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

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Contents

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Foreword

This final draft ETSI Standard (ES) has been produced by ETSI Technical Committee Speech and multimedia Transmission Quality (STQ), and is now submitted for the ETSI standards Membership Approval Procedure.

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, modem data services and SMS";

Part 3: "QoS parameters specific to Public Land Mobile Networks (PLMN)";

Part 4: "Internet access".

ES 202 057-1 (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.

EG 202 057-2 [i.4] contains user related QoS parameter definitions and measurement methods for voice, Group 3 fax, modem data services and SMS accessed via the public telecommunications network. The data parameters are specified for the case where an ITU-T Recommendations V.90 [4] and V.92 [5], compliant modem is used since this kind of modem is in common use.

EG 202 057-3 [i.5] contains user related QoS parameter definitions and measurement methods for Public Land Mobile Networks (PLMN).

EG 202 057-4 [i.6] contains user related QoS parameter definitions and measurement methods specific to Internet access.

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 this multi-part deliverable. This multi-part deliverable 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.

EG 202 843 [i.3]: "User Group; Quality of ICT Services; Definitions and Methods for Assessing the QoS parameters of the Customer Relationship Stages other than utilization" refers to EG 202 057 series for some parameters. These parameters are listed in the relevant clauses of the present document.

Introduction

With regard to the previous versions, the description of the QoS parameters in the present document has been enhanced by adding explanation on the definition, the equation that provides the assessment result and the type of result (Time, OR, %, Number, etc.).

Evaluation specific description, trigger points, accuracy of indicator (metric of measure), representativeness and presentation of parameter values clauses have also been added in order to facilitate the use of these parameters.

A timeline on the process whose QoS is assessed, is provided at the beginning of each parameter description to make more explicit the equation used for the definition of the parameters.

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. Annexes E and F provide a set of in-force specifications, Guides and standards for QoS.

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.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

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

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

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

[4] 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".

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

[6] Void.

[7] ETSI TS 102 852: "User Group; Quality of ICT Services; Assessment process of the QoS parameters of the customer relationship stages".

[8] ETSI TS 102 845: "User Group; Quality of ICT Services; Requirements for Check-up on Metering and Billing Processes".

[9] ETSI TS 102 846: "User Group; Quality of ICT Services; Requirements for Bodies Providing Conformity Assessment of Checking-up on Metering and Billing Processes".

[10] Void.

[11] Void.

[12] Void.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] 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.

[i.2] Public Opinion Quarterly, 49, 535-552: "The measurement of values in surveys: A comparison of ratings and rankings", Alwin, D. F. & Krosnick, J. A. (1985).

[i.3] ETSI EG 202 843: "User Group; Quality of ICT Services; Definitions and Methods for Assessing the QoS parameters of the Customer Relationship Stages other than utilization".

[i.4] ETSI EG 202 057-2: "Speech and multimedia Transmission Quality (STQ); User related QoS parameter definitions and measurements; Part 2: Voice telephony, Group 3 fax, modem data services and SMS".

[i.5] ETSI EG 202 057-3: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 3: QoS parameters specific to Public Land Mobile Networks (PLMN)".

[i.6] ETSI EG 202 057-4: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 4: Internet access".

3 Definitions, symbols 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 (NTP) 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 [i.1].

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

Internet: computer network consisting of a worldwide network of computer networks that use the TCP/IP network protocols to facilitate data transmission and exchange

Internet access: making available of facilities and/or services for the purpose of providing an access to the public Internet in order to provide a user with access to services or resources of the Internet

NOTE 1: The Internet access can be separated in two parts, the physical and the logical access.
The physical access provides a connection from the user's premises to, but not including, the POP (normally a dial-up circuit or broadband link or leased line) whereas the logical access consist of the setting up of an account that later on enables the user by a login process with the ability to access to the services and resources of the Internet (normally by assigning an IP address).

NOTE 2: The physical and logical access may be provided by different service providers.

NOTE 3: The function of the physical access may be provided by several interconnected networks.

Internet Access Provider (IAP): organization that provides users with an Internet access

login process: multi-step process which includes both authentication and authorization as well as other system start-up tasks in order to provide a user with access to services or resources

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 (NTP): physical point at which a user is provided with access to a public telecommunications network

Opinion Rating (OR): quantitative value (a number) assigned to a qualitative performance criterion on a predefined rating scale to reflect the merit of that criterion to a user/customer

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 Internet: part of the Internet that is available to the general public

NOTE: The access is normally provided by Internet access and Internet service providers.

Public Telecommunications Network (PTN): 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 [2].

Service Provider (SP): organization that provides electronic communications services to users and customers

NOTE 1: See ITU-T Recommendation E.800 [2].

NOTE 2: A service provider does not have to 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 [3]).

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

EXAMPLE: 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 [i.1].

3.2 Symbols

For the purposes of the present document the symbols given in EG 202 843 [i.3] and the following apply:

P1	Supply time for fixed network access
P1.11	The time by which the fastest 50 % of orders are completed
P1.12	The time by which the fastest 95 % of orders are completed
P1.13	The time by which the fastest 99 % of orders are completed
P1.2	Percentage of orders completed by the date agreed with the customer
P1.3	Number of days, for the late deliveries, by which the agreed date is exceeded
P2	Supply time for Internet access
P2.11	The time by which the fastest 50 % of orders are completed
P2.12	The time by which the fastest 95 % of orders are completed
P2.13	The time by which the fastest 99 % of orders are completed
P2.2	Percentage of orders completed by the date agreed with the customer
P2.3	Number of days, for the late deliveries, by which the agreed date is exceeded
P3	Proportion of problems with number portability procedures
P4	Fault report rate per fixed access lines
P4.1	Valid faults attributable to the fixed access line
P4.2	Faults attributable to the core network
P4.3	Faults attributable to other networks
P4.4	Faults attributable to CPE
P4.5	Invalid faults
P5	Fault repair time for fixed access lines
P5.11	The time by which the fastest 80 % of valid faults on access lines are repaired
P5.12	The time by which the fastest 95 % of valid faults on access lines are repaired
P5.2	Percentage of repairs completed within a specified time period
P6	Response time for operator services
P6.1	Response time for operator services - mean time to answer
P6.2	Response time for operator services - percentage of calls answered within 20 seconds
P7	Response time for directory enquiry services
P7.1	Mean time to answer directory enquiries
P7.2	Percentage of directory enquiries answered within 20 seconds
P7.3	Percentage of directory information provided within a time specified as a reference or a commitment
P8	Mean time to answer admin/billing enquiries
P8.1	Percentage of enquiries handled by IVR systems
P8.2	Percentage of enquiries transferred to a human operator by the IVR systems
P8.31	The time by which the fastest 80 % of admin/billing enquiries have been answered (by e-mail)
P8.32	The time by which the fastest 95 % of admin/billing enquiries have been answered (by e-mail)
P8.33	Percentage of admin/billing enquiries answered within the delay taken as a commitment by the provider (by e-mail)
P8.41	The time by which the fastest 80 % of admin/billing enquiries have been answered (Voice call)
P8.42	The time by which the fastest 95 % of admin/billing enquiries have been answered (Voice call)
P8.43	Percentage of admin/billing enquiries answered within the delay taken as a commitment by the provider (Voice call)
P8.51	The time by which the fastest 80 % of admin/billing enquiries have been answered (letter/postcard)
P8.52	The time by which the fastest 95 % of admin/billing enquiries have been answered (letter/postcard)
P8.53	Percentage of admin/billing enquiries answered within the delay taken as a commitment by the provider (letter/postcard)
P8.61	The time by which the fastest 80 % of admin/billing enquiries have been answered (Web page)
P8.62	The time by which the fastest 95 % of admin/billing enquiries have been answered (Web page)
P8.63	Percentage of admin/billing enquiries answered within the delay taken as a commitment by the provider (Web page)
P8.71	The time by which the fastest 80 % of admin/billing enquiries have been answered (shop)
P8.72	The time by which the fastest 95 % of admin/billing enquiries have been answered (shop)
P8.73	Percentage of admin/billing enquiries answered within the delay taken as a commitment by the provider (shop)
P9	Frequency of customer complaints

P9.1	Frequency of customer complaints - By e-mail
P9.2	Frequency of customer complaints - By telephone (two way conversation)
P9.3	Frequency of customer complaints - By post
P9.4	Frequency of customer complaints - By Internet web pages
P9.5	Frequency of customer complaints - By live talk at a shop
P10	Customer complaints resolution time
P10.11	The time by which the fastest 80 % of complaints have been resolved (by e-mail)
P10.12	The time by which the fastest 95 % of complaints have been resolved (by e-mail)
P10.13	The percentage of complaints resolved within any time stated as an objective by the service provider (by e-mail)
P10.21	The time by which the fastest 80 % of complaints have been resolved (Voice call)
P10.22	The time by which the fastest 95 % of complaints have been resolved(Voice call)
P10.23	The percentage of complaints resolved within any time stated as an objective by the service provider (Voice call)
P10.31	The time by which the fastest 80 % of complaints have been resolved (letter/postcard)
P10.32	The time by which the fastest 95 % of complaints have been resolved (letter/postcard)
P10.33	The percentage of complaints resolved within any time stated as an objective by the service provider (letter/postcard)
P10.41	The time by which the fastest 80 % of complaints have been resolved (Web page)
P10.42	The time by which the fastest 95 % of complaints have been resolved (Web page)
P10.43	The percentage of complaints resolved within any time stated as an objective by the service provider (Web page)
P10.51	The time by which the fastest 80 % of complaints have been resolved (shop)
P10.52	The time by which the fastest 95 % of complaints have been resolved (shop)
P10.53	The percentage of complaints resolved within any time stated as an objective by the service provider (shop)
P11	Bill correctness complaints
P12	Prepaid account credit correctness complaints
P13	Bill presentation quality
P13.1	How easy is it to find exactly which tariffs and optional services you are subscribing to?
P13.2	How easy is it to locate the record of a specific communication to or from a specific destination?
P13.3	How easy is it to find the exact price paid including VAT and any discounts, for a specific communication (voice or data)?
P13.4	How easy is it to find which charge band and which rate (peak/off-peak) is applied to a specific communication (voice or data)?
P13.5	How do you rate the bill overall in terms of clarity, understand ability and ease of use?
P14	Mean Opinion Rating of the customer relation
P15	Mean Opinion Rating of the professionalism of a help line
P105	Response time of the commercial desk
P106	Overall rating of the responsiveness of the service desk
P107	User friendliness of the Internet user interface
P108	User friendliness of the service desk operators
P205	Response time of the commercial desk
P206	Delay to settle a contract
P207	Delay for a contract acknowledgment
P208	Overall rating of the responsiveness of the sales desk
P209	Ease of the subscription process
P210	Vendors empathy and responsiveness
P309	Provisioning time
P310	Overall quality of the provisioning process including the reception desk
P311	Provider ability to match the customer's wishes for conditions of achievement
P312	User friendliness of the means available to the customer for the operations he has to perform
P313	Portage delay
P314	Proportion of problems with number portability procedures
P409	Response time of the alteration service
P410	Overall quality of the alteration process
P411	User friendliness of the means available to the customer for the operations he has to perform
P509	Overall quality of the technical upgrade process
P510	Provider ability to match the customer's wishes for conditions of achievement
P511	User friendliness of the means available to the customer for the operations he has to perform
P628	Response time of the technical support
P629	Request to technical support resolution time

P630	Number of customer requests to technical support
P631	User friendliness of the technical support
P647	Response time of the commercial support
P648	Request to commercial support resolution time
P649	Number of customer requests to commercial support
P650	Quality of the commercial support
P651	User friendliness of the commercial support
P667	Response time of the complaint management desk
P668	Customer complaints resolution time
P669	Number of customer complaints of any kind
P670	Professionalism of the complaint management desk
P706	Fault repair time
P707	Number of customer complaints related to repair services
P708	Professionalism of the repair staff
P709	Provider ability to match the customer's wishes for conditions of achievement
P710	User friendliness of the repair service
P810	Bill correctness complaints
P811	Prepaid account credit correctness complaints
P812	Provider ability to match the customer's wishes for charging/billing conditions
P813	User friendliness of the desk in charge of billing issues
P814	Bill presentation quality
P907	Response time of the operator of the network/service management facility
P909	Number of customer complaints related to network/service management by the customer
P910	Overall quality of the network/service management process
P911	Provider ability to match the customer's wishes for network/service management conditions
P912	User friendliness of the means available to the customer for the operations he has to perform
P1006	Response time of the cessation facility
P1007	Overall quality of the cessation process
P1008	Number of customer complaints related to cessation
P1009	Ease of the cessation process

3.3 Abbreviations

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

ACD	Automatic Call Distribution
ATM	Asynchronous Transfer Mode
CDF	Cumulative Distribution Function
CDR	Call Detail Record
CPE	Customer Premises Equipment

NOTE: Controlled and normally provided by the customer.

GSM	Global Service for Mobile communication
IAP	Internet Access Provider
ICT	Information and Communication Technologies
IP	Internet Protocol
ISDN	Integrated Services Digital Network
IVR	Interactive Voice Response
NTP	Network Termination Point
ONP	Open Network Provision
OR	Opinion Rating
PDF	Probability Distribution Function
PI	Preliminary Information
PLMN	Public Land Mobile Networks
POP	Point of Presence
PSTN	Public Switched Telephone Network
PTN	Public Telecommunications Network
QoS	Quality of Service
QoSAP	Quality of Service Assessment Party
SMS	Short Message Service

TCP/IP	Transmission Control Protocol / Internet Protocol
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 telecommunications 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 1st January, 1st April, 1st July and 1st 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 This parameter applies also for "Supply time for initial connection"
Supply time for Internet 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.	All actual	Internet service providers This parameter applies also for "Supply time for initial connection"
Proportion of problems with number portability procedures	number 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

Parameter	Measure	Measurement Method	Application
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
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 enquiry services
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
Prepaid account credit correctness complaints	percentage of all prepaid accounts resulting in a customer complaint.	all actual	all service providers
Bill presentation quality	OR value.	survey	all service providers
Frequency of customer complaints	number of complaints logged per customer.	all actual	all service providers
Customer complaints resolution time	a) the time by which the fastest 80 % and 95 % of complaints have been resolved; b) percentage of complaints resolved any time stated as an objective by the service provider.	all actual	all service providers
Customer relations	OR value.	survey	all service providers
Professionalism of help line	OR 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
Supply time for Internet 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 Internet 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

Parameter	Measure	Information provided by
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
Prepaid account credit correctness complaints	percentage of all prepaid accounts resulting in a customer complaint.	provider who is billing the customer
Bill presentation quality	OR value	provider who is billing the customer
Frequency of customer complaints	number of complaints logged per customer.	provider who is billing the customer
Customer complaints resolution time	a) the time by which the fastest 80 % and 95 % of complaints have been resolved; b) percentage of complaints resolved any time stated as an objective by the service provider.	provider with customer relation
Customer relations	OR value.	provider with customer relation
Professionalism of help line	OR value.	provider with customer relation

The assessment of several parameters playing a key role in the quality of billing, have not been included in the present document as being too difficult to use by the end-user. Two Technical Specifications, TS 102 845 [8] and TS 102 846 [9] have been developed to specifically check the quality of metering and billing systems and provide to the end-user a more understandable information on the reliability of billing.

TS 102 852 [7] defines an assessment process of the QoS parameters of the customer relationship stages" and may be used in association with the present document.

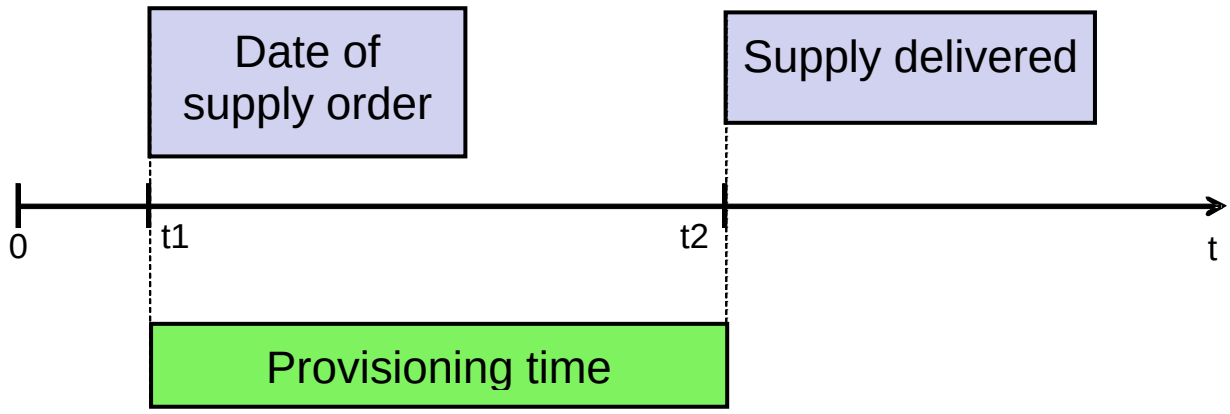
Timeline figures are provided for each time related parameter to make more explicit the equation used for the assessment of these parameters.

Blue boxes (above the timeline) always show the observable events from the customer's point of view whereas the green boxes (below the timeline) represent the related parameters.

Dotted lines connect the parameters to the timeline and show:

- either the start and end points in time (referred as "trigger points") which are relevant for a parameter; or
- they are connected to a specific point of time after which a parameter can be determined.

5.1 Supply time for fixed network access [Time]



NOTE: Where:
t_1 Point of time when supply event is ordered
t_2 Point of time when supply event actually occurs

Figure 1: Events and parameters for supply time for fixed network access

5.1.1 Definition

The delay between the supply order and the supply delivery.

5.1.1.1 Explanation of parameter 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.

NOTE: In many cases the fixed network access is offered in bundle with Internet access services. Thus the supply time includes the provision of Internet access and is not assessed separately. Therefore the supply time should be measured using the parameter "supply time for fixed network access" without applying parameter "supply time for Internet access" in cases where service providers provider fixed network access and Internet access simultaneously. The parameter is only applicable to physical Internet accesses provided in combination with a fixed network access.

This definition is applicable to a set of similar parameters mentioned in EG 202 843 [i.3]:

P309: Provisioning time [Time]
P409: Response time of the alteration service [Time]

5.1.3 Equation

$$P1\ [Time] = \left(t_{2,i} - t_{1,i}\right)$$

(see figure 1)

where:

P1	Supply time for fixed network access
i	Index of each supply event
$t_{1,i}$	Point of time when supply event *i* is ordered
$t_{2,i}$	Point of time when supply event *i* actually occurs

The following indicators should be provided:

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

P1.11 is defined so that $P(T_i \leq P1.11) \geq \frac{50}{100}$

P1.12 is defined so that $P(T_i \leq P1.12) \geq \frac{95}{100}$

P1.13 is defined so that $P(T_i \leq P1.13) \geq \frac{99}{100}$

where:

$T_i = t_{2,i} - t_{1,i,}$

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.

$$P1.2\ [\%] = \frac{N_S}{N_C}$$

with $$N_S = \begin{cases} 1, & \text{if } t_2 \leq t_A \text{ and } t_2 \leq T_L \\ 0, & \text{if } t_2 > t_A \end{cases}$$

where

P1.2	Percentage of orders completed by the date agreed with the customer
N_S	Number of orders with successful supply within time period T_L
N_C	Number of contracts with agreed date
t_2	Point of time when supply event occurs
t_A	Point of time when supply is agreed
T_L	Contractual time limit for supply

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 deliveries, by which the agreed date is exceeded.

If *P1.2* < 80 %

$$P1.3\ [\%] = \frac{\sum Dl}{N_l}$$

where

P1.3	The average number of days, for the late deliveries, by which the agreed date is exceeded.
Dl	Number of days, for the late deliveries, by which the agreed date is exceeded.
N_l	Number of late deliveries.

NOTE 1: Throughout the present document, this is an inclusive "or"; both statistics may be provided.

NOTE 2: Normally service providers agree the date with the customer at the same time the service is ordered. But there are also service providers that agree the date when the order is in progress. In order to provide comparable statistics these two cases should always be reported separately or reporting should be limited to cases where the date is agreed with the customer at the time of order.

NOTE 3: In case of service providers offering different supply times for e.g. residential and business customers, it is especially valuable to provide separate statistics for different kind of customers. See also clause 4.3 for information on separate reporting.

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

5.1.4 Evaluation specific description

Precondition: Contract signed and supply date agreed.

Evaluation of this parameter can be achieved by:

- Analysis by the QoSAP of data stored at the SP.
- Survey of new customers.

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.

5.1.4.1 Supplementary services

The installation of supplementary services is excluded from the measurement.

5.1.4.2 Number portability

The supply time may be affected by the time needed to port numbers. Therefore in each of the above given cases, figures should be given separately for cases with and without service provider number portability.

NOTE: In some cases service providers are using a two-step approach to deal with supply access with number portability. In the first step they supply an access with a second number for outgoing traffic remaining the old access line for incoming traffic until number portability process is completed in a second step. The supply time count is finished when the first step is completed. Therefore, no supply time difference exists for supplies with and without number portability. In these cases stakeholders may decide not to report separate figures with and without service provider number portability.

5.1.4.3 Supply time counting

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

Service providers may exclude from clause 5.1.3 a) cases where delays to provision are requested by the customer.

Service providers may exclude from clause 5.1.3 a) and b) cases where essential access to customer premises is not provided by the customer on the agreed date and time.

NOTE 1: 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 in clause 5.1.3 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, another 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 2: Normally service providers agree the date with the customer at the same time the service is ordered. But there are also service providers that agree the date when the order is in progress. In order to provide comparable statistics it should be avoided to produce combined reports in cases where both procedures may be used. Statistic in clause 5.1.3 b) is meant to cover the cases where service providers agree a date at the moment the service is ordered. If the statistic is also be used for cases where the date is agreed later on, separate statistics for each case should be produced with a clear indication for what kind of date agreement the statistic applies.

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.

NOTE 4: When there is a specific regulation on contracts set by correspondence including a cooling-off period, the cooling-off period should be included in the supply time.

5.1.4.4 Standard accuracy for keeping appointments

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: 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.

5.1.4.5 Specific service accesses

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: 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.

5.1.5 Trigger points

Table 3: Supply time for fixed network access trigger point

Event	Trigger point from customer's point of view	Condition
Supply event is agreed by the SP	Start: t_1 in figure 1	Contract is signed
Supply delivered	Stop: t_2 in figure 1	Supply is successfully completed

5.1.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.1.7 Representativeness

The parameter can be applied to any customer group of interest (e.g. customer segments or the whole customer population of a SP). If customer segments are chosen, the samples should include as far as possible the whole population of each segment.

5.1.8 Presentation of parameter values

Depending on the sample size per assessed customer segment, these presentations are recommended:

- Histograms.
- Probability Distribution Function (PDF).
- Cumulative Distribution Function (CDF).
- Quantile values.

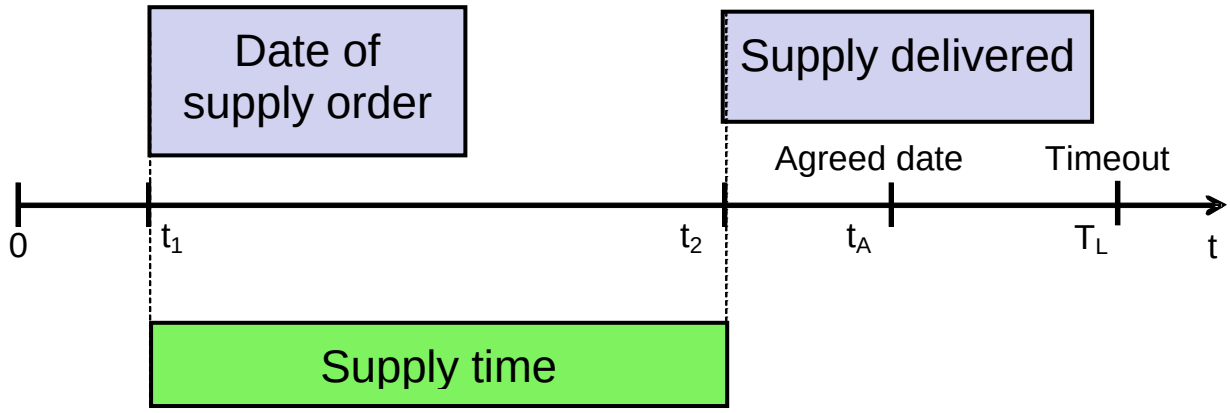
Results should be provided on a regular basis with a clear indication on the panel composition and size or/and volume of SP data reviewed.

A chart can be used to display the results for the various types of services.

5.1.9 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 Supply time for Internet access [Time]



NOTE: Where:

t_1 Point of time when service supply event is ordered (order received by the provider)
t_2 Point of time when supply event occurs
t_A Point of time when supply is agreed
T_L Contractual time limit for supply

Figure 2: Events and parameters for supply time for Internet access

5.2.1 Definition

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

5.2.1.1 Explanation of parameter definition

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.

5.2.2 Application

The QoS parameter is applicable to Internet access services only.

NOTE: This parameter is primarily used for those cases where an Internet access is provided over lines that are already in use. In cases where the Internet access is provided simultaneously with a new fixed network access the parameter "supply time for fixed network access" should be used.

This definition is applicable to a set of similar parameters detailed in EG 202 843 [i.3]:

P309: Provisioning time
P409: Response time of the alteration service

5.2.3 Equation

$$P2\ [Time] = \left(t_{2,i} - t_{1,i}\right) \mathrm{P302[Time]} = \frac{\sum_{i=1}^{N}(t_{3,i} - t_{1,i})}{N}$$

where:

$P2$ Supply time for Internet access
i Index of each service supply event

$t_{1,i}$	Point of time when service supply event *i* is ordered
$t_{2,i}$	Point of time when service supply event *i* actually occurs

The following indicators should be provided:

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

P2.11 is defined so that $P(T_i \leq P2.11) \geq \frac{50}{100}$

P2.12 is defined so that $P(T_i \leq P2.12) \geq \frac{95}{100}$

P2.13 is defined so that $P(T_i \leq P2.13) \geq \frac{99}{100}$

where:

$T_i = t_{2,i} - t_{1,i,}$

or

b) percentage of orders completed by the date agreed with the customer

$$P2.2\ [\%] = \frac{N_S}{N_C}$$

with $$N_S = \begin{cases} 1, & \text{if } t_2 \leq t_A \text{ and } t_2 \leq T_L \\ 0, & \text{if } t_2 > t_A \end{cases}$$

where

P2.2	percentage of orders completed by the date agreed with the customer
N_S	Number of orders with successful supply within time period T_L
N_C	Number of contracts with agreed date
t_2	Point of time when supply event occurs
t_A	Point of time when supply is agreed
T_L	Contractual time limit for supply

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

If *P2.3* < 80 %

$$P2.3\ [\%] = \frac{\sum D_l}{N_l}$$

where

P2.3	The average number of days, for the late deliveries, by which the agreed date is exceeded.
Dl	Number of days, for the late deliveries, by which the agreed date is exceeded.
N_l	Number of late orders.

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 cases where essential access to customer premises is not provided by the customer on the agreed date and time.

Separate statistics should be provided in the following cases where applicable:

a) the provision of physical Internet access;

b) the provision of logical Internet access;

c) the provision of Internet access including both physical or logical access.

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

5.2.4 Evaluation specific description

Precondition: Contract signed and supply date agreed.

Evaluation of this parameter can be achieved by:

- Analysis by the QoSAP of data stored at the SP.
- Survey of new customers.

These statistics should be provided separately for the following cases:

a) Internet access provided over an existing installed access line.

b) Internet access provided over a new line.

NOTE: Separate statistics should be provided for any kind of technology providing an Internet access.

5.2.4.1 Number portability

The supply time may be affected by the time needed to port numbers. Therefore in each of the above given cases, figures should be given separately for cases with and without service provider number portability.

NOTE: In some cases service providers are using a two-step approach to deal with supply access with number portability. In the first step they supply an access with a second number for outgoing traffic remaining the old access line for incoming traffic until number portability process is completed in a second step. The supply time count is finished when the first step is completed. Therefore, no supply time difference exists for supplies with and without number portability. In these cases stakeholders may decide not to report separate figures with and without service provider number portability.

5.2.4.2 Supply time counting

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

Service providers may exclude from clause 5.2.3 a) cases where delays to provision are requested by the customer.

Service providers may exclude from clause 5.2.3 a) and b) cases where essential access to customer premises is not provided by the customer on the agreed date and time.

NOTE 1: 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 in clause 5.2.3 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, another 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 2: Normally service providers agree the date with the customer at the same time the service is ordered. But there are also service providers that agree the date when the order is in progress. In order to provide comparable statistics it should be avoided to produce combined reports in cases where both procedures may be used. Statistic in clause 5.2.3 b) is meant to cover the cases where service providers agree a date at the moment the service is ordered. If the statistic is also be used for cases where the date is agreed later on, separate statistics for each case should be produced with a clear indication for what kind of date agreement the statistic applies.

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.

NOTE 4: When there is a specific regulation on contracts set by correspondence including a cooling-off period, the cooling-off period should be included in the supply time.

5.2.4.3 Standard accuracy for keeping appointments

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: 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.

5.2.5 Trigger points

Table 4: Supply time for Internet access trigger point

Event	Trigger point from customer's point of view	Condition
Supply period is agreed by the SP after contract is concluded	Start: t_1 in figure 2	Contract is signed
Successful supply within time period agreed by the provider	Stop: t_2 in figure 2	Supply is done before agreed period ends at t_A in figure 2
Successful supply after time period agreed by the provider	Stop: t_2 in figure 2 exceeds agreed period t_A in figure 2	Supply is not done before agreed period ends at t_A in figure 2
Supply does not occur before the regulatory time limit T_L	Stop: t_2 in figure 2 exceeds time limit T_L in figure 2	Contract is in principle cancelled unless explicit consent between provider and customer

5.2.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.2.7 Representativeness

The parameter can be applied to any customer group of interest (e.g. customer segments or the whole customer population of a SP). If customer segments are chosen, the samples should include as far as possible the whole population of each segment.

5.2.8 Presentation of parameter values

Depending on the sample size per assessed customer segment, these presentations are recommended:

- Histograms.
- Probability Distribution Function (PDF).
- Cumulative Distribution Function (CDF).
- Quantile values.

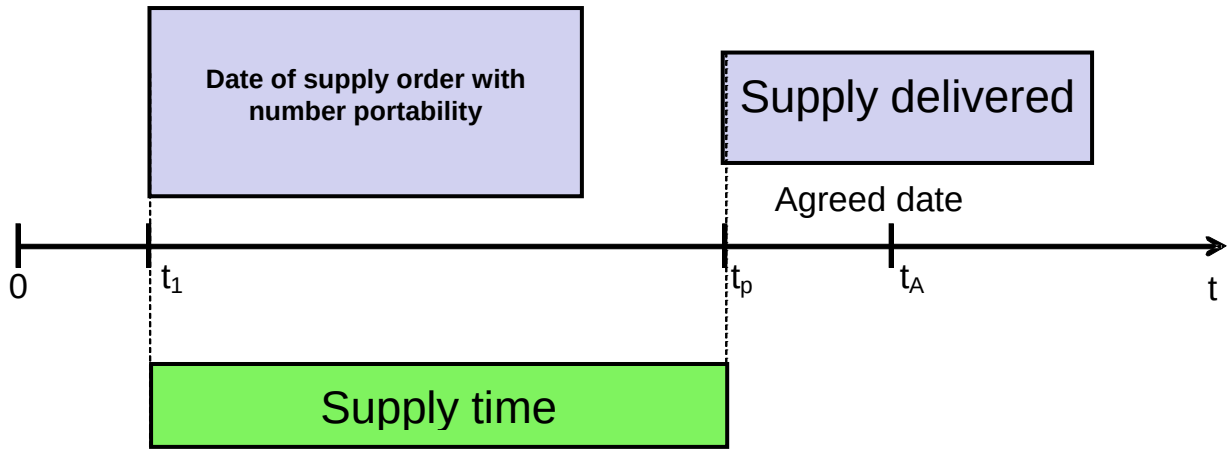
Results should be provided on a regular basis with a clear indication on the panel composition and size or/and volume of SP data reviewed.

A chart can be used to display the results for the various types of services.

5.2.9 Further considerations

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

5.3 Proportion of problems with number portability procedures [%]



NOTE: Where:

t_1 Point of time of supply order with number portability
t_p Point of time when service provisioning event occurs
t_A Point of time when service provisioning date is announced

Figure 3: Events and parameters for supply with number portability

5.3.1 Definition

According to the current regulation rules, a portability procedure should be completed within a specified period. A problem occurs if this procedure is not completed within this period.

5.3.1.1 Explanation of parameter 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; or
- the recipient operator has to open an incidence (issue) as a consequence of an event that does not permit to consider the number portability completed after the period agreed.

5.3.2 Application

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

This definition is applicable to the parameter P314 mentioned in EG 202 843 [i.3].

5.3.3 Equation

$$P3\ [\%] = \frac{\sum N_f}{\sum N_p} \times 100$$

with $$0 \leq\ t_P \leq t_A$$

where:

$P3$	Proportion of problems with number portability procedures
$\sum N_f$	Number of contracts with number portability problem within the time period t_A
$\sum N_p$	Number of contracts with service provisioning including number portability
t_p	Point of time when service provisioning event occurs
t_A	Point of time when service provisioning date is announced

When the parameter is expressed as a ratio the equation becomes:

$$P3\ = \frac{\sum N_f}{\sum N_p}$$

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.

5.3.4 Evaluation specific description

If, for any reason, it is not possible at all to make the service available to the customer, the order should be counted as an order with problem.

5.3.5 Trigger points

Table 5: Proportion of problems with number portability procedures trigger point

Event	Trigger point from customer's point of view	Condition
Provisioning period is announced by SP after contract is concluded	Start: t_1 in figure 3	Contract is signed
Successful provisioning within time period specified by provider	Stop: t_2 in figure 3	Provisioning is done before announced period ends at t_A in figure 3
Unsuccessful or too late provisioning within time period specified by provider	Stop: t_2 in figure 3	Provisioning is not done before announced period ends at t_4 in figure 3

5.3.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets. Therefore, the sample chosen should be, as far as possible the whole of the population as its number is expected to be relatively small.

5.3.7 Representativeness

For the same reasons as for the accuracy, the sample chosen should be, as far as possible the whole of the population.

5.3.8 Presentation of parameter values

The proportion of problems with number portability procedures is expressed as a percentage that should be provided on a regular basis (boxplots).

5.4 Fault report rate per fixed access lines [%]

5.4.1 Definition

The number of fault reports per fixed access line.

5.4.1.1 Explanation of parameter definition

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.

5.4.2 Application

The QoS parameter is applicable to fixed access lines and fixed direct services only. The parameter can be applied to any fixed access line allowing connection to the PTN for the use of any telecommunication service.

5.4.3 Equation

$$P4\,[\%] = \frac{\sum N_f}{\sum N_l}$$

with

$$N_P = \begin{cases} 1\ if\ \ t_P \le T_s \\ 0\ if\ \ t_P > T_s \end{cases}$$

where:

$P4$	Fault report rate per fixed access lines
$\sum N_f$	Number of fault report within time period T_s
$\sum N_l$	Number of operational lines
t_p	Point of time when fault event occurs
T_s	Specified period of time

All measures are related to the reporting period.

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.

NOTE: Normally fault reports are recorded by the service provider by the use of so called trouble ticket systems. Where these systems are in use, service providers should count the number of trouble tickets generated.

5.4.4 Evaluation specific description

Service providers that cannot distinguish between:

- P4.1 valid faults attributable to the fixed access line;
- P4.2 faults attributable to the core network;
- P4.3 faults attributable to other networks;
- P4.4 faults attributable to CPE; or
- P4.5 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.

5.4.5 Trigger points

Not applicable as the survey is carried out off line.

5.4.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.4.7 Representativeness

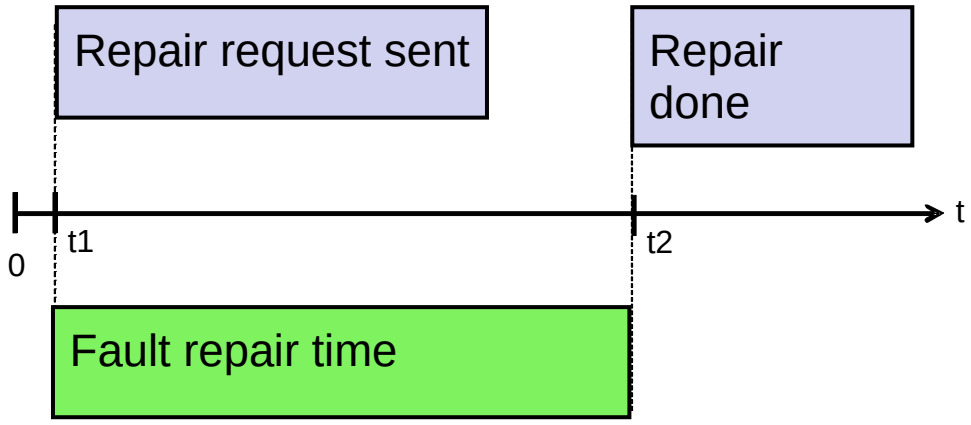
The accuracy of this indicator depends on the number of available data sets. Therefore, the sample chosen should be, as far as possible the whole of the population as its number is expected to be relatively small.

5.4.8 Presentation of parameter values

5.4.9 Further considerations

If only a specific type of access like e.g. fixed telephone access should be assessed only lines that support telephony or a bundle of services that include telephony should be considered.

5.5 Fault repair time for fixed access lines [Time]



NOTE: Where:
t_1 Time when the request for repair event occurs
t_2 Time when the service repair event actually occurs

Figure 4: Events and parameters for Repair services

5.5.1 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.

5.5.1.1 Explanation of parameter definition

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.

5.5.2 Application

The QoS parameter is applicable to fixed direct services only.

This definition is applicable to the parameter P706 mentioned in EG 202 843 [i.3].

5.5.3 Equation

$$P5[\text{Time}] = \frac{\sum_{i=1}^{N}(t_{2,i}-t_{1,i})}{N}$$

where:

$P5$	Fault repair time for fixed access lines
i	Index of each service repair event
N	Number of repair events
t_{1i}	Time when the request for repair event i occurs
$t_{2,i}$	Time when the service repair event i actually occurs

The following indicators 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);

P5.1 is defined so that $P(T_i \leq P5.1) \geq \frac{80}{100}$

P5.2 is defined so that $P(T_i \leq P5.2) \geq \frac{95}{100}$

where:

$T_i = t_{2,i} - t_{1,i,}$

or

b) the percentage of faults cleared in the time specified in any contract or service level agreement. In this case the time should be reported together with the percentage.

$$P5.3\ [\%] = \frac{N_S}{N_C}$$

with $$N_S = \begin{cases} 1, & \text{if } t_2 \leq t_A \\ 0, & \text{if } t_2 > t_A \end{cases}$$

where:

P5.3	percentage of repairs completed within the specified time period T_L
N_S	Number of repairs completed within the specified time period T_L
N_C	Number of requests for repair within the survey period
t_2	Point of time when repair event occurs
T_A	Contractual time limit for repair

5.5.4 Evaluation specific description

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 on access lines in the data collection period. 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 1: 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 2: 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.

5.5.5 Trigger points

Table 6: Fault repair time for fixed access lines trigger points

Event	Trigger condition from customer's point of view	Condition
Repair requested	Start: t_1 in figure 4	Expiration of allowed repair interval
Repair completed	Stop: t_2 in figure 4	Repair completed and service back to normal

5.5.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.5.7 Representativeness

The accuracy of this indicator depends on the number of available data sets. Therefore, the sample chosen should be, as far as possible the whole of the population as its number is expected to be relatively small.

5.5.8 Presentation of parameter values

Depending on the sample size per assessed customer segment, these presentations are recommended:

- Histograms.
- Probability Distribution Function (PDF).
- Cumulative Distribution Function (CDF).
- Quantile values.

Results should be provided on a regular basis with a clear indication on the panel composition and size or/and volume of SP data reviewed.

A chart can be used to display the results for the various types of services.

5.5.9 Further considerations

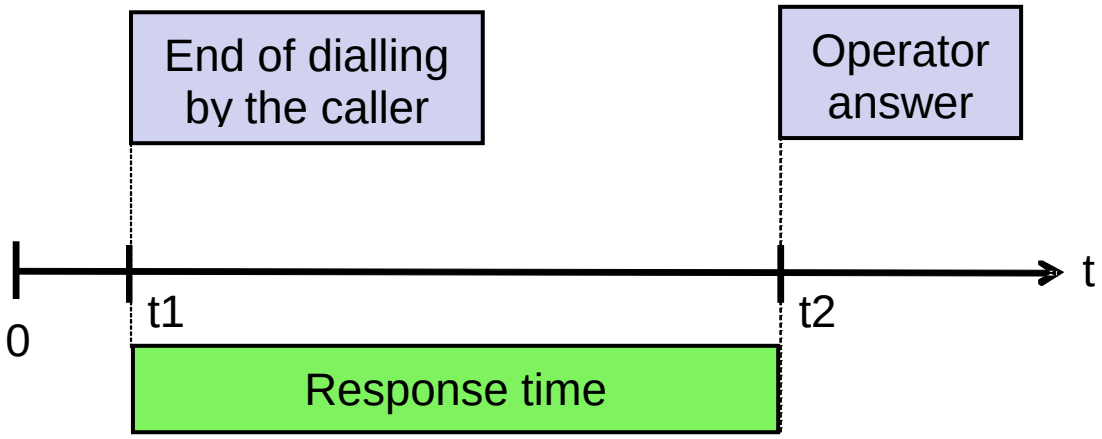
Cases where:

- 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.

If only a specific type of access like e.g. fixed telephone access should be assessed only lines that support telephony or a bundle of services that include telephony should be considered.

5.6 Response time for operator services [Time]



NOTE: Where:
t_1 Point of time when setting up a call
t_2 Point of time when the call actually reaches an operator

Figure 5: Events and parameters for operator services

5.6.1 Definition

Time elapsed between the end of dialling and reaching an operator.

5.6.1.1 Explanation of parameter 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.

5.6.2 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 [1] as calls with "semi-automatic" and "manual" operation.

5.6.3 Equation

The following indicators should be provided:

a) mean time to answer;

$$P6.1\ [Time] = \frac{\sum_{i=1}^{N}(t_{2,i} - t_{1,i})}{N}$$

where:

P6.1	Response time for operator services - mean time to answer
N	Number of calls
i	Index of each c
$t_{1,i}$	Point of time when setting up call *i*
$t_{2,i}$	Point of time when call *i* actually reach an operator

or

b) percentage of calls answered within 20 seconds:

$$P6.2\ [\%] = \frac{N_S}{N_C} \times 100\%$$

where:

P6.2	Response time for operator services - percentage of calls answered within 20 seconds
N_S	Number of successful calls within the specified period of time of 20 seconds.
N_C	Number of calls sent

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.

5.6.4 Evaluation specific description

Precondition: The customer needs to have to reach the operators desks (for any reason: commercial, technical…).

Evaluation of this parameter can be achieved by:

- analysis by the QoSAP (as defined in EG 202 843 [i.3]) of data stored at the SP; or
- survey of relevant customers.

5.6.5 Trigger points

Table 7: Response time for operator services trigger point

Event	Trigger point from customer's point of view	Condition
User has fully dialled the right operator's desk number	Start: t_1 in figure 5	No
User got an answer from Operator's desk	Stop: t_2 in figure 5	$t_2 < 20$ seconds

5.6.6 Accuracy of indicator (metric of measure)

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.

5.6.7 Representativeness

The parameter can be applied to any customer group of interest (e.g. customer segments or the whole customer population of a SP).

5.6.8 Presentation of parameter values

Although the basic parameter delivers a single percentage, it is expected to be processed on a regular basis so that higher aggregations of this parameter, depending on the sample size per assessed customer segment, can be represented in terms of:

- Histograms.
- Probability Distribution Function (PDF).
- Cumulative Distribution Function (CDF).
- Quantile values.

Results should be provided on a regular basis with a clear indication on the panel composition (if relevant) and size or/and volume of SP data reviewed.

A chart can be used to display the results for the various types of services.

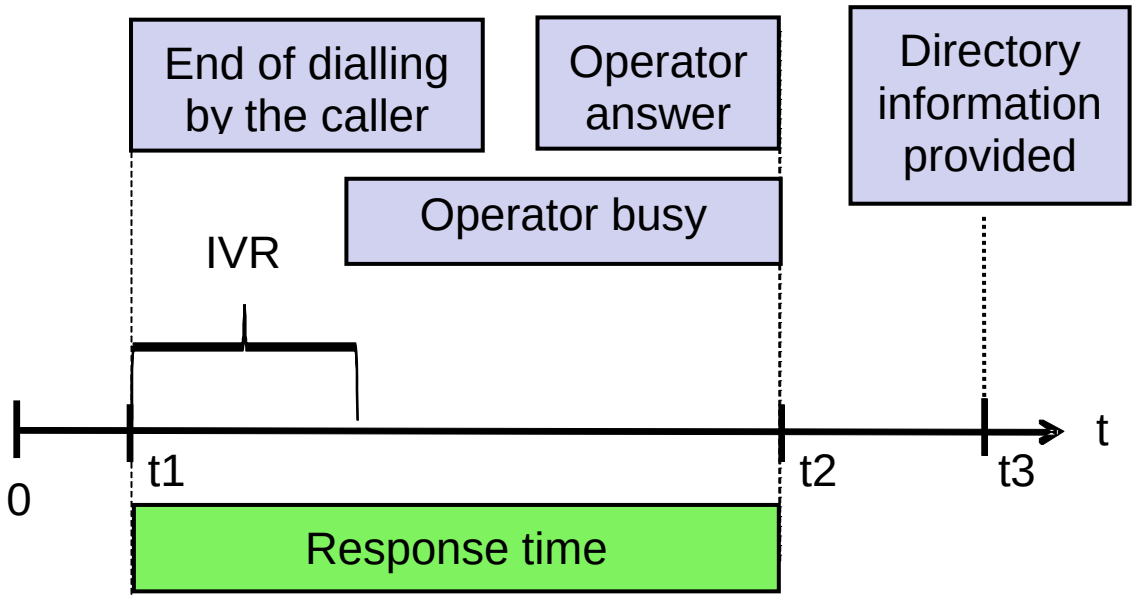
5.6.9 Further considerations

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 EG 202 057-2 [i.4].

5.7 Response time for directory enquiry services [Time]



NOTE: Where:

t_1 Time when the request for directory enquiry occurs
t_2 Time when the service directory enquiry actually occurs
t_3 Time when the directory information is provided

Figure 6: Events and parameters for directory enquiry services

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 provide the number information requested.

5.7.1.1 Explanation of parameter definition

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

These QoS parameters are applicable to all directory enquiry service providers.

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.

5.7.3 Equation

The following indicators should be provided:

a) mean time to answer:

$$P7.1\ [Time] = \frac{\sum_{i=1}^{N}(t_{2,i} - t_{1,i})}{N}$$

where:

$P7.1$	Mean time to answer directory enquiry services
i	Index of each directory enquiry
N	Number of directory enquiry
$t_{1,i}$	Time when the request for directory enquiry i occurs
$t_{2,i}$	Time when the service directory enquiry i actually occurs

b) percentage of calls answered within 20 seconds:

$$P7.2\ [\%] = \frac{N_{ca}}{N_c}$$

where:

$P7.2$	Percentage of directory enquiry answered within 20 seconds
N_c	Number of directory enquiry
N_{ca}	Number of directory enquiry answered within 20 seconds

NOTE 1: 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.

NOTE 2: Where an informative message on the service prior to the beginning of the service is mandatory, operators should exclude from b) the time due to this message.

NOTE 3: In fact the most important issue, from the user viewpoint, is the delay of the information provision (i.e. t_3).

c) percentage of directory information provided within T_s:

$$P7.3\ [\%] = \frac{N_{ca}}{N_c}$$

where:

$P7.3$	Percentage of directory information provided within T_s
N_c	Number of directory enquiry
N_{ca}	Number of directory information provided within T_s

5.7.4 Evaluation specific description

Precondition: The customer needs to have to reach the operators desks (for any reason: commercial, technical...).

Evaluation of this parameter can be achieved by:

- analysis by the QoSAP (as defined in EG 202 843 [i.3]) of data stored at the SP; or
- survey of relevant customers.

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.

5.7.5 Trigger points

Table 8: Response time for directory enquiry services trigger point

Event	Trigger point from customer's point of view	Condition
User has fully dialled the right operator's desk number	Start: t_1 in figure 6	No
User got an answer from Operator's desk	Stop: t_2 in figure 6	$t_2 < 20$ seconds

5.7.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.7.7 Representativeness

The collection is, as far as possible the whole of the population.

When it is impossible to take the whole of the population the response time can be estimated by sampling.

5.7.8 Presentation of parameter values

Although the basic parameter delivers a single percentage, it is expected to be processed on a regular basis so that higher aggregations of this parameter, depending on the sample size per assessed customer segment, can be represented in terms of:

- Histograms.
- Probability Distribution Function (PDF).
- Cumulative Distribution Function (CDF).
- Quantile values.

Results should be provided on a regular basis with a clear indication on the panel composition (if relevant) and size or/and volume of SP data reviewed.

A chart can be used to display the results for the various types of services.

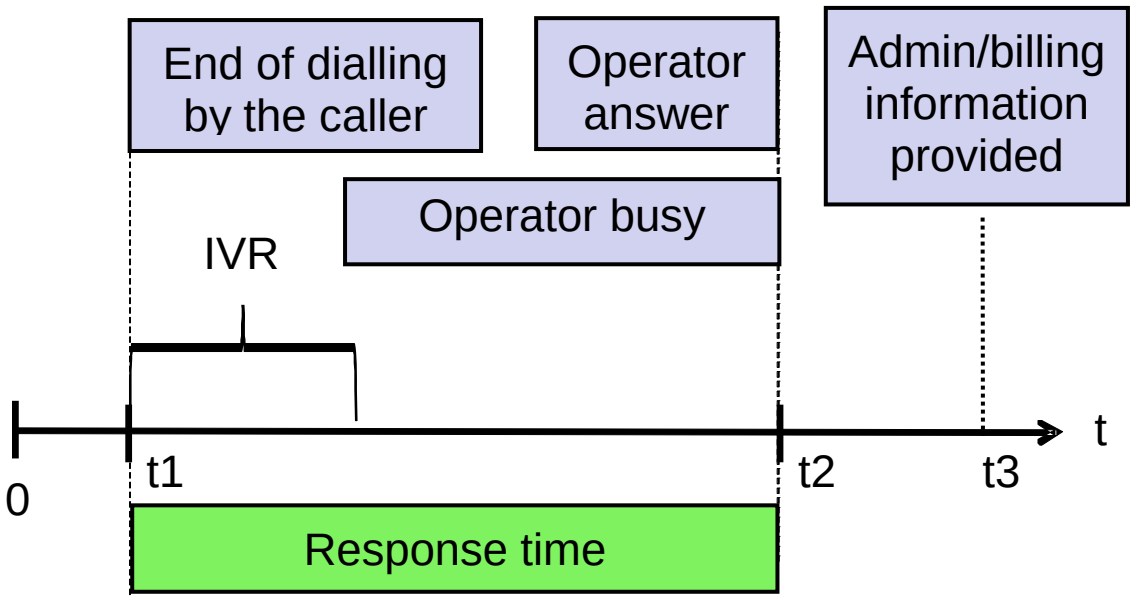
5.7.9 Further considerations

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 EG 202 057-2 [i.4].

5.8 Response time for admin/billing enquiries [Time]



NOTE: Where:

t_1 Time when the request for admin/billing enquiry occurs

t_2 Time when the admin/billing enquiry actually occurs (for voice call)

t_3 Time when the admin/billing information is provided (for all other types of enquiries)

Figure 7: Events and parameters for admin/billing enquiries

5.8.1 Definition

For voice calls, the time elapsed between the end of dialling and reaching a human operator.

For other types of enquiries the time elapsed between the answer from the user and the answer from SP: t_3 is taken into account instead of t_2.

5.8.1.1 Explanation of parameter 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 handle the enquiry.

NOTE 1: The definition excludes the enquiries attended by interactive voice response (IVR) systems, because no waiting times are produced in that case. Nevertheless, it includes the enquiries transferred from an IVR system to a human operator to complete them, but excluding times for going through IVR systems to reach the point where the enquiry can be handled by the human operator.

NOTE 2: The period in this definition includes waiting times because attendants are busy. 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.

For the other types of enquiries (e-mail, post, web page, shop, etc.) the parameter is defined by the time elapsed between the answer from the user and the answer from SP.

5.8.2 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.

This definition is applicable to a set of similar parameters mentioned in EG 202 843 [i.3]:

P105: Response time of the commercial desk
P205: Response time of the commercial desk
P206: Delay to settle a contract
P207: Delay for a contract acknowledgment
P313: Portage delay
P628: Response time of the technical support
P647: Response time of the commercial support
P667: Response time of the complaint management desk
P907: Response time of the operator of the network/service management facility
P1006: Response time of the cessation facility

5.8.3 Equation

For voice calls:

$$P8\ [Time] = \frac{\sum_{i=1}^{N}(t_{2,i} - t_{1,i})}{N}$$

where:

P8 Mean time to answer admin/billing enquiries
N Number of admin/billing enquiry
i Index of each admin/billing enquiry
$t_{1,i}$ Point of time when setting up admin/billing enquiry *i*
$t_{2,i}$ Point of time when admin/billing enquiry *i* actually reaches an operator

The following indicators should be provided:

a) Percentage of enquiries handled by IVR systems:

$$P8.1[\%] = \frac{N_I}{N}$$

where:

P8.1 Percentage of enquiries handled by IVR systems.
N Number of admin/billing enquiry
N_I Number of admin/billing enquiry handled by IVR systems

and, for those enquiries, the percentage of enquiries transferred to a human operator:

$$P8.2[\%] = \frac{N_I}{N_h}$$

where:

P8.2 Percentage of enquiries transferred to a human operator by the IVR systems.
N_I Number of admin/billing enquiry handled by IVR systems
N_h Number of admin/billing enquiry transferred to a human operator by IVR systems

For other types of enquiries (e-mail, post, web page, shop) the parameter equation is:

$$P8\ [Time] = \frac{\sum_{i=1}^{N}(t_{3,i} - t_{1,i})}{N}$$

where:

P8 Mean time to answer admin/billing enquiries

N	Number of admin/billing enquiry
i	Index of each admin/billing enquiry
$t_{1,i}$	Point of time when setting up admin/billing enquiry i
$t_{3,i}$	Point of time when admin/billing information i actually provided

b) For enquiries handled by human operator:

- Indicators like the following ones should be provided for each mode of admin/billing enquiry:
  - e-mail (8.11, 8.12 and 8.13)
  - Voice call (8.21, 8.22 and 8.23)
  - Letter/postcard (8.31, 8.32 and 8.33)
  - Web page (8.41, 8.42 and 8.43)
  - Shop (8.51, 8.52 and 8.53)
- The time by which the fastest 80 % and 95 % of admin/billing enquiries are answered (expressed in clock hours):
  - *P8.x1* is defined so that $P(T_i \leq P8.x1) \geq \frac{80}{100}$
  - *P8.x2* is defined so that $P(T_i \leq P8.x2) \geq \frac{95}{100}$

where:

$T_i = t_{2,i} - t_{1,i,}$

or

percentage of enquiries answered within the delay taken as a commitment by the provider:

$$P8.x3\ [\%] = \frac{N_{ea}}{N_e} \times 100$$

Where:

P8.x3	Percentage of admin/billing enquiries answered within the delay taken as a commitment by the provider.
N_e	Number of admin/billing enquiry
N_{ea}	Number of admin/billing enquiry answered within the delay taken as a commitment by the provider

5.8.4 Evaluation specific description

Precondition: The customer needs to have to reach the operators desks (for any reason: commercial, technical...).

Evaluation of this parameter can be achieved by:

- analysis by the QoSAP (as defined in EG 202 843 [i.3]) of data stored at the SP; or
- survey of relevant customers.

Statistics should either:

- include all enquiries to admin/billing 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.

5.8.5 Trigger points

Table 9: Response time for admin/billing enquiries trigger point

Mode	Start trigger	Successful stop trigger	Unsuccessful stop trigger
Request is sent via an e-mail	Customer sends a request for PI via e-mail to a SP	Customer receives the desired PI within mode-dependent expected time period	Customer receives other information than PI within mode-dependent expected time period or Customer does not receive any kind of information within mode-dependent expected time period (timeout condition)
Request is sent via a voice call	Customer calls a SP to deliver PI to him	Same as above	Same as above
Request is sent via a letter/postcard	Customer sends a request for PI via a letter/postcard to a SP	Same as above	Same as above
Request is sent via a web page	Customer sends a request for PI via a web page to a SP	Same as above	Same as above
Request is given to a member of shop staff	Customer talks to someone in a SP's shop to receive PI	Same as above	Same as above

Table 10: Examples of time dependent timeouts

Mode	Sending request to SP	Delay in delivering PI
e-mail	{30} minutes	{A few hours}
Voice call	No delay, real-time	Immediate delivery in the same phone call or follow-up phone call within {2} hours
Letter/postcard	{2} days	{2} days
Web page	No delay, real-time	Immediate delivery via files/written information on homepage
Shop	No delay, real-time	Immediate delivery
NOTE: The values in brackets "{}" are provided for information as realistic values however the actual values are depending of the contract with the SP.		

5.8.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.8.7 Representativeness

The sample chosen is, as far as possible the whole of the population.

5.8.8 Presentation of parameter values

The response time may be published separately for each of the following categories of enquiry mode:

- By e-mail.
- By telephone (two way conversation). Here more than one conversation is necessary to obtain the information the total time of actual conversation time would constitute the tie for supply of the information.
- By post.

- By Internet web pages.
- By live talk at a shop.

In each case the sample size is also to be quoted.

The spread should be quoted for 2 and 3 standard deviations in each case.

Observations should also be presented in histograms as far as possible.

A chart can be used to display the results of the different available modes.

5.8.9 Further considerations

Where a service provider re-sells to customers admin/billing enquiry 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 EG 202 057-2 [i.4].

5.9 Number of customer complaints per data collection period [Number]

5.9.1 Definition

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

5.9.2 Application

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

This definition is applicable to a set of similar parameters mentioned in EG 202 843 [i.3]:

P630: Number of customer requests to technical support
P649: Number of customer requests to commercial support
P669: Number of customer complaints of any kind
P707: Number of customer complaints related to repair services
P909: Number of customer complaints related to network/service management by the customer
P1008: Number of customer complaints related to cessation

5.9.3 Equation

$$P9[\text{Number}] = \sum_{t_1}^{t_2} \text{R}$$

where:

P9 Number of customer complaints per data collection period
t_1 Start of data collection period
t_2 End of data collection period
R Requests/complaints in data collection period t_1 to t_2

5.9.4 Evaluation specific description

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.

NOTE: Where more than one complaint is made by the same customer on the same subject, each instance of the complaint should be counted separately in the statistics. If a customer complaints again before an existing complaint has been closed, then this should not be treated as a separate complaint but as a continuation of the first unclosed complaint.

5.9.5 Trigger points

Not applicable as the survey is carried out off line.

5.9.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.9.7 Representativeness

For representativeness stake, the sample chosen is, as far as possible the whole of the population.

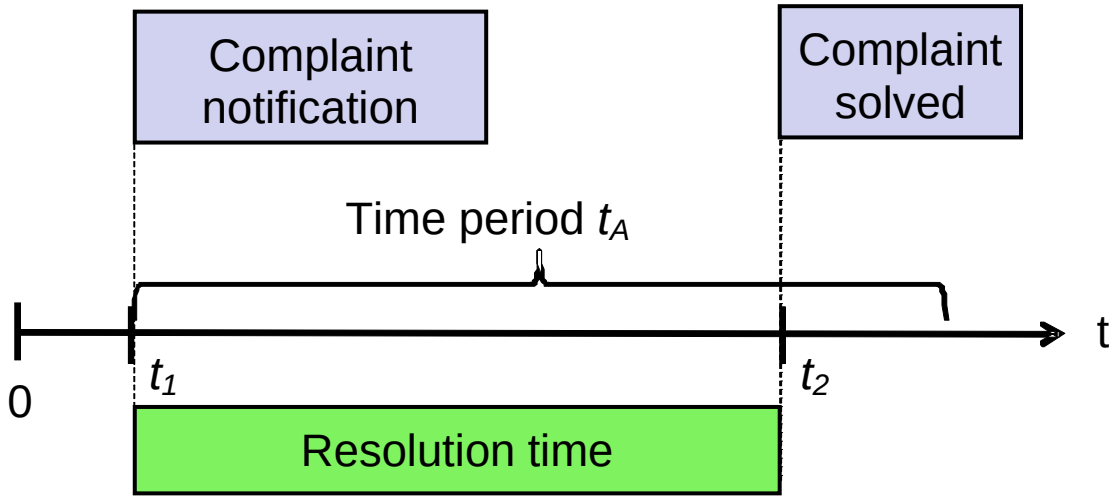
5.9.8 Presentation of parameter values

The frequency of complaints should be published separately for each of the following categories of complaining mode:

P9.1: By e-mail.
P9.2: By telephone (two way conversation). Here more than one conversation is necessary to obtain the information the total time of actual conversation time would constitute the tie for supply of the information.
P9.3: By post.
P9.4: By Internet web pages.
P9.5: By live talk at a shop.

In each case the sample size is also to be quoted.

5.10 Customer complaints resolution time [Time]



NOTE: Where:

t_1	Point of time when a request is sent to the technical support
t_2	Point of time when a solution proposal is actually received
t_A	Time stated as an objective by the service provider

Figure 8: Events and parameters for Customer complaints resolution

5.10.1 Definition

The duration from the instant a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the instant the cause for the complaint has been resolved.

5.10.2 Application

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

This definition is applicable to a set of similar parameters mentioned in EG 202 843[i.3]:

P629:	Request to technical support resolution time
P648:	Request to commercial support resolution time
P668:	Customer complaints resolution time

5.10.3 Equation

$$P10\,[\text{Time}] = \left(t_{1,\text{i}} - t_{2,\text{i}}\right)$$

where:

P10	Customer complaints resolution time
i	Index of each request to the technical support
$t_{1,i}$	Point of time when a request *i* is sent to the technical support
$t_{2,i}$	Point of time when a solution proposal *i* is actually received

Indicators like the following ones should be provided for each mode of customer complaint:

- e-mail (10.11, 10.12 and 10.13)
- Voice call (10.21, 10.22 and 10.23)
- Letter/postcard (10.31, 10.32 and 10.33)

- Web page (10.41, 10.42 and 10.43)
- Shop (10.51, 10.52 and 10.53)

a) the time by which the fastest 80 % and 95 % of complaints have been resolved (expressed in clock hours); or

$P10.11$ is defined so that $P(T_i \leq P10.11) \geq \frac{80}{100}$

$P10.12$ is defined so that $P(T_i \leq P10.12) \geq \frac{95}{100}$

where:

$T_{i=} t_{2,i} - t_{1,i}$

b) the percentage of complaints resolved any time stated as an objective by the service provider.

$$P10.13\ [\%] = \frac{N_S}{N_C}$$

with

$$N_S = \begin{cases} 1, & \text{if } t_2 - t_1 \leq t_A \\ 0, & \text{if } t_2 - t_1 > t_A \end{cases}$$

where:

$P10.13$	percentage of complaints resolved any time stated as an objective by the service provider
N_S	Number of complaints with successful solution within the time period t_A
N_C	Number of complaints received within the time period T_p
t_1	Point of time when complaint is received
t_2	Point of time when complaint is solved
t_A	Time stated as an objective by the service provider
T_p	Data collection period

NOTE 1: Where more than one complaint is made by the same costumer on the same subject, each instance of the complaint should be counted separately in the statistics. If a customer complaints again before an existing complaint has been closed, then this should not be treated as a separate complaint but as a continuation of the first unclosed complaint.

NOTE 2: When calculating the complaint resolution time service providers may subtract from the measured time any delay introduced by the customer.

NOTE 3: If the resolution of a complaint is delayed because the collaboration of the customer is needed but cannot be obtained in a reasonable term, the instance may be excluded from the statistics.

NOTE 4: If a complaint is received within the data collection period T_p but too late to be solved within t_A, it should be counted in the following period.

5.10.4 Evaluation specific description

Statistics should include all complaints received in the data collection period T_p.

5.10.5 Trigger points

Table 11: Customer complaints resolution time trigger point

Event	Trigger point from customer's point of view	Condition
Problem occurred, try to contact support	Start: t_1 in figure 8	Customer wants to access complaint management desk after occurrence of problem
Solution proposal applied	Stop: t_2 in figure 8	SP solution proposal applied
End of specified data collection period	Stop: T_p in figure 8	End of specified data collection period

5.10.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.10.7 Representativeness

The sample chosen is, as far as possible the whole of the population.

Each mode of complaining should be monitored separately.

5.10.8 Presentation of parameter values

Depending on the sample size per assessed customer segment, these presentations are recommended:

- Histograms.
- Probability Distribution Function (PDF).
- Cumulative Distribution Function (CDF).
- Quantile values.

Results should be provided on a regular basis with a clear indication where the data come from (panel composition and size or SP data).

A chart can be used to display the results for the various available modes.

5.11 Bill correctness complaints [%]

5.11.1 Definition

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

5.11.1.1 Explanation of parameter definition

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.

5.11.2 Application

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

This definition is applicable to the parameter P810 mentioned in EG 202 843 [i.3].

5.11.3 Equation

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

$$P11\ [\%] = \frac{\sum N_C}{\sum N_B} \times 100\%$$

where:

$P11$	Bill correctness complaints
$\sum N_C$	Number of bill correctness complaints
$\sum N_B$	Number of bills sent

All measures are related to the reporting period.

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.

5.11.4 Evaluation specific description

Precondition: Valid complaints should come from registered customers within the data collection period agreed.

Due to the relatively low number of such complaints, statistics should include all billing complaints received in the data collection period T_p. Nevertheless, as stated above, an information request should not be considered as a complaint.

Evaluation of this parameter should be achieved by an analysis by the QoSAP (as defined in EG 202 843 [i.3]) of data stored at the SP.

5.11.5 Trigger points

Not applicable as the survey is carried out off line.

5.11.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.11.7 Representativeness

The representativeness of the assessment depends on the representativeness of the customer panel. Therefore the panel composition is crucial to the representativeness. The better means to ensure it is to take the most of the customers having had a call to the customer desk.

5.11.8 Presentation of parameter values

The frequency of complaints should be published separately for each of the following categories of complaining mode:

P11.1	By e-mail.
P11.2	By telephone (two way conversation). Here more than one conversation is necessary to obtain the information the total time of actual conversation time would constitute the tie for supply of the information.
P11.3	By post.
P11.4	By Internet web pages.
P11.5	By live talk at a shop.

In each case the sample size is also to be quoted.

5.11.9 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. As it would be very difficult to accurately assess a parameter for such errors, it was concluded that such errors should be more efficiently checked out by a specific process like that described in [8] with an additional possible reliability ensured via a conformity assessment described in [9].

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

5.12 Prepaid account credit correctness complaints [%]

5.12.1 Definition

The proportion of prepaid accounts resulting in a customer complaint about the correctness of its credit or the charges made.

5.12.1.1 Explanation of parameter definition

A prepaid account credit correctness complaint is an expression of dissatisfaction with the credit of a prepaid account received from a customer i.e. the credit 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 charged incorrectly, call discounts, credits or debts are handled incorrectly, or the total charge including VAT is calculated incorrectly. A prepaid account credit correctness complaint should not be confused with a credit query (a request for information) or with a fault report.

5.12.2 Application

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

P811: Prepaid account credit correctness complaints

5.12.3 Equation

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

$$P12\ [\%] = \frac{\sum N_C}{\sum N_{PAC}} \times 100\% \mathrm{P403}[\%] = \frac{\sum \mathrm{N_C}}{\sum \mathrm{P403}[\ \ ] = \frac{\sum \mathrm{N_C}}{\sum \mathrm{N_S}} \times 100\% \mathrm{N_S}} \times 100\%$$

where:

$P12$	Prepaid account credit correctness complaints
$\sum N_C$	Number of prepaid account credit correctness complaints
$\sum N_{PAC}$	Number of prepaid account credit

5.12.4 Evaluation specific description

All measures are related to the reporting period.

Statistics should include all prepaid account credit 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 prepaid accounts for telecommunication services.

5.12.5 Trigger points

Not applicable as the survey is carried out off line.

5.12.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the number of available data sets.

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

5.12.7 Representativeness

The sample chosen is, as far as possible the whole of the population as its number is expected to be relatively small.

5.12.8 Presentation of parameter values

The proportion of prepaid account credit correctness complaints is expressed as a percentage that should be provided on a regular basis (boxplots).

5.13 Bill presentation quality [OR]

5.13.1 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.

5.13.2 Application

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

P814	Bill presentation quality.

5.13.3 Equation

$$P13[\mathrm{OR}] = \frac{\sum_i \mathrm{OR}_i(Q_1)}{N} + \frac{\sum_i \mathrm{OR}_i(Q_2)}{N} + \frac{\sum_i \mathrm{OR}_i(Q_3)}{N} + \frac{\sum_i \mathrm{OR}_i(Q_4)}{N} + \frac{\sum_i \mathrm{OR}_i(Q_5)}{N}$$

Where OR is the weighted opinion rating comprising:

P13	Bill presentation quality
i	Index of expert/customer
N	Number of experts/customers assessing the related question
Q	Question 1 to 5

5.13.4 Evaluation specific description

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

For each of the indicators *P13*.1 to *P13*.5 composing the *P13* parameter, the customers should be asked:

P13.1	How easy is it to find exactly which tariffs and optional services you are subscribing to?
P13.2	How easy is it to locate the record of a specific communication to or from a specific destination?
P13.3	How easy is it to find the exact price paid including VAT and any discounts, for a specific communication (voice or data)?
P13.4	How easy is it to find which charge band and which rate (peak/off-peak) is applied to a specific communication (voice or data)?
P13.5	How do you rate the bill overall in terms of clarity, understand ability and ease of use?

Opinion Rating [OR] as defined in EG 202 843 [i.3] is used in the present document to give a quantitative value to a qualitative performance criterion.

In such a case, for questions 1 to 4 the customer should rate the effort according to the following scale.

Table 12: Effort scale

Very strong	Strong	Above average	Average	Below average	Small	Very small
0	1	2	3	4	5	6

For question 5 the customer should rate the quality according to the following scale.

Table 13: Quality scale

Very poor	Poor	Below average	Average	Above average	Good	Excellent
0	1	2	3	4	5	6

The sample size for this measure should be at least 100 valid responses (valid responses exclude those questions without experts/customers answer).

For each of the five questions the result of the opinion rating (OR) assessments should be provided.

5.13.5 Trigger points

Not applicable as the survey is carried out off line.

5.13.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the manning of the panel. The more opinions are gathered within the OR, the more accurate the overall result will be. For more information on this, see Annex C.

5.13.7 Representativeness

The representativeness of the assessment depends on the representativeness of the customer panel. Therefore the panel composition is crucial to the representativeness, it should take into consideration age and culture of the customers. The larger it is the better the representativeness.

5.13.8 Presentation of parameter values

The following should be published:

- Opinion rating of the panel should be presented with an indication on the distribution of the members' individual scores taking into account the various types of services.
- Sample size.

Results should be provided on a regular basis with a clear indication where the data come from (panel composition and size).

5.14 Customer relations [OR]

5.14.1 Definition

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

5.14.1.1 Explanation of parameter definition

There are many occasion to experience relations between the provider and his customer. Therefore, it is useful to specify which particular type of relation is rated.

5.14.2 Application

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

This definition is applicable to a set of similar indicators mentioned in EG 202 843 [i.3]:

P106: Overall rating of the responsiveness of the service desk
P107: User friendliness of the Internet user interface
P108: User friendliness of the service desk operators
P208: Overall rating of the responsiveness of the sales desk
P209: Ease of the subscription process
P210: Vendors empathy and responsiveness
P310: Overall quality of the provisioning process including the reception desk
P311: Provider ability to match the customer's wishes for conditions of achievement
P312: User friendliness of the means available to the customer for the operations he has to perform
P410: Overall quality of the alteration process
P411: User friendliness of the means available to the customer for the operations he has to perform
P509: Overall quality of the technical upgrade process
P510: Provider ability to match the customer's wishes for conditions of achievement
P511: User friendliness of the means available to the customer for the operations he has to perform
P631: User friendliness of the technical support
P650: Quality of the commercial support
P651: User friendliness of the commercial support
P709: Provider ability to match the customer's wishes for conditions of achievement
P710: User friendliness of the repair service
P812: Provider ability to match the customer's wishes for charging/billing conditions
P813: User friendliness of the desk in charge of billing issues
P910: Overall quality of the network/service management process
P911: Provider ability to match the customer's wishes for network/service management conditions

P912: User friendliness of the means available to the customer for the operations he has to perform
P1007: Overall quality of the cessation process
P1009: Ease of the cessation process

5.14.3 Equation

$$P14[\mathrm{OR}] = \frac{\sum_{i=1}^{N} \mathrm{OR}_i}{N}$$

where OR is the mean opinion rating, with OR_i (i = 1…N) being the individual opinion ratings for the N members of the audit panel.

P14 Opinion Rating of the customer relation, defining the degree of satisfaction
i Index of expert/customer
N Number of experts/customers in the panel.

5.14.4 Evaluation specific description

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 a specific aspect of the customer relations service.

Are you satisfied by the "customer relationship"?

Table 14: Satisfaction scale

Very unsatisfied	Unsatisfied	Below average	Average	Above average	Satisfied	Very satisfied
0	1	2	3	4	5	6

NOTE: For the other parameters defined in clause 5.14.2, "customer relationship" in the question above will be replaced by the relevant application.

Some or all of the indicators listed in clause 5.14.2 should be assessed according to the following scale.

Table 15: Quality scale

Very poor	Poor	Below average	Average	Above average	Good	Excellent
0	1	2	3	4	5	6

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).

5.14.5 Trigger points

Not applicable as the survey is carried out off line.

5.14.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the manning of the panel. The more opinions are gathered within the OR, the more accurate the overall result will be. For more information on this, see Annex C.

5.14.7 Representativeness

The representativeness of the assessment depends on the representativeness of the customer panel. Therefore the panel composition is crucial to the representativeness. The better means to ensure it is to take the most of the customers having had a call to the customer desk.

5.14.8 Presentation of parameter values

The following should be published:

- Opinion rating of the panel should be presented with an indication on the distribution of the members' individual scores taking into account the various types of services.
- Sample size.

Results should be provided on a regular basis with a clear indication where the data come from (panel composition and size or SP data).

5.15 Professionalism of help line [OR]

5.15.1 Definition

The degree of satisfaction that a customer has with the professionalism of a help line.

5.15.1.1 Explanation of parameter definition

5.15.2 Application

The QoS parameters are applicable to all service providers offering help lines.

This definition is applicable to a set of similar parameters mentioned in EG 202 843 [i.3]:

P670: Professionalism of the complaint management desk
P708: Professionalism of the repair staff

5.15.3 Equation

$$P15[\mathrm{OR}] = \frac{\sum_{i=1}^{N} \mathrm{OR}_i}{N}$$

where OR is the mean opinion rating, with OR_i (i = 1…N) being the individual opinion ratings for the N members of the audit panel.

P15	Mean Opinion Rating of the professionalism of help line
i	Index of expert/customer
N	Number of experts/customers in the panel

5.15.4 Evaluation specific description

A random sample is taken of residential customers who have dealt directly with the help line of a given service provider within the last 3 months. The customers are asked what they think of the professionalism of the answer they receive from the help line. The measure should exclude customers who respond "don't know" or who refuse to answer.

The customers are asked how satisfied they are with a specific aspect of the customer relations service.

Are you satisfied by the "professionalism of the help line"?

Table 16: Satisfaction scale

Very unsatisfied	Unsatisfied	Below average	Average	Above average	Satisfied	Very satisfied
0	1	2	3	4	5	6

NOTE: For the other parameters defined in clause 5.15.2, "professionalism of the help line" in the question above will be replaced by the relevant application.

Some or all of the indicators listed in clause 5.14.2 should be assessed according to the following scale.

Table 17: Quality scale

Very poor	Poor	Below average	Average	Above average	Good	Excellent
0	1	2	3	4	5	6

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).

5.15.5 Trigger points

Not applicable as customer survey and panel ratings are carried out on a historical basis.

5.15.6 Accuracy of indicator (metric of measure)

The accuracy of this indicator depends on the manning of the panel. The more opinions are gathered within the OR, the more accurate the overall result will be. For more information on this, see Annex C.

5.15.7 Representativeness

The accuracy of this indicator depends on the number of available data sets. Therefore, the sample chosen should be, as far as possible the whole of the population as its number is expected to be relatively small.

5.15.8 Presentation of parameter values

The following should be published:

- Opinion rating of the panel should be presented with an indication on the distribution of the members' individual scores taking into account the various types of services.
- Sample size.

Results should be provided on a regular basis with a clear indication where the data come from (panel composition and size).

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 aggregation of weekly statistics into quarterly statistics:

- $S_{quarterly} = (\Sigma Ni.Si) / (\Sigma Ni)$
- where i = 1, 2...13, and
- N_i = The number of events in each week
- S_i = The statistic for each week

b) For aggregation of monthly statistics into quarterly statistics:

- $S_{quarterly} = (\Sigma Ni.Si) / (\Sigma Ni)$
- where i = 1, 2, 3, and
- N_i = The number of events in each month
- S_i = The statistic for each month

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 (informative): 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 (informative): 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 set-up time (calculated from former measurements);

mean(x): is the expected mean value of the call set-up 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 to 0,3	1 000
> 0,3 to 0,5	2 500
> 0,5 to 0,7	5 000
> 0,7 to 0,9	7 500
> 0,9	10 000

Annex D (informative): Opinion Rating

Opinion Rating [OR] is used in the present document to give a quantitative value to a qualitative performance criterion.

D.1 Definition of OR

OR is a quantitative value (a number) assigned to a qualitative performance criterion on a predefined rating scale to reflect the merit of that criterion to a user/customer.

Examples of qualitative criteria in telecommunications are:

- User friendliness of man-machine interface of services.
- Empathy shown by service provider's employees towards customers.
- Ergonomics of terminal equipment, etc.

Predefined rating scales considered are usually 5, 7, 10 or 100. However, published literature (based on research) [i.2] indicates a unipolar 7 scale is most suited for best recording opinion ratings. Therefore a 0-6 scale has been chosen for rating qualitative criteria in the present document, thus:

Table D.1: 0-6 Unipolar scale

Very poor	Poor	Below average	Average	Above average	Good	Excellent
0	1	2	3	4	5	6

Bipolar scales are numbered with the middle point as '0' and with positive and negative numbers on its either side as illustrated below:

Table D.2: Bipolar scale with a middle point '0'

Very poor	Poor	Below average	Average	Above average	Good	Excellent
-3	-2	-1	0	+1	+2	+3

In practice the wordings in the scoring boxes may be varied to suit the particular performance characteristics of the qualitative criterion being surveyed.

However all the wordings in the seven scoring boxes of the bipolar scale should be consistent and refer to same concepts or parameters.

D.2 Example

For statistical purposes the scale of -3 to +3 may be converted to 0 to 6 or 1 to 7 and where necessary re-converted to -3 to +3 ratings.

Preliminary Information

-3 Definitely not satisfied with the PI provided

i.e. too many unanswered questions, contradictory and/or confusing information, etc. Evasive and unhelpful. Obvious lack of professionalism. Definitely not able to proceed further on decision making about this service.

-2 Quite dissatisfied

i.e. not forthcoming with all pertinent information unless specifically requested. I do not know what questions I have not asked!

-1 Somewhat dissatisfied

i.e. very little information provided. Need to make further enquiries to be in a position to make informed judgement about this service.

0 Neither satisfied nor dissatisfied

i.e. not made any enquiries. Further information is needed before making a judgement on the PI available on this service.

+1 OK with basic information

i.e. more queries to ensure I have all relevant information.

+2 Reasonably satisfied

i.e. ready to make a decision - just a few clarifications needed before making it.

+3 Fully satisfied

i.e. professionally handled all queries and provided all pertinent PI. I can now make an informed decision on this service.

Annex E (informative): A set of in-force specifications, Guides and standards for QoS

Figure E.1 provides a set of in-force specifications, Guides and standards for QoS to be used in addition to EG 202 057-1.

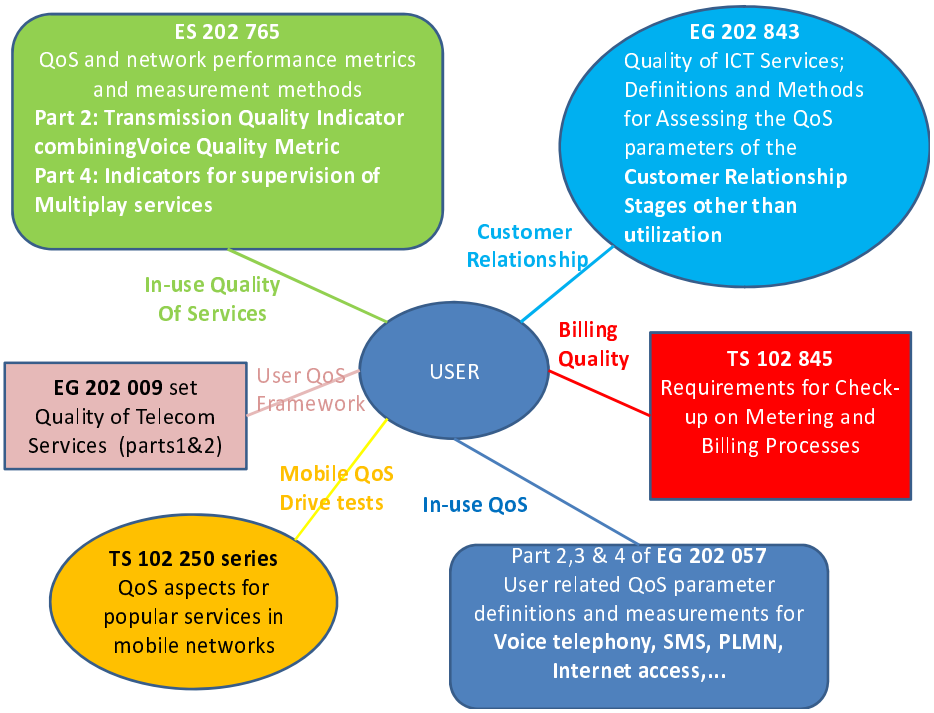


Figure E.1

Annex F (informative): Bibliography

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".

ETSI TR 102 126: "Speech Processing, Transmission and Quality Aspects (STQ); Implementation of QoS parameter measurements according to ETSI EG 201 769".

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".

ETSI ES 202 765-2: "Speech and multimedia Transmission Quality (STQ);QoS and network performance metrics and measurement methods; Part 2 : Transmission Quality Indicator combining Voice Quality Metrics".

ETSI ES 202 765-4: "Speech and multimedia Transmission Quality (STQ);QoS and network performance metrics and measurement methods; Part 4: Indicators for supervision of Multiplay services".

ETSI TS 102 250-1: "Speech and multimedia Transmission Quality (STQ); QoS aspects for popular services in mobile networks; Part 1: Assessment of Quality of Service".

History

Document history		
V1.1.1	September 2002	Publication as EG 202 057-1
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V1.3.1	July 2008	Publication as EG 202 057-1
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