to publicly available telephone directories. The QoS parameter should be applied only to these services.

5.6.3 Measurement and statistics

The following statistics should be provided:

a) mean time to answer; or

b) percentage of calls answered within 20 seconds

NOTE: The first statistic gives the more comparable measure of overall performance, and the second statistic indicates the proportion of calls where the waiting time is unacceptably long. The percentage of calls answered within 20 seconds was chosen rather than the time to answer the fastest 90 % because the calculation does not require large quantities of data to be stored.

Statistics should either:

a) include all calls to directory enquiry services in the data collection period; or

b) be based on a representative sample, in which case the number of observations should be provided.

Annex C gives a formula for calculating the number of observations needed.

Measurements apply to both direct and indirect services. Where a service provider provides both direct and indirect services, it should provide a combined report for these service types.

5.6.4 Further considerations

Where a service provider re-sells to customers directory services provided by a third party, the service provider has responsibility for reporting on quality but may subcontract the measurements to the third party who will have to make separate measurements for each service provider that it supports.

Many directory enquiry call centres are equipped to measure response times locally and exclude the call set-up time. In this case, service providers should make an appropriate adjustment to the statistics to take account of the call set-up time from the NTP to the call centre.

NOTE: Call set-up times measured for national calls could be used in this adjustment if appropriate. Care should be taken to use an adequate adjustment since calls to directory enquiry call centres are often set up by using different routing mechanisms.
For detailed information on how to measure call set-up times refer to part 2 of the present document.

5.7 Response time for admin/billing enquiries

5.7.1 Definition

The duration from the instant when the address information required for setting up a call is received by the network (e.g. recognized on the calling user's access line) to the instant the human operator or an equivalent voice-activated response system answers the calling user to handle the enquiry.

NOTE: The period in this definition includes waiting times because attendants are busy, and times for going through voice response systems to reach the point where the enquiry can be handled. However it excludes the handling of the enquiry itself, e.g. conversation with the attendant and the response of any database used by the attendant. The reasons are that the variety of enquiries is too wide and that it is too difficult/costly in practice to measure when the answer is given.

5.7.2 Application

The QoS parameters is applicable to all admin/billing enquiries made to a call centre irrespective whether they should be accessed by the customer via fixed, mobile, direct and/or indirect services.

5.7.3 Measurement and statistics

The following statistics should be provided:

a) mean time to answer; or

b) percentage of calls answered within 20 seconds.

NOTE: The first statistic gives the more comparable measure of overall performance, and the second statistic indicates the proportion of calls where the waiting time is unacceptably long. The percentage of calls answered within 20 seconds was chosen rather than the time to answer the fastest 90 % because the calculation does not require large quantities of data to be stored.

Statistics should either:

- include all calls to directory enquiry services in the data collection period; or

- be based on a representative sample, in which case the number of observations should be provided.

Annex C gives a formula for calculating the number of observations needed.

Measurements apply to both direct and indirect services. Where a service provider provides both direct and indirect services, it should provide a combined report for these service types.

5.7.4 Further considerations

Where a service provider re-sells to customers directory services provided by a third party, the service provider has responsibility for reporting on quality but may subcontract the measurements to the third party who will have to make separate measurements for each service provider that it supports.

Many directory enquiry call centres are equipped to measure response times locally and exclude the call set-up time. In this case, service providers should make an appropriate adjustment to the statistics to take account of the call set-up time from the NTP to the call centre.

NOTE: Call set-up times measured for national calls could be used in this adjustment if appropriate. Care should be taken to use an adequate adjustment since calls to directory enquiry call centres are often set up by using different routing mechanisms.
For detailed information on how to measure call set-up times refer to part 2 of the present document.

5.8 Frequency of customer complaints

5.8.1 Definition

The number of complaints logged per customer per data collection period.

5.8.2 Application

The QoS parameters is applicable to all services irrespective whether they are provided by fixed and/or mobile networks or whether they are accessed directly and/or indirectly.

5.8.3 Measurement and statistics

The number of complaints logged per customer per data collection period should be provided.

Statistics should include all complaints received in the data collection period, regardless of the validity and subject of the complaint.

5.9 Bill correctness complaints

5.9.1 Definition

The proportion of bills resulting in a customer complaint about the correctness of a given bill.

A bill correctness complaint is an expression of dissatisfaction with a bill received from a customer i.e. the bill is found to be inaccurate by the customer. An inaccuracy occurs when, for example, incorrect call data are used, calls are charged at an incorrect rate, services are billed incorrectly, call discounts, credits or debts are handled incorrectly, or the total charge including VAT is calculated incorrectly. A bill correctness complaint should not be confused with a billing query (a request for information) or with a fault report.

5.9.2 Application

The QoS parameters is applicable to all bill correctness complaints irrespective whether they are related to fixed, mobile, direct and/or indirect services.

5.9.3 Measurement and statistics

The percentage of bills resulting in a customer complaint should be provided.

Statistics should include all billing complaints received in the reporting period, regardless of the validity of the complaint and the dates of calls or any other occurrences that are the subject of the complaint.

Measurements apply to all kind of bills for telecommunication services irrespective whether direct and indirect services or a combination of them are involved. Where a service provider provides both direct and indirect services, it should provide a combined report for these service types.

In those cases were the billing for the indirectly connected call is performed by the access service provider a separate statistic is required.

5.9.4 Further considerations

There are three aspects of quality for billing:

- the absolute accuracy of the bill
- the presentation of the bill
- the number of customer complaints about the bill

A bill is prepared in three stages:

- call detail records (CDRs) are generated
- tariff and customer discounts are applied to the CDRs, normally by a mediation device (this is known as call rating)
- the rated CDRs are assembled into the bill

Unless customers have their own means of making their own call records, it is very difficult to prove whether a CDR is correct or not. This means that it is very difficult to measure the absolute accuracy of a bill and therefore absolute accuracy is not included as a parameter.

In practice, any billing problems are likely to be the result of applying wrong tariffs or discounts as a result of incorrect data stored in the mediation devices that do the call rating. Such errors would affect many bills and will normally be corrected retrospectively when they are discovered. A parameter for such errors could be included but STQ concluded that it is not necessary because the effects would be indicated by the customer complaints parameter.

The customer complaints parameter is identical to the one for ONP.

5.10 Bill presentation quality

5.10.1 Definition

A subjective measure of the user's assessment of the quality of the presentation and accessibility of information in a bill. The measure is also suitable to measure the presentation quality of itemized billing.

5.10.2 Application

The QoS parameters is applicable to all bills irrespective whether they are related to fixed, mobile, direct and/or indirect services.

5.10.3 Measurement and statistics

A random sample should be taken of residential customers who have received a bill from a given service provider within the last 3 months.

The customers should be asked:

a) How easy is it to find exactly which tariffs and optional services you are subscribing to?

b) How easy is it to locate the record of a specific call to a specific number?

c) How easy is it to find the exact price paid including VAT and any discounts, for a specific call?

d) How easy is it to find which charge band and which rate (peak/off-peak) is applied to a specific call?

e) How do you rate the bill overall in terms of clarity, understand ability and ease of use?

For questions a to d the customer should rate the effort according to the following scale:

Table 4: Effort scale

Score	Effort required to perform task (How easy is it to...?)
5	Very easy; no effort required
4	Attention necessary; a little effort required
3	Moderate effort required
2	Considerable effort required
1	Not possible with any reasonable effort

For question e the customer should rate the quality according to the following scale:

Table 5: Quality scale

Quality	Score
Excellent	5
Good	4
Fair	3
Poor	2
Bad	1

The sample size for this measure should be at least 100 valid responses (valid responses exclude those customers who refused to answer all questions).

For each of the five questions the average of the opinion scores should be calculated (Mean Opinion Score, MOS).

The bill presentation quality is then given by:

$$\text{Bill presentation quality} = \frac{\sum_{i=1}^{5} MOS_{Question\ i}}{5}$$

5.11 Customer relations

5.11.1 Definition

The degree of satisfaction that a customer has with the overall way in which they are treated.

5.11.2 Application

The QoS parameters is applicable to all services irrespective whether they are provided by fixed and/or mobile networks or whether they are accessed directly and/or indirectly.

5.11.3 Measurement and statistics

A random sample is taken of residential customers who have dealt directly with a given service provider within the last 3 months. The customers are asked what they think of the overall way they are treated rather than the quality or price of the telecommunications services provided. The measure should exclude customers who respond "don't know" or who refuse to answer.

The customers are asked how satisfied they are with the customer relations service according to the following scale:

Table 6: Quality scale

Quality	Score
Excellent	5
Good	4
Fair	3
Poor	2
Bad	1

The sample size for this measure should be at least 100 valid responses (valid responses exclude those customers who respond with "don't know" and those customers who refused to answer).

The quality of customer relations is then given by the average of the opinion scores.

Annex A (informative): Combination of weekly or monthly results

Mean values and percentages produced weekly or monthly may be aggregated into quarterly statistics using one of the following formulae:

a) For weekly statistics

$S_{quarterly} = (\sum N_i.S_i) / (\sum N_i)$ where i = 1, 2...13

and

N_i = The number of events in each week

S_i = The statistic for each week

b) For monthly statistics

$S_{quarterly} = (\sum N_i.S_i) / (\sum N_i)$ where i = 1, 2, 3

and

N_i = The number of events in each month

S_i = The statistic for each week

For aggregating the median or the 95 %-quantile into quarterly statistics, one has to apply the same procedure as explained in annex B.

Annex B (normative): Further explanation of "fastest X %"

Several parameters require a statistic of the form:

"the time by which the fastest X % of <relevant event>"

This annex explains what is meant.

The measurements give a list of times recorded for the events, for example a list of supply times. This list of times should be counted and sorted into ascending order.

X % of the total number of measurements counted should be calculated giving a number, say "n" which would be rounded down to the nearest integer.

The "n"th time in the sorted ascending list will then be "the time by which the fastest X % of <relevant event>" occurred and is the statistic to be reported.

Annex C (normative): Method of calculating the number of observations required for measures of time

The number of observations for quantitative variables depends on the variability of the measurements. It can be calculated by the formula

$$n = \frac{z_{1-\alpha/2}^2}{a^2} \cdot \left(\frac{s}{mean(x)} \right)^2$$

Where

$z_{1-\alpha/2}$: is the 1-α/2-percentile of the standard normal distribution

s: is the expected standard deviation of the call setup time (calculated from former measurements)

mean(x): is the expected mean value of the call setup time (calculated from former measurements)

a: is the relative accuracy.

Even though there is no requirement to provide the standard deviation, an estimate should be available for use in this formula.

The following table gives the resulting values where:

$z_{1-\alpha/2}$ = 1,96 for a confidence level of 95 %

a = 2 %.

s/mean(x)	observations
< 0,1	100
0,1 - 0,3	1 000
> 0,3 - 0,5	2 500
> 0,5 - 0,7	5 000
> 0,7 - 0,9	7 500
> 0,9	10 000

Annex D (informative): Bibliography

ETSI EG 202 009-1: "User Group; Quality of Telecom Services; Part 1: Methodology for identification of parameters relevant to the Users".

ETSI EG 202 009-2: "User Group; Quality of Telecom Services; Part 2: User related parameters on a service specific basis".

Directive 97/51/EC of the European Parliament and of the council of 6 October 1997 amending Council Directives 90/387/EEC and 92/44/EEC for the purpose of adaptation to a competitive environment in telecommunications.

ETSI EG 201 769: "Speech Processing, Transmission and Quality Aspects (STQ); QoS parameter definitions and measurements; Parameters for voice telephony service required under the ONP Voice Telephony Directive 98/10/EC".

History

Document history		
V1.1.1	July 2002	Membership Approval Procedure MV 20020906: 2002-07-09 to 2002-09-06
V1.1.1	September 2002	Publication