

**User Group;
Quality of telecom services;
Part 2: User related parameters on a service specific basis**



Reference

REG/USER-00015-2

Keywords

QoS, SLA, quality, service, user

ETSI

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

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:

<http://www.etsi.org>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<http://portal.etsi.org/tb/status/status.asp>

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

http://portal.etsi.org/chaicor/ETSI_support.asp

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2007.
All rights reserved.

DECT™, **PLUGTESTS™** and **UMTS™** are Trade Marks of ETSI registered for the benefit of its Members.
TIPHON™ and the **TIPHON logo** are Trade Marks currently being registered by ETSI for the benefit of its Members.
3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

Contents

Intellectual Property Rights	4
Foreword.....	4
Introduction	4
1 Scope	5
2 References	6
3 Definitions and abbreviations.....	7
3.1 Definitions	7
3.2 Abbreviations	11
4 QoS methodology implementation.....	12
4.1 General principles for the indicator and parameter definition	12
4.2 Service specifications	13
4.3 Particular QoS aspects	13
4.3.1 Charging and billing	13
4.3.2 Security	14
5 QoS parameters for the technical quality for the service utilization	14
5.1 Audio broadcast.....	15
5.2 Directory enquiry services.....	16
5.3 E-mail	17
5.4 Fax	19
5.5 Internet access	20
5.6 Multimedia Message Service (MMS).....	23
5.7 Operator services.....	24
5.8 Short Message Service (SMS).....	26
5.9 Telephony	27
5.10 Video broadcast.....	29
5.11 Voice mail	30
5.12 For further study.....	32
6 QoS indicators and parameters for all service life cycle steps other than utilization	33
6.1 QoS parameters for sales.....	33
6.1.1 Preliminary information.....	33
6.1.1.1 Preliminary information needed by the customer for a telephony contract (fixed or mobile).....	35
6.1.1.2 Preliminary information needed by the customer for an ISP contract.....	35
6.1.1.3 Preliminary information needed by the customer for a multi-services contract (fixed or mobile).....	36
6.1.2 Establishment of the contract (Terms and conditions).....	36
6.2 QoS parameters for service provisioning	38
6.3 QoS parameters for service alteration and technical upgrade.....	40
6.3.1 Service alteration	40
6.3.2 Technical upgrade.....	42
6.4 QoS parameters for service support.....	43
6.4.1 QoS parameters for documentation	43
6.4.2 QoS parameters for technical support.....	44
6.4.3 QoS parameters for commercial support	46
6.4.4 QoS parameters for complaint management.....	48
6.5 QoS parameters for repair services.....	49
6.6 QoS parameters for metering/charging/billing	51
6.7 QoS parameters for network/service management by the customer.....	53
6.8 QoS parameters for cessation	55
7 Specific aspects of the general public users' criteria	57
8 Conclusion.....	57
Annex A (informative): Bibliography.....	58
History	60

Intellectual Property Rights

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

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

Foreword

This ETSI Guide (EG) has been produced by ETSI User Group (USER).

It includes, among other contributions, excerpts of the final report of Bannock Consulting's project for the European Commission's DG Information Society.

The present document is part 2 of a multi-part deliverable covering the quality of telecom services, as identified below:

Part 1: "Methodology for identification of parameters relevant to the Users";

Part 2: "User related parameters on a service specific basis";

Part 3: "Template for Service Level Agreements (SLA)".

Introduction

Quality of Service can be evaluated from different perspectives and therefore using different measurement methods:

- a) a first level of QoS is related to the reliability of the equipment and can be measured accurately via technical means because of both the dispersion of the test and the size of the sample to be tested;
- b) a second level is related to the service provision and is closely linked to the kind of use of the service. Therefore appropriate criteria have to be defined according to this kind of use between the customer and the supplier;
- c) the last one is intended to measure the subjective satisfaction of the customer and there is often no other means than a survey to get it (MOS value).

In the two first categories, technical means can be used to perform the measurements and in such cases, standards are often useful to achieve a common approach; such standards are given as references where appropriate. They include a precise definition of the relating indicators and parameters and how to measure them. Unfortunately, they are not always providing enough indications on the size and how to select the samples to be measured. EG 202 009-1 [23] can help on these aspects but additional study may be needed to reach the right accuracy.

In the last category, the present document aims to give guidance on how to carry out the measurements including the subjective ones.

Measurements of every interesting parameter all the time might be very expensive and can even jeopardize the network performances. It can be more appropriate to get some of them via a poll on a limited number of users and for a limited period of time. In addition, a third party may be needed to carry out these measurements to make them more reliable and avoid any criticism from one of the involved parties.

1 Scope

In the current competitive world, Quality of Service (QoS) is becoming, jointly with cost, a key parameter in selling and buying telecommunications services. At the same time, technology and liberalization trends are raising new types of concerns unknown with the Plain Old Telephony Services (POTS) using switched connections provided by a single monopoly supplier.

Nowadays, there are several standards describing QoS measurements but the question of which indicators are the most interesting to be monitored from the users point of view and which values they should meet is still open. The present document proposes a reference model to evaluate the Quality of Service from the users point of view, defining the following concepts:

- a) the appropriate indicators for a QoS assessment from the user point of view;
- b) the methods to acquire the indicator values needed to assess the quality of service.

The main principles for these definitions are:

- To define the services according to the applications performed by the user and not by the technical solution: for example, voice over IP is one of the many technical solutions to communicate between subscribers of the world-wide telephone network; ATM, frame Relay, IP are some of the many technical solutions to ensure a data transmission service between a terminal and a server or between networks. The quality criteria are the same, only the Service Level achieved can be different.
- To define the quality criteria with respect of usage and not technique. In speech quality, users are more interested in intelligibility than in bandwidth, distortion, signal to noise ratio or lost packets. Quality criteria should be defined from the functional criteria, then translated into technical criteria. This means that different performance parameters may be used to quantify and monitor the quality, depending on those that are relevant for the technology used.

Therefore, the present document does not intend to describe measurement techniques since several ETSI TCs are dealing with such techniques and have the appropriate technical knowledge to develop standards in this area. EG 202 009-1 [23] gives guidance in identifying the indicators relevant from the user point of view. If these indicators and parameters are used in a Service Level Agreements (SLA), it is crucial to define, at least for the most important ones, the agreed quality targets. If they are used to compare the respective providers' performances, then quality targets can be provided as guidance for the general public but what matters to the users are the results achieved.

The present document intends to define user related service specific QoS parameters as far as possible using formal standards while EG 202 009-3 [24] proposes a template for a SLA dealing with all service aspects, including penalties, escalation procedures, areas of responsibility, etc where these indicators and parameters can be used.

The purpose is to use the methodology described in EG 202 009-1 [23] to define, for each QoS criterion, the relevant indicators and parameters for a choice of services and for each step of the service life. Hence each customer can have a comprehensive information on the features of the service he intends to buy according to the various providers. This will enable him to select the best suited to his needs.

2 References

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

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

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

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

- [1] ITU-T Recommendation E.721: "Network grade of service parameters and target values for circuit-switched services in the evolving ISDN".
- [2] ITU-T Recommendation E.800: "Terms and definitions related to quality of service and network performance including dependability".
- [3] ITU-T Recommendation G.107: "The E-Model, a computational model for use in transmission planning".
- [4] ITU-T Recommendation G.109: "Definition of categories of speech transmission quality".
- [5] ITU-T Recommendation G.111: "Loudness ratings (LRs) in an international connection".
- [6] ITU-T Recommendation G.1010: "End-user multimedia QoS categories".
- [7] ITU-T Recommendation I.113: "Vocabulary of terms for broadband aspects of ISDN".
- [8] ITU-T Recommendation I.430: "Basic user-network interface - Layer 1 specification".
- [9] ITU-T Recommendation I.431: "Primary rate user-network interface - Layer 1 specification".
- [10] ITU-T Recommendation M 60: " Maintenance terminology and definitions".
- [11] ITU-T Recommendation P.800: "Methods for subjective determination of transmission quality".
- [12] ITU-T Recommendation P.831: "Subjective performance evaluation of network echo cancellers".
- [13] ITU-T Recommendation P.832: "Subjective performance evaluation of Hands-free Terminals".
- [14] ITU-T Recommendation P.862: "Perceptual evaluation of speech quality (PESQ), an objective method for end-to-end speech quality assessment of narrowband telephone networks and speech codecs".
- [15] ITU-T Recommendation O.172: "Jitter and wander measuring equipment for digital systems which are based on the synchronous digital hierarchy (SDH)".
- [16] ITU-T Recommendation T.22: "Standardized test charts for document facsimile transmissions".
- [17] ETSI ETR 003: "Network Aspects (NA); General aspects of Quality of Service (QoS) and Network Performance (NP)".
- [18] ETSI ETR 138: "Network Aspects (NA);Quality of service indicators for Open Network Provision (ONP) of voice telephony and Integrated Services Digital Network (ISDN)".
- [19] ETSI EG 201 013: "Human Factors (HF); Definitions, abbreviations and symbols".
- [20] ETSI EG 201 219: "User requirements; Guidelines on the consideration of user requirements when managing the standardization process".

- [21] 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".
- [22] ETSI TS 101 329-5: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 5: Quality of Service (QoS) measurement methodologies".
- [23] ETSI EG 202 009-1: "User Group; Quality of Telecom Services; Part 1: Methodology for identification of parameters relevant to the Users".
- [24] ETSI EG 202 009-3: "User Group; Quality of telecom services; Part 3: Template for Service Level Agreements (SLA)".
- [25] ETSI EG 202 057-1: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 1: General".
- [26] ETSI EG 202 057-2: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 2: Voice telephony, Group 3 fax, modem data services and SMS".
- [27] 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)".
- [28] ETSI EG 202 057-4: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 4: Internet access".
- [29] ETSI EG 202 308: "User Group; User interoperability criteria".
- [30] CEN CWA14357: "CEN Workshop Agreement -Quality of Internet Service - Project Team Final Report - ICS 35.240.60".
- [31] ISO/IEC 17021: "Conformity assessment - Requirements for bodies providing audit and certification of management systems".
- [32] ISO/IEC 15408: "Information technology - Security techniques - Evaluation criteria for IT security".
- [33] ITU-T Recommendation I.350: "General aspects of quality of service and network performance in digital networks, including ISDNs".
- [34] IETF RFC 792: "Internet Control Message Protocol".

3 Definitions and abbreviations

3.1 Definitions

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

access: function that enables a service session from an end user equipment, EG 202 308 [29]

accuracy: faithfulness and completeness in carrying out the communication function with respect to a reference level. The reference level may be specified or may be an independent function or a function of an input

NOTE: See ETR 003 [17].

assurance in the supplier-customer interface: knowledge and courtesy of employees and their ability to convey trust and confidence

audit: control carried out by a third party on the compliance of a provider organization to a code of practice or a regulation

availability: likelihood with which the relevant components of the service function can be accessed as required by the contractual conditions (temporal and spatial)

NOTE: Space covers the geographic coverage and resource size aspects.

call: any connection (fixed or temporary) capable of transferring information between two or more users of a telecommunications system. In this context a user may be a person or a machine

Call Detail Record (CDR): formatted collection of information about a chargeable event (e.g. time of call set-up, duration of the call, amount of data transferred, etc) for use in billing and accounting

NOTE: For each party to be charged for parts of or all charges of a chargeable event a separate CDR should be generated, i.e. more than one CDR may be generated for a single chargeable event, e.g. because of its long duration, or because more than one charged party is to be charged (see TR 121 905).

call set-up time: period starting 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) and finishing when the called party busy tone or ringing tone or answer signal is received by the calling party (e.g. recognized on the calling user's access line)

NOTE 1: See ETR 138 [18].

NOTE 2: In some standards, Post Dialling Delay (PDD) is used instead of call set-up time. (See the definition below (TS 101 329-5 [22])).

capability: the ability of an item to meet a demand of a given size under given internal conditions

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

NOTE 2: Internal conditions refer, for example, to any given combination of faulty and not faulty sub-items.

NOTE 3: Trafficability performance and effectiveness are capabilities.

NOTE 4: Demands are of two types - service and traffic.

Circuit Loudness Rating (CLR): loudness loss between two electrical interfaces in a connection or circuit, each interface terminated by its nominal impedance which may be complex

NOTE: See TR 101 329-1.

connection: connection provides for transfer of information between endpoints

NOTE: See ITU-T Recommendation I.113-504 modified [7].

connection set up time: time between end of dialling and start of display of the first screen of a web page

defect: limited interruption of the ability of an item to perform a required function. It may or may not lead to maintenance actions depending on the results of additional analysis

NOTE: See ITU-T Recommendation I.113- 601 [7].

dependability in the supplier-customer interface: the ability to provide what was promised, dependably and accurately

directory enquiry service: operator or machine based service intended to provide information on phone number, addresses or e-mail addresses of people or organizations on user request

empathy in the supplier-customer interface: degree of caring and individual attention provided to customers

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

NOTE: See ITU-T Recommendation I.113-603 [7].

fidelity/accuracy: faithfulness and completeness in carrying out a service facility with respect to a reference level. The reference level may be specified or may be an independent function or a function of an input, (similar to **accuracy**)

function: set of processes defined for the purpose of achieving a specified objective

NOTE: See ITU-T Recommendation I.112-403.

jitter: functional description for measuring output jitter at a digital interface can be found in ITU-T Recommendation O.172 [15]

Loudness Rating (LR): objective measure of the loudness loss, i.e. a weighted, electro-acoustic loss between certain interfaces in the telephone network

NOTE 1: If the circuit between the interfaces is subdivided into sections, the sum of the individual section LRs is equal to the total LR. In loudness rating contexts, the subscribers are represented from a measuring point of view by an artificial mouth and an artificial ear respectively, both being accurately specified (ITU-T Recommendation G.111 [5], TR 101 329-1 (see bibliography)).

NOTE 2: As used in the G-Series Recommendations for planning.

Mean Opinion Score (MOS): panel of a sufficient number of users or observers are asked to give their opinion on the quality of a service amongst the following score (5 to 1): Excellent, High, Fair, Poor, Bad. The MOS is the mean value of these scores. This subjective quality measure, determined by asking people a set of questions under controlled conditions can be used to assess a QoS parameter, for example on the relevance of the operators' answers. This score when applied to voice telephony is evaluated according to the effort required to understand the meanings of group of sentences:

Excellent:	Complete relaxation possible; no effort required.
High:	Attention necessary; no appreciable effort required.
Fair:	Moderate effort required.
Poor:	Considerable effort required.
Bad:	No meaning understood with any feasible effort.

An assessment about the quality of service can also be obtained by calculating the percentage of all test persons rating the configuration as "Good or Better" or as "Poor or Worse". For a given connection these results are expressed as "Percentage GOOD or BETTER" (GoB) and "Percentage POOR or WORSE" (PoW).

When speech samples of good quality are evaluated, *degradation mean opinion scores* (DMOS) may be more suitable where:

Excellent:	Degradation is inaudible.
High:	Degradation is audible but not annoying.
Fair:	Degradation is slightly annoying.
Poor:	Degradation is annoying.
Bad:	Degradation is very annoying.

Every detail on how to perform these measurements is given in ITU-T Recommendation P.800 [11]. Further evaluation procedures specifically for echo canceller and hands-free terminal testing can be found in ITU-T Recommendations P.831 [12] and P.832 [13].

In another perspective, the ITU-T Recommendation P.862 [14] allows for an automated and end-to-end oriented MOS measurement.

monitoring: use of any available technical tool to assess permanently or for a given period of time a particular QoS parameter, e.g. a server load or the response time for a directory enquiry service

overall transmission quality rating (R): full acoustic-to-acoustic (mouth to ear) quality, experienced by an average user, for a typical situation using a "standard" telephony handset

NOTE: The overall transmission quality rating is calculated using the E-Model (see ITU-T Recommendation G.107 [3]). The relation between overall transmission quality rating (R) and user perception of quality is defined in ITU-T Recommendation G.109 [4].

parameter: when a QoS criterion is defined with boundaries and scope unambiguously and clearly stated this then becomes a parameter

NOTE: See TR 102 276.

poll: panel of a sufficient number of users or observers are asked to assess a particular QoS parameter, e.g. "Delay to provide a draft contract"

Post Dialling Delay (PDD): time in milliseconds between dialling the last digit and an audible tone being heard at the originating end

NOTE 1: The audible tone is typically ring-back or the engaged tone (ITU-T Recommendation E.721 [1], TS 101 329-5 [22]).

NOTE 2: Some systems have shown to present the user with a ring-back tone before a connection has been established, this gives the impression that the PDD is low. If the connection fails this is later switched to an engaged tone. This is an unacceptable operation and should be tested.

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

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

NOTE 2: The quality of service is characterized by the combined aspects of service support performance, service operability performance, serviceability performance, service security performance and other factors specific to each service. The term "quality of service" is not used to express a degree of excellence in a comparative sense nor is it used in a quantitative sense for technical evaluations. In these cases a qualifying adjective (modifier) should be used.

NOTE 3: Complementary definition on QoS requirements of the user/customer, QoS offered by service provider, QoS achieved by service provider, QoS perceived by the user/customer are given in ETR 003 [17].

reliability: ability of an item to perform a required function under stated conditions for a given time period

NOTE 1: See ITU-T Recommendations E.800 [2] and M 60 [10].

NOTE 2: It is generally assumed that the item is in a state to perform this required function at the beginning of the time interval.

NOTE 3: In French, the term fiabilité is also used to denote the performance quantified by this probability.

reliability in the supplier-customer interface: ability to provide what was promised, dependably and accurately

response time for operator services: 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

NOTE 1: See EG 202 057-1 [25].

NOTE 2: Services provided wholly automatically, e.g. by voice response systems are excluded (ETR 138 [18] and EG 201 769-1). 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 3: 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.

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

NOTE: See EG 202 057-1 [25].

responsiveness in the supplier-customer interface: willingness to help customers and provide prompt services

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

NOTE 1: A service provider needs not to be a network operator (EG 201 769-1 [21]).

NOTE 2: A service provider that is subject to the requirements of the ONP Voice Telephony Directive will in most cases also be a network operator.

speed: speed is the performance criterion that describes the time interval required to perform a function or the rate at which the function is performed (The function may or may not be performed with the desired accuracy)

NOTE: See ITU-T Recommendation I.350 [33].

survey: Enquiry carried out to assess a particular QoS parameter, e.g. "Queue time at the information desk" or "percentage of cities of more than 5000 inhabitants with an information desk"

Terminal Equipment (TE): functional group on the user side of a user-network interface

NOTE 1: See ITU-T Recommendation I.112-417.

NOTE 2: In ITU-T Recommendations I.430 [8] and I.431 [9], "TE" is used to indicate terminal terminating layer 1 aspects of TE1, TA and NT2 functional groups.

threshold: reference value to determine that a parameter is within the acceptable contractual fork

time to connect: time between the end of dialling and ringing or lift up or busy tone

trafficability: ability of any relevant components of the service function to be sized according to the contractual conditions

user: individuals, including consumers, or organizations using or requesting telecommunications services available on public or private networks. The user may or may not be the person who has subscribed to the provision of the service. Without any specific addition this word is used to identify the telecommunication user community in general, e.g. end-users and IT&T managers who use products and services possibly conforming to standards, EG 201 219 [20]

usability: effectiveness, efficiency and satisfaction with which specified users can achieve specified goals (tasks) in a particular environment. In telecommunications, usability should also include the concepts of learnability and flexibility; and reference to the interaction of more than one user (the A and B parties) with each other and with the terminals and the telecommunications system, EG 201 013 [19].

3.2 Abbreviations

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

ADSL	Asymmetric Digital Subscriber Line
CDR	Call Detail Record
CLR	Circuit Loudness Rating
CRM	Customer Relationship Management
DMOS	Degradation Mean Opinion Score
DNS	Domain Name System
GPRS	General Packet Radio Service
GSM	Global System for Mobile
ISP	Internet Service Provider
ITSEC	Information Technology SECURITY
LR	Loudness Rating
MMS	Multimedia Message Service
MO	Mobile Originate
MOS	Mean Opinion Score
MT	Mobile Terminate
PDD	Post Dialling Delay
POP	Post Office Protocol
POTS	Plain Old Telephony Service
PSQM	Perceptual Speech Quality Measurement
PSTN	Public Switched Telephone Network
QoS	Quality of Service
SLA	Service Level Agreement

SMS	Short Message Service
TE	Terminal Equipment
UMTS	Universal Mobile Telecommunications System

4 QoS methodology implementation

To implement the methodology detailed in EG 202 009-1 [23], the process consists first in defining carefully the intended service, including its conditions of use, then to check for each service life step and each QoS criterion what are the best suited indicators and parameters. When this is done for each cell of the EG 202 009-1 [23] matrix, there will probably be too much parameters for a convenient handling, therefore only the most relevant should be taken for publication or to include in a SLA.

Trying to limit drastically the number of parameters may be counter-productive as it gives the provider an incentive to focus on a particular measure, perhaps at the expense of the general QoS. Also trade-offs may be necessary - for example between cost and reliability. Benchmarking, when available, can provide useful support in this aspect. To ensure the best compromise between the number of parameters and their ability to provide an effective assessment of the QoS, it would be helpful to use surveys focusing on users' complaints to identify where are the main non quality issues to adapt the indicator sample accordingly. This indicator selection should be reviewed regularly.

4.1 General principles for the indicator and parameter definition

Every technical measurement should keep in with the customer perception (e.g. end-to-end transit time), although suppliers may need to carry out technical measurements on particular points to ensure the customer perceived quality even if these QoS parameters are not directly perceptible to the user.

Some general principles should apply:

- Beware of mean values that gives figures which might be very far from a particular customer feeling.
- Focus on disturbance (should be 0) rather than performance (close to 100 %).
- Use figures that may be consolidated (disturbance rate).
- For QoS targets define thresholds suited to the aim.

When reading this document, anyone should have in mind that an indicator is, in the user language, the translation of a rate, a frequency or any other measurable quantity. The following tables endeavour to give guidance on the relevant indicators and parameters for the main electronic communication services and, when available, the corresponding standards. Nevertheless, it should be clear that users can ask for different quality levels for the same service used in different contexts. QoS thresholds may be appropriate when there is a legal constraint or a contractual commitment (SLA); in such cases, they have to be defined on a case by case basis with, possibly, different requirements in the same SLA for different uses. Otherwise, the publication of QoS parameter values is expected to help to the freedom of choice for users, making the different provider QoS performance clear to them.

QoS indicators for the technical performance of the service are in many cases service specific while in the other steps of the service life they are often common to most services. Therefore to ease the reading, the definitions of QoS indicators and parameters are split in two parts: those related to the technical quality (functional aspects) and those related to other aspects of the service: sales, provision, alteration, operation, repair, upgrade, charging/billing, complaint management, network/service management, cessation, commercial and technical support (non functional aspects).

It is important that the following points are made:

- What are the performance indicators that are pertinent to the particular service?
- How are these to be measured?
- Who will measure it?
- What are the acceptable measuring procedures (test specification, i.e. ITU-T recommendation, ETSI standard or survey and the frequency of measurement, sample size, confidence limits, etc)?

and in addition in an SLA:

- What is the acceptable range of performance?

EG 202 009-1 [23] provides guidance on these aspects that have to be specified for any QoS assessment. In the following clauses, tables are given to define the relevant QoS indicators and parameters for a selection of services along the various aspects of the ICT service life cycle.

Parameters may be measured by various means: technical measurements performed by the supplier or an independent organization, or a poll of a user panel.

It is users' opinion that in most cases both technical measurements and surveys among users are useful to draw a realistic picture of the QoS.

Along with these considerations, the following tables will consider various parameters for the QoS, seeking to identify a set of measures that are expected to form the basis for judging the performance of the supplier from the point of view of the consumers or business users. In this area the statistical quality is crucial to the credibility of the results and should be given for most if not all of these measurements.

In these tables, the indicator gives an expression of a criterion from the user viewpoint and relevant to his control panel. Parameters are used to give a quantifiable value allowing for the appraisal of the quality of a given service.

These tables are built on the basis of two general principles:

- 1) It is crucial, to avoid misunderstanding, that the indicators and parameters to measure the QoS can be used and managed by both the users and the providers, even if these parameters are viewed from different perspectives.
- 2) Theoretically, at least one QoS parameter is necessary for an actual evaluation of each criterion and all the criteria are needed for a comprehensive QoS appraisal of a given service aspect. The tables are built on this principle but, as explained earlier, for practical reasons, a reduced set of carefully selected parameters may be used for QoS monitoring.

Hence, each table shows the indicators, the parameters and where appropriate the proposed thresholds. In addition, for each indicator, the last column shows which type of measurement is appropriate.

As indicated earlier in this clause, the parameters given in these tables often refer to standards that provide additional information about how the measurements should be performed and who is expected to perform and provide them. Any one intending to assess QoS is invited to carefully read them. When there is no standard available to define appropriate indicators and/or parameters, definitions are nevertheless proposed to compensate for the lack of such.

4.2 Service specifications

Since nowadays, most services are in fact a service make-up, it is crucial before intending to assess the QoS of a service, to describe what the service is intended for, what are the conditions of use, what are the functions (services) and options included, etc. In particular, for the GSM, UMTS, GPRS and ADSL services, the areas where the service is available should be specified as well as the population served (percentage of the inhabitants).

Therefore, since the tables dealing with the parameters for the technical quality are service specific, the definition of the function of the intended service is given at the beginning of the table.

4.3 Particular QoS aspects

For some particular aspects of the quality of service, QoS parameters can hardly be published. This is the case for charging and billing issues as well as security matters.

4.3.1 Charging and billing

There are multiple causes that can lead to billing errors with respect to the actual use of the service but such errors can hardly be monitored in real time. Therefore, an approval of the metering and billing system seems more appropriate than a QoS parameters monitoring. Such approval should focus on several aspects:

- Ensure that there is no systematic error in the metering system.

- Ensure that there is no discrepancy between the metering and the billing.
- Ensure that any change in the metering and billing system does not lead to a new error cause.

Such an approval should be carried out by a third party formally recognized for its competence in this area. This approval has to be monitored and reviewed regularly in conformance with the available standards in the management area, e.g. ISO/IEC 17021 [31].

4.3.2 Security

Security, data protection, privacy are key user concerns. In this context, IT security means (ITSEC [xvi]):

- confidentiality - prevention of the unauthorised disclosure of information;
- integrity - prevention of the unauthorised modification of information;
- availability - prevention of the unauthorised withholding of information or resources.

In this area too, QoS parameters are practically impossible to monitor. Therefore, the compliance of the management system to a good practice code seems more appropriate than a QoS parameters monitoring. Such a conformance should be recognized by a trusted body complying to available relevant standards like ISO/IEC 15408 [32] and ISO/IEC 17021 [31]. Although this document is not intended to define in depth IT security functional and assurance requirements, in the following tables, for this criterion instead of defining QoS parameters, some of the sensitive aspects of the service with regard to the security are given for an audit to focus on them:

- mechanism efficiency: ability to ensure and take part in the security in predefined conditions;
- mechanism resistance: ability to counter or block an action or a force;
- robustness: force intrinsic to resist, resistance.

Therefore, the implementation of the security criterion to each step of the service life will endeavour, in a certification perspective, to identify, according to these principles, which type of threats are particularly undermining to this service.

5 QoS parameters for the technical quality for the service utilization

It is very important to notice that the tables in this clause are intended to be focused on the services and to be technology agnostic: being user oriented, the parameters should be the same whatever the technology of the bearer network. The differences due to differing technologies are expected to appear in the results, the presentation of them taking possibly account of the communication path. These does not mean that a breakdown of the results according to the technology or to the type of contract is irrelevant. Therefore, when the QoS assessment is expected to provide for a comparison between the QoS achieved by several providers, a particular care should be given to the composition of the test sample for each of them. Particularly when IP technology is used to provide the service, location, type of contract and specification of the set-top-box of each sample item should be carefully selected to ensure the measurements actually represent the QoS provided.

The services listed here are drawn from ITU-T Recommendation G.1010 [6] with some changes to take into account the current market situation. The definition of the function achieved by each of them is given in the first sentence of the related clause. Some services have usually several components and, when appropriate, indicators and parameters for such components are identified separately in the list of the service indicators. Due to time and resource constraints, QoS indicators and parameters are not available yet for all these services. For the services listed in clause 5.12, they will be provided in a later edition.

The methodology can be used to monitor the compliance of a provision to the provider commitments as well as a performance assessment without any reference, for example in the intention to provide comparative information to a prospect in order to help him to choose the offer best suited to his wishes.

It is worth noting that the reference to formal standards is crucial to the reliability of the results and to enable comparisons between providers. On the other hand, the targets to meet are related to a contractual approach between the provider and the regulator or between the provider and his customers.

What is at stake is that the user can know and possibly negotiate the targets on which the provider is committed and then to get access to the information enabling him to check whether these commitments are met.

Users should be interested to have some guidance on which targets QoS parameters should reach to ensure a good QoS but at this stage of the work, it was not possible to provide such guidance. This will be for a later revision if the QoS measurement experience has grown enough.

5.1 Audio broadcast

Audio broadcast: A mechanism whereby audio content can be rendered at the same time that it is being transmitted to the client over the data network.

Availability

Indicator	Parameter (measure)
Rate of server accessibility	Percentage of successful log-ins with respect to a required number of attempts, {Successful log-in ratio; Reference: EG 202 057-4 [28]}
Listening break-up ratio	Consolidated duration of audible listening break-up over one minute listening.
Listening break-up frequency	Number of audible listening break-up over one minute listening.
Successful one minute listening ratio	Number of continuous listening minutes without break-up over the required listening time.

Fidelity/accuracy

Indicator	Parameter (measure)
Audio quality	Assessment of the audio quality by a representative user panel (MOS value).

Speed

Indicator	Parameter (measure)
Access time	Time in seconds within the fastest 80 % and 95 % of logins {Login time; Reference: EG 202 057-4 [28]}
Starting delay	Maximum and mean time in second between the start order and the beginning of the hearing.

Capability

Indicator	Parameter (measure)
Throughput achieved	Ratio of the data bit-rate provided compared to the required bandwidth.

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Provider capacity to adjust to the user connection and equipment features.	Assessment of the adjustment capacity by a representative user panel (MOS value).

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel (MOS value).

Security

Indicator	Parameter (measure)
Protection against user identity theft	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against intrusion and breach of customer's privacy.	Efficiency and robustness of the protection mechanism: Certificate from an entitled body.

5.2 Directory enquiry services

Directory enquiry services: operator or machine based service intended to provide information on phone number, addresses or e-mail addresses of people or organizations on user request.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the service	Number of successful attempts to access an operator with respect to the total number of attempts required over a given period.
Outage frequency	Number of times the user's connection is terminated for reasons other than their choosing to disconnect by agreed period of time.
Served call rate (provider)	Rate of calls providing the caller with the ability to place his request.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of correctness in answering the customer questions	Survey.

Speed

Indicator	Parameter (measure)
Response time for directory enquiry services	Duration from the dialling to the instant the human operator or an equivalent voice-activated response system answers the calling user: a) mean time to answer; b) percentage of calls answered within 20 seconds. {Response time for directory enquiry services; Reference: EG 201 769 [21], EG 202 057-1 [25]}
Reply time	Period starting when the operator pick-up the receiver until the user has got the expected answer.

Capability

Indicator	Parameter (measure)
Adequacy of the number of operators to the number of call (provider)	Occupation rate of the operators.

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available means to access the service (Mobile, fixed, Internet, etc.)	List of available means: Survey.

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel (MOS value).
Ability of the operator to cope with the caller language	Languages taken into account: Survey.

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection of the customer's private data or related to the person concerned by the enquiry.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.3 E-mail

email: exchange of text files with possible attached files between two PCs via networks and through distant servers where the message can be stored until the recipient download it.

Availability

Indicator	Parameter (measure)
Rate of SMTP failures	a) {Percent of SMTP (Send) failures: % failures of attempts of the user to send an email to an Internet e-mail address over a week; Reference: CWA14357 [30]} b) {SMTP failures longer than a certain amount of time (for example one hour); Reference: CWA14357 [30]}
Rate of POP3 failures	{Percent of POP3 (Receive) failures over a week., with detail on POP3 failures lasting longer than a certain amount of time (for example one hour); Reference: CWA14357 [30]}
Outages rate	Total outage duration by week separately for SMTP and POP servers; {Outages periods; Reference: CWA14357 [30]}
Outage frequency	Number of outages by week separately for SMTP and POP servers.
Rate of message loss	Number of messages sent to the right address that do not reach the user mailbox with respect to the total number of messages received.

Fidelity/accuracy

Indicator	Parameter (measure)
If the service includes a security mechanism: Rate of undue deletions of email by the security mechanisms	Percentage of valid message deleted with respect to the total number of messages received.

Speed

Indicator	Parameter (measure)
Average time to check an empty mailbox	Mean time spent between the start time to check a mailbox and the comeback of the information the mailbox is empty {Average time to check an empty mailbox; Reference: CWA14357 [30]}
Average delivery time from the ISP to other ISPs	Mean time spent between the ending of a standard-sized message to the user ISP and the message is available in another ISP user mailbox {Average delivery time from the ISP to other ISPs; Reference: CWA14357 [30]}

Capability

Indicator	Parameter (measure)
Servers throughput	Number of successful attempts sending messages to the SMTP server over a given period {Throughput sending messages to the SMTP server; Reference: CWA14357 [30]} Number of successful attempts retrieving messages from the POP3 server over a given period {Throughput retrieving messages from the POP3 server; Reference: CWA14357 [30]}
Speed of upload to the ISP's mail-server	Average and standard deviation of time to upload a standard-sized attachment to the ISP's mail-server (e.g. 1 megabyte).
Speed of download from the ISP's mail-server.	Average and standard deviation of time to download a standard-sized attachment from the ISP's mail-server (e.g. 1 megabyte); {Speed of download from the ISP's mail-server Reference: [xi]}

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Ease to change the contractual specifications (e.g. the mailbox size)	Assessment of the change ease by a representative user panel (MOS value) Time to change the mailbox size.

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel (MOS value).

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection against intrusion, breach of customer's privacy, spam and any kind of virus.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.4 Fax

Fax service: Telecommunications service of transport of facsimile via the PTN such that any user can use equipment connected to a network termination point to exchange facsimiles with another user of equipment connected to another termination point.

Availability

Indicator	Parameter (measure)
Refer to the telephony service both in terms of availability of the service and availability of the connection.	

Fidelity/accuracy

Indicator	Parameter (measure)
Transmission fidelity test	ITU-T Recommendation T.22 test {Test ~5; Reference: ITU-T Recommendation T.22 [16]} .

Speed

Indicator	Parameter (measure)
N/A (speed is defined by the terminal available)	

Capability

Indicator	Parameter (measure)
N/A	

Reliability

Indicator	Parameter (measure)
Successful fax transactions ratio at the highest mutual transmission speed of the send and receive fax machines;	Successful fax transactions ratio at the highest mutual transmission speed of the send and receive fax machines: a) the percentage of successful fax transactions; b) the number of test calls. $(\text{Total number effective transactions} / \text{Total number of required observations}) \times 100$ {Fax connection quality; Reference: EG 202 057-2 [26]}
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
N/A: no change expectable in the service.	

Usability

Indicator	Parameter (measure)
N/A: aspect linked to the terminal and not to the service.	

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection against user identity theft and content violation.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.5 Internet access

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 is an example of multicomponents services: it can not work without authentication and domain name services but it usually also includes other components such as Web browsing (consultation, data transfer), web page hosting, etc. Where appropriate, specific indicators and parameters are defined for such components.

Availability for Internet access

Indicator	Parameter (measure)
Successful log-in ratio	Percentage of successful log-ins with regard to the total attempt number required. {Successful log-in ratio; Reference: EG 202 057-4 [28]}
Outage rate	Total sum of access outage durations by agreed period of time. {Duration of ISP outages; Reference: [xi]}
Outage frequency	Number of access outages by agreed period of time {Frequency of ISP outages; Reference: [xi]} Number of times the user's connection is terminated for reasons other than their choosing to disconnect by agreed period of time. {Frequency of connection termination; Reference: [xi]}
Rate of successful access to authentication	Number of successful attempts with respect to the total number of attempts required over a given period (e.g. 100 attempts a day).
Rate of successful access to generic name translation	Number of successful attempts with respect to the total number of attempts required over a given period (including authorized masked servers). {Domain Name System (DNS) performance; Reference: CWA14357 [30]}

Availability for Web browsing

Indicator	Parameter (measure)
Outage rate to a set of designated sites	Break-up rate during the consultation of a set of designated sites (e.g. for a business its most demanded or business-critical websites - such as its suppliers' websites, or websites used for research, and for indiscriminate users, this could be the top 50 visited websites) are unavailable. {Proportion of time which designated sites are unreachable. Reference: [xi]}
Availability of a set of web pages hosted by the ISP	Generic scenario availability: Percentage of time a generic scenario ends successfully.
Frequency of untimely break-up during data transfer	Number of untimely break-up during the data transfers over the required period. {Frequency and duration of ISP outages; Reference: [xi]}
Rate of accessibility to the ISP input ports	Number of successful attempts to access the ISP input ports with respect to the total number of attempts required over a given period.
Rate of accessibility to the ISP output ports	Number of successful attempts to access the ISP links with the Internet network with respect to the total number of attempts required over a given period.

Availability for Web page hosting

Indicator	Parameter (measure)
Rate of accessibility to the allocated space	Number of successful attempts with respect to the total number of attempts required over a given period.

Fidelity/accuracy for Internet access

Indicator	Parameter (measure)
Error rate in data transmissions	Number of unsuccessful transmissions of a test file due to data alteration with respect to the total number of transmission attempts. {Unsuccessful data transmissions ratio; Reference: EG 202 057-4 [28]}

Fidelity/accuracy for Web browsing

Indicator	Parameter (measure)
Rate of packet loss during the consultation	The percentage of packets that the ISP sends which are unable to find their destination (are dropped) during a site consultation. {Packet loss statistics; Reference: [xi]}
Error rate in data transmissions	Number of unsuccessful transmissions of a predefined file due to data alteration with respect to the total number of transmissions attempts during a data transfer. {Unsuccessful data transmissions ratio; Reference: EG 202 057-4 [28]}
NOTE:	The fidelity failures on authentication or domain name attribution have an impact on availability that can not be discriminated from other causes by the users.

Speed for Internet access

Indicator	Parameter (measure)
Delay (one way transmission time)	Half ping time (RFC 792 [34]). {Delay (one way transmission time); Reference: EG 202 057-4 [28]}
Radio channel access delay (mobiles)	round-trip-MS/PLMN delay;
Authentication time	Time in seconds within the fastest 80 % and 95 % of attempts. {Login time; Reference: EG 202 057-4 [28]}
Generic domain name translation time	Time in seconds within the fastest 80 % and 95 % of attempts. {Domain Name System (DNS) performance; Reference: CWA14357 [30]}

Speed for Web browsing

Indicator	Parameter (measure)
Web response time	Time between the start and the end of display while playing a generic scenario to connect in HTTP to a standard webpage within the ISP network Time between the start and the end of display while playing a generic scenario to connect in HTTP to a standard webpage beyond the ISP network.

Speed for Web page hosting

Indicator	Parameter (measure)
Time to upload a test web page by the owner of the allocated space	Time to upload a web page of a given size by the owner of the allocated space from the ISP network. Time to upload a web page of a given size by the owner of the allocated space from another network than the ISP one.
Time to display a test web page by any web user	Time to display a web page of a given size by any web user from the ISP network. Time to upload a web page of a given size by any web user from another network than the ISP one.

Capability for Internet access

Indicator	Parameter (measure)
Throughput achieved (upload and download)	a) The maximum data transmission rate in kbit/s achieved. b) The minimum data transmission rate in kbit/s achieved. c) The mean value and standard deviation of the data transmission rate in kbit/s. {Data transmission speed achieved; Reference: EG 202 057-4 [28]}
Throughput of dial-up access to the Internet	Transmission rate of modem data of 80 % of connections in bit/s. {Data rate of dial-up access to the Internet; Reference: EG 202 057-2 [26]}

Capability for Web browsing

Indicator	Parameter (measure)
Occupation rate of ISP links	Maximum rate of ISP links with the worldwide web being busy.
Occupation rate of ISP input ports	Maximum rate of ISP input ports being busy.

Reliability for the overall service

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Fault report rate per fixed access lines	Number of fault reports separately for access and core network. {Fault report rate per fixed access lines; Reference: EG 202 057-1 [25]}

Flexibility for the overall service

Indicator	Parameter (measure)
Ease to change the contractual specifications (bit rate and options)	Assessment of the change ease by a representative user panel (MOS value). Time to change one contractual specification.

Usability for the overall service

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value)
Adaptability to make use easier to people with disabilities	Assessment of the user friendliness by a representative user panel of people with disabilities. (MOS value)

Security for the overall service

Indicator	Parameter (measure)
Protection against user identity theft	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against intrusion and breach of customer's privacy.	Efficiency and robustness of the protection mechanism: Certificate from an entitled body.
Compliance to the customer security requirements as specified in the contract, in particular: screening of the World Wide Web content and threats, walled garden area implementation, sensitive data encryption, etc.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.6 Multimedia Message Service (MMS)

Multimedia Message Service (MMS): transfer of multimedia messages between users without the requirement for the multimedia messages to be transferred in real-time.

Availability

Indicator	Parameter (measure)
Successful MMS Ratio	Probability that a user can send a MMS successfully from a terminal equipment to a MMS centre: a) percentage of successfully sent MMS, b) number of observations used and the absolute accuracy limits for 95 % confidence calculated from this number.

Fidelity/accuracy

Indicator	Parameter (measure)
Completion Rate for MMS	The ratio of correctly sent and received MMS between two terminal equipments. The following statistics should be provided separately: The ratio of successfully sent and received Multimedia messages, together with the number of observations used and the absolute accuracy limits for 95 % confidence calculated from this number.

Speed

Indicator	Parameter (measure)
End-to-End delivery time for MMS	The end-to-end delivery time for MMS is the period starting when sending a MMS from a terminal equipment to a MMS centre and finishing when receiving the very same MMS on another terminal equipment. The following statistics should be provided separately: a) the mean value in seconds for sending and receiving a standard sized MMS (e.g. 5Mo); b) the time in seconds within which the fastest 95 % of MMS are sent and received; c) the number of observations performed.

Capability

Indicator	Parameter (measure)
The impact of the server capability to process multiple simultaneous messages is not directly perceived by the users.	
NOTE: The size of the MMS storage space allowed, the maximum storage time and MMS number allowed on the server are important features to the user that can differentiate the suppliers and therefore should be specified in the contract but are not per se QoS parameters.	

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Ease to change the contractual specifications (bit rate and options)	Assessment of the change ease by a representative user panel (MOS value) Time to change one contractual specification.
Range of available means to send and receive MMS (Mobile, fixed, Internet, etc.)	Survey

Usability

Indicator	Parameter (measure)
Options available to make use easier to people with disabilities	Assessment of the user friendliness to people with disabilities by a representative user panel. (MOS value)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value)

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection against intrusion, breach of customer's privacy, spam and any kind of virus.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.7 Operator services

Operator services: Service provided by human operator to establish or assist customers in establishing local or long-distance telephone connections.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the service	Number of successful attempts to access an operator with respect to the total number of attempts required over a given period.
Outage frequency	Number of times the user's connection is terminated for reasons other than their choosing to disconnect by agreed period of time.
Served call rate (provider)	Rate of calls providing the caller with the ability to place his request.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of correctness in fulfilling the customer request	Survey

Speed

Indicator	Parameter (measure)
Response time for operator services	Duration from the dialling to the instant the human operator answers the calling user: a) mean time to answer; b) percentage of calls answered within 20 seconds. {Response time for operator services; References: EG 201 769 [21] and EG 202 057-1 [25]}
Call set-up time	Period starting when the operator pick-up the receiver until the expected ringing tone or answer signal is received by the calling party.

Capability

Indicator	Parameter (measure)
Adequacy of the number of operators to the number of call (provider)	Occupation rate of the operators.

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available means to access the service (Mobile, fixed, Internet, etc.)	List of available means: Survey.

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value).
Ability of the operator to cope with the caller language	Languages taken into account: Survey.

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection of the customer's private data or related to the person concerned by the enquiry.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.8 Short Message Service (SMS)

Short Message Service (SMS): gives the ability to send character messages to phones. SMS messages can be Mobile Originate (MO) or Mobile Terminate (MT).

NOTE: SMS allows alphanumeric messaging between mobile phones and other equipment such as voice mail systems and email.

Availability

Indicator	Parameter (measure)
Successful SMS Ratio	Probability that a user can send a SMS successfully from a terminal equipment to a SMS centre: a) percentage of successfully sent short messages; b) number of observations used and the absolute accuracy limits for 95 % confidence calculated from this number. {Successful SMS Ratio; Reference: EG 202 057-2 [26]}

Fidelity/accuracy

Indicator	Parameter (measure)
Completion Rate for SMS	Ratio of correctly sent and received SMS between two terminal equipments. The following statistics should be provided separately: a) ratio of successfully sent and received short messages; b) number of observations used and the absolute accuracy limits for 95 % confidence calculated from this number. {Completion Rate for SMS; Reference: EG 202 057-2 [26]}

Speed

Indicator	Parameter (measure)
End-to-End delivery time for SMS	The end-to-end delivery time for SMS is the period starting when sending a SMS from a terminal equipment to a Short Message centre and finishing when receiving the very same SMS on another terminal equipment. The following statistics should be provided separately: a) the mean value in seconds for sending and receiving short messages; b) the time in seconds within which the fastest 95 % of short messages are sent and received; c) the number of observations performed. {End-to-End delivery time for SMS; Reference: EG 202 057-2 [26]}
Delivery time of the message delivery notification	Maximum, mean value and standard deviation of the time to receive the delivery notification.

Capability

Indicator	Parameter (measure)
The impact of the server capability to process multiple simultaneous messages is not directly perceived by the users.	
NOTE: The size of the SMS storage space allowed, the maximum storage time and SMS number allowed on the server are important features to the user that can differentiate the suppliers and therefore should be specified in the contract but are not per se QoS parameters.	

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available means to send and receive SMS (Mobile, fixed, Internet, etc.)	Survey

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value)

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection against intrusion, breach of customer's privacy, spam and any kind of virus.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.9 Telephony

Telephony: A person to person or person to machine voice distant conversation using a switched link temporarily set.

Availability

Indicator	Parameter (measure)
Unsuccessful call ratio	Unsuccessful call ratio is defined as the ratio of unsuccessful calls to the total number of call attempts in a specified time period. The following statistics should be provided separately: a) The percentage of unsuccessful calls for national calls, together with the number of observations used and the absolute accuracy limits for 95 % confidence calculated from this number. b) The percentage of unsuccessful calls for international calls, together with the number of observations used and the absolute accuracy limits for 95 % confidence calculated from this number. {Unsuccessful call ratio; References: EG 201 769 [21], EG 202 057-2 [26], EG 202 057-3 [27]}
Dropped call ratio	The percentage of dropped calls, calculated from all the calls in the period, e.g. interruptions due to the network during a standard duration of the communication. {Dropped call ratio; Reference: EG 202 057-3 [27]}
Retainability rate	a) The percentage of standard duration communications (e.g. 2 minutes) that are successfully maintained until hang up. b) The percentage of standard duration communications (e.g. 2 minutes) that are successfully maintained until hang up while roaming (mobiles).
Outage rate	Total sum of outages durations of the faulty lines by agreed period of time (day, week, month, year).
Public pay-telephones in working order	Percentage of the sum total of "working order pay-telephone"-days, divided by the sum total of the pay-telephone-days. {Public pay-telephones in working order; Reference: EG 202 769 [21]}

Fidelity/accuracy

Indicator	Parameter (measure)
Predictable speech connection quality	A predictive quality of end-to-end (mouth to ear) speech quality for conversational speech of a voice service call. The following results should be provided separately: a) The quality category of the speech connection quality of the voice service should be provided, according to ITU-T Recommendation G.109 [4]. b) The kind/characteristics of terminals underlying these calculations. c) The reference configurations. {Speech connection quality; Reference: EG 202 057-2 [26]}
Observed voice quality	The quality category of the speech connection quality of the voice service according to ITU-T Recommendation P.862 [14]. {ACR Listening Quality Opinion Scale; Reference: [14]}
Signalling failure rate	Number of routing failures over the required period.

Speed

Indicator	Parameter (measure)
Call set-up time:	The period starting when the address information required for setting up a call is received by the network and finishing when the called party busy tone or ringing tone or answer signal is received by the calling party. The following statistics should be provided separately: a) The mean value in seconds for national calls. b) The time in seconds within which the fastest 95 % of national calls are set-up. c) The mean value in seconds for international calls. d) The time in seconds within which the fastest 95 % of international calls are set-up. e) The number of observations performed for national and international calls. {Call set-up time; References: EG 201 769 [21], EG 202 057-2 [26]}

Capability

Indicator	Parameter (measure)
Availability of the voice and signalling channels (provider)	Occupation rate of the voice and signalling channels (Erlang).

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Fault report rate per fixed access lines	Number of fault reports separately for access and core network. {Fault report rate per fixed access lines; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Ease to change the contractual specifications	Assessment of the change ease by a representative user panel. (MOS value). Time to change one contractual specification.

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value).
Adaptability to make use easier to people with disabilities	Assessment of the user friendliness by a representative user panel of people with disabilities. (MOS value).

Security

Indicator	Parameter (measure)
Protection against user identity theft	Qualification of the customer's private data protection system: Certificate from an entitled body.
Protection against intrusion, fraudulent listening and breach of customer's privacy	Qualification of the customer's private data protection system: Certificate from an entitled body.

5.10 Video broadcast

Video broadcast: A mechanism whereby video content can be rendered at the same time that it is being transmitted to the client over the data network.

Availability

Indicator	Parameter (measure)
Rate of server accessibility	Percentage of successful log-ins with respect to a required number of attempts. {Successful log-in ratio; Reference: EG 202 057-4 [28]}
Display break-up ratio	Consolidated duration of visible display break-up over one minute watching.
Display break-up frequency	Number of visible display break-up over one minute watching.
Successful one minute watching ratio	Number of continuous watching minutes without break-up over the required watching time.

Fidelity/accuracy

Indicator	Parameter (measure)
Audio quality	Assessment of the audio quality by a representative user panel. (MOS value)
Video quality	Assessment of the video quality (Absence of perceptible frozen blanks) by a representative user panel. (MOS value)

Speed

Indicator	Parameter (measure)
Access time	Time in seconds within the fastest 80 % and 95 % of logins. {Login time; Reference: EG 202 057-4 [28]}
Starting time	Maximum and mean time in second between the start order and the beginning of the display.

Capability

Indicator	Parameter (measure)
Throughput achieved	Ratio of the data bit-rate provided compared to the available required bandwidth.

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Ease to change the contractual specifications	Assessment of the change ease by a representative user panel (MOS value) Time to change one contractual specification.

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value)

Security

Indicator	Parameter (measure)
Protection against user identity theft	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against intrusion and breach of customer's privacy	Efficiency and robustness of the protection mechanism: Certificate from an entitled body.

5.11 Voice mail

Voice mail: Any system for sending, storing and retrieving audio messages, like a telephone answering machine. A voice mailbox is typically associated with a telephone number or extension. This service is a multi-components service generally including:

- a) recording, storage and transmission of a welcome message by the voicemail owner;
- b) recording and storage of a message by a caller on no reply or busy line under the guidance of a voice server;
- c) information of the voicemail owner that a message is available;
- d) listening of a recorded message by the voicemail owner.

Other systems making a caller able to directly record a message in a voice mailbox using either phone or digital voice record exchange are not in the scope of this clause.

Availability

Indicator	Parameter (measure)
Rate of successful access to the recording server (voice guide)	Number of successful attempts to access to the server with regard to the total attempt number required.
Rate of successful access to the message listening server	Number of successful attempts to access to the server with regard to the total attempt number required.
Outage rate of the message recording server	Total sum of access outage durations by agreed period of time.
Outage rate of the message listening server	Total sum of access outage durations by agreed period of time.
Outage frequency of the message recording server	Number of access outages by agreed period of time.
Outage frequency of the message listening server	Number of access outages by agreed period of time.
Rate of message loss	Number of messages lost with respect to the total number of messages received.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of message spoiling Failure of the information to the voice mailbox owner	Number of messages spoiled (incoming message without information to the voice mailbox owner, disjointed, truncated, etc.) with respect to the total number of messages received.

Speed

Indicator	Parameter (measure)
Response time of the voice guide after the reply time out	Time in seconds within the fastest 80 % and 95 % of connection to the message recording server (voice guide) on busy line or no reply after the reply time out.
Message recording server response time	Time in seconds after the end of the welcome message within the fastest 80 % and 95 % of connection to the message recording server (start of recording signal).
Time to receive the notification of a message record in the voice mailbox	Time in seconds within the fastest 80 % and 95 % of delay between a message record and its announcement to the voice mailbox owner.
Message listening server response time	Time in seconds after the end of the welcome message within the fastest 80 % and 95 % of connection to the message listening server (start of the first message transmission).

Capability

Indicator	Parameter (measure)
The impact of the server capability to process multiple simultaneous messages is perceived by the users by the time to send the record signal but not directly.	
NOTE:	The size of the message storage space allowed, the maximum storage time and size allowed on the server are important features to the user that can differentiate the suppliers and therefore should be specified in the contract but are not per se QoS parameters.

Reliability

Indicator	Parameter (measure)
Rate of overall technical reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Level of customer complaints	Number of complaints logged per customer over the required period of time. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Ease to change the contractual specifications (options and set-up)	Assessment of the change ease by a representative user panel (MOS value) Time to change one contractual specification.
Range of available means to record and receive (Mobile, fixed, Internet, etc.)	Survey

Usability

Indicator	Parameter (measure)
User friendliness of the interface	Assessment of the user friendliness by a representative user panel. (MOS value)

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract, in particular: protection against fraudulent message listening and change of the welcome recorded message.	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

5.12 For further study

Several services have been identified but, due to lack of time, are expected to be dealt later on. They are listed and defined hereafter:

Conversational: An interactive service which provides for bi-directional communication by means of real-time (no store and forward) end-to-end information transfer from user to user, ITU-T Recommendation I.113 [7].

e-Commerce: The commercial activities carried out through computer networks such as the Internet, including online promotion and sale of products, services and information, as well as the exchange of electronic correspondence.

NOTE 1: Include On line shopping.

Instant messaging: Differs from email primarily in that its primary focus is substantially immediate end-user delivery.

NOTE 2: Instant messaging allows users to maintain a list of people that they wish to interact with. They can send messages to any of the people in their list, often called a buddy list or contact list, as long as that person is online. Sending a message opens up a small window where either correspondent can type in messages that both can see.

Interactive games: Internet-based electronic games involving several individuals interacting with each other in ongoing, open-ended play.

Location-based services: Technologies allowing for customized service provision depending on the customer positioning.

NOTE 3: Such positioning may either be GPS based or network based. The network based positioning typically rely on various means of triangulation of the signal from cell sites serving a mobile phone. There are four major categories of Location Based Services:

- Location based information.
- Location sensitive billing.
- Emergency services.
- Tracking.

Newsgroup (Usenet): A newsgroup is a repository within the Usenet system for messages posted from many users at different locations.

Presence service: Capability to support management of presence information between watchers and presentities, in order to enable applications and services to make use of presence information.

NOTE 4: Presence and availability technologies provide the ability to determine the event in which a mobile user is present in a certain location and/or available for certain events to take place such as mobile messaging, games, and other location based services.

Teleconference: Used as a superset of Telephoneconference, Videoconference and Audioconference (Audiographic conference).

Audio-conference (short name for audiographic conference): Connection between two or more terminals, exchanging audio, text and graphic information only.

telephone-conference: Three or more terminals exchanging audio information.

videoconference: Service providing an interactive, bi-directional, real time audio-visual communication, normally intended for multiple users at either end.

NOTE 5: The terminals are normally exchanging audio/video/graphic information.

Telecontrol: Interaction between local and remote machine to control and monitor equipment and Inputs/Outputs signals in remote locations.

Telnet: the Internet standard protocol for remote login. Runs on top of TCP/IP. Defined in STD 8, RFC 854 and extended with options by many other RFCs.

videotelephony: A service providing an interactive, bi-directional, real time audio-visual communication, normally intended for a single user at either end.

Voice messaging: Person to remote server unilateral voice transmission.

6 QoS indicators and parameters for all service life cycle steps other than utilization

This clause deals with sales, service management and network/service management by the customer. The reader can find a detailed description of the activities related to each step of the service life cycle in clause 6.1 of EG 202 009-1 [23], particularly on the tuning of the QoS criterion to these particular aspects of the services. For an easier reading, the scope of each step is given in the first sentence of the related clause.

6.1 QoS parameters for sales

Embraces all QoS assessments related to activities from the time communications are established between the provider and the customer to the time the contract is signed for the provision of a service or a set of services by the provider.

6.1.1 Preliminary information

All QoS assessments related to information on the service provided on request of the prospect to help him choosing the service and provider most appropriate to his needs.

Availability

Indicator	Parameter (measure)
Rate of accessibility to an information desk	Percentage of cities of more than 5 000 inhabitants with an information desk. Open hours of the information desk. (Survey)
Legibility of the information: Size of the print font, ease of reading, use of words from the common language: rate of words understood, rate of omissions, rate of falsifications	Assessment of the legibility of the information by a representative user panel. (MOS value)

Fidelity/accuracy

Indicator	Parameter (measure)
Error rate in advertisements	Assessment of the correctness and completeness of the description in advertisements of the service features, performance, service support and charges via an audit.
Error rate in the contract form	Assessment of the correctness and completeness of the contract via an audit.

Speed

Indicator	Parameter (measure)
Service response time	Time taken from the initial information request to the instant the pertinent information has been supplied to the customer: a) the time by which the fastest 50 %, 95 % and 99 % of information or draft contract have been sent (expressed in clock hours); or b) the percentage of information or draft contract sent any timestated as an objective by the service provider. (Survey)
Response time of the commercial desk	Time elapsed between the end of dialling and reaching a commercial operator: a) mean time to answer; and b) percentage of calls answered within 20 seconds. {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}

Capability

Indicator	Parameter (measure)
Efficiency of the services in charge of providing preliminary information.	Rating of the request stream: - Queue time at the information desk (Survey). - Load rate of the employees at the counter (Survey). - Load rate of the Web-servers (Monitoring).

Reliability

Indicator	Parameter (measure)
Overall rating of the responsiveness of the information desk	Assessment of the responsiveness of the information desk by a representative user panel (MOS value). {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available information channels (phone, Internet, information desk, etc.)	List of channels available.

Usability

Indicator	Parameter (measure)
User friendliness of the Internet user interface	Assessment of the user friendliness by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence	Assessment of the assurance, empathy and responsiveness of the information desk operators by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Empathy: The degree of caring and individual attention provided to customers	
Responsiveness: The willingness to help customers and provide prompt services	

Security

Indicator	Parameter (measure)
Protection against breach of customer's privacy	Efficiency and robustness of the protection mechanism: Certificate from an entitled body.
Guaranty that no contractual obligation is taken against the customer without his consent	(Audit) {Quality of customer relations; Reference: EG 202 057-1 [25]}

6.1.1.1 Preliminary information needed by the customer for a telephony contract (fixed or mobile)

- 1) Conditions of customer membership, including tariff (subscription and communications) and options.
- 2) Duration of the commitment with the provider.
- 3) Help line availability + tariff details.
- 4) Description of the services available.
- 5) Contract management facilities offerings:
 - Restriction services: parental screening; etc.
 - Cost management services: expense signal, limited account, expense information, expense summary, etc.
 - Charging/Billing medias available: paper, WEB, eBilling, CDRom, etc.
 - Payment means available: cash, standing order; etc.
 - Bill collection means available.
- 6) Availability and conditions for security and privacy offerings.
- 7) Coverage: geographic area and percentage of the inhabitants (GSM, UMTS, GPRS and ADSL services).

6.1.1.2 Preliminary information needed by the customer for an ISP contract

- 1) Conditions of customer membership, including tariff and options.
- 2) Data bit rate offered.
- 3) Number of email addresses.
- 4) Size of email, storage size, storage time and other relevant details.
- 5) Availability + conditions for web space.
- 6) Help line availability + tariff details.

- 7) Data protection practices.
- 8) Availability and conditions for control of "spam".
- 9) Availability and conditions for control of "virus".
- 10) Availability and conditions for parental control.
- 11) Availability and conditions for security offerings.
- 12) Interaction with other ISPs.
- 13) Residues after uninstallation of ISP software.

6.1.1.3 Preliminary information needed by the customer for a multi-services contract (fixed or mobile)

- 1) Conditions of customer membership, including tariff (subscription and communications) and options.
- 2) Duration of the commitment with the provider.
- 3) Help line availability + tariff details.
- 4) List and description of the services available.
- 5) Contract management facilities offerings:
 - Restriction services: parental screening; etc.
 - Cost management services: expense signal, limited account, expense information, expense summary; etc.
 - Charging/Billing medias available: paper, WEB, eBilling, CDRom; etc.
 - Payment means available: cash, standing order; etc.
 - Bill collection means available.
- 6) Additional facilities.
- 7) Availability and conditions for security offerings.
- 8) Coverage (mobile networks).

6.1.2 Establishment of the contract (Terms and conditions)

All QoS assessments related to activities from the customer decision to contract with the provider to the time the contract is effective. Establishment of the contract is meant here for agreeing to the contractual conditions, conditions of use, customer and provider commitments whether or not there is a formal signature of the contract.

Availability

Indicator	Parameter (measure)
Rate of accessibility to a trading desk	Percentage of cities of more than 5 000 inhabitants with a trading desk. List of available trading channels. Open hours of the subscription facilities. (Survey)
Legibility of the information: Size of the print font, ease of reading, use of words from the common language: rate of words understood, rate of omissions, rate of falsifications	Assessment of the legibility of the information by a representative user panel. (MOS value)

Fidelity/accuracy

Indicator	Parameter (measure)
Compliance rate of the information contained in the contract with that previously supplied to the customer	Assessment of the compliance of the contract information via an audit.
Error rate of the description of the service in the contract	Assessment of the correctness and completeness of the description of the performances, support, cost and conditions of use of the service in the contract via an audit.

Speed

Indicator	Parameter (measure)
Response time of the commercial desk	Time elapsed between the end of dialling and reaching a commercial operator: a) mean time to answer, and b) percentage of calls answered within 20 seconds. {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}
Delay to settle a contract: Time taken from the initial contact between the customer and the commercial operator to the instant the contract is placed for a service	a) the time by which the fastest 50 %, 95 % and 99 % of contract settlement have been completed (expressed in clock hours); or b) the percentage of contract settlement completed any time stated as an objective by the service provider. (Survey) {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}
Delay for a contract acknowledgment: Time taken from the registration by the prospect to the acknowledgment received by the customer	a) the time by which the fastest 50 %, 95 % and 99 % of acknowledgments have been sent (expressed in clock hours); or b) the percentage of acknowledgments sent any time stated as an objective by the service provider. (Survey) {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}
Portage delay (when applicable)	a) Time taken from the portage request by the customer to its achievement for the fastest 50 %, 95 % and 99 % of requests b) Time taken from the portage request by the incoming operator to the reception of the acknowledgment by the departing operator for the fastest 50 %, 95 % and 99 % of requests. {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}

Capability

Indicator	Parameter (measure)
Efficiency of the services in charge of establishment of the contract	Ability to deal with the number of customers accessing this service: - Rating of the request stream: (Survey). - Load rate of the employees at the counter (Survey). - Load rate of the Web-servers (Monitoring).

Reliability

Indicator	Parameter (measure)
Proportion of problems with number portability procedures	Ratio between the number of portability requests having experienced problems and the total request number. {Proportion of problems with number portability procedures Reference: EG 202 057-1 [25]}
Overall rating of the responsiveness of the sales desk	Assessment of the responsiveness of the sales desk by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Ease to change the contract clauses once signed	Assessment of the ease to change the contract clauses by a representative user panel. (MOS value)
Ease to obtain from the provider a contract fitting the customer wishes	Assessment of the ease to obtain the contract needed by a representative user panel. (MOS value)
Range of available access mode (phone, Internet, information desk, etc.)	List of available trading channels.

Usability

Indicator	Parameter (measure)
Ease of the subscription process	Assessment of the ease of the subscription process by a representative user panel. Ease with which all activities associated with the establishment of the contract may be carried out with the provider. Ease with which forms can be filled and ease with which orders can be placed. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Vendors empathy and responsiveness	Assessment of the empathy and responsiveness of the information desk operators by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication: Certificate from an entitled body Certificate from an entitled body.
Protection against unexpected customer's data modifications	
Compliance to the specific customer premises security conditions if the provider staff has to work in these premises.	
Conformity of the contract to the laws on trade and electronic communication.	Survey

6.2 QoS parameters for service provisioning

All QoS assessments related to activities associated with the provision of a telecommunication service, from the time of effective contract to the time the customer is able to use the service.

Availability

Indicator	Parameter (measure)
Rate of provisioning unavailability	Percentage of orders with a claim for not being available as announced by the provider (audit).

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of conformity of the delivery with the contractual specifications	Percentage of orders with a claim for non-compliance to the contractual specifications (audit).
Timeliness in appointments	Standard accuracy for keeping appointments (if applicable) Number of delays in appointments with respect to the total number of appointments in percentage.
Timeliness in equipment delivery	Number of delays in equipment delivery with respect to the total number of new connections in percentage.

Speed

Indicator	Parameter (measure)
Provisioning time: Time elapsed between the request and the completion of the network connection	Supply time for 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. 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 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. {Supply time for fixed network access; Reference: EG 202 057-1 [25]} {Supply time for Internet access; Reference: EG 202 057-1 [25]}

Capability

Indicator	Parameter (measure)
Efficiency of the services in charge of service provisioning	Ability to deal with the number of orders: Rating of the order stream: - Load rate of the employees (delay to get an appointment) (Survey). - Percentage of time the hardware needed to implement the service is unavailable (Survey).

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Overall quality of the provisioning process including the reception desk	Assessment of the overall quality of the provisioning process by a representative user panel (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Provider ability to match the customer's wishes for conditions of achievement	Assessment of the provider ability to match the customer's wishes by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Usability

Indicator	Parameter (measure)
User friendliness of the means available to the customer for the operations he has to perform	Assessment of the overall quality of the user friendliness by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against unexpected customer's data modifications	
Compliance to the specific customer premises security conditions if the provider staff has to work in these premises	

6.3 QoS parameters for service alteration and technical upgrade

Alteration is an operation requested by the customer, while a technical upgrade is proposed or imposed by the provider as a consequence of the technical evolution of his own equipment.

6.3.1 Service alteration

All QoS assessments related to activities associated with the alteration of a telecommunication service, from the time alteration to a service is requested by the customer to the time this alteration is carried out to the satisfaction of the customer.

Availability

Indicator	Parameter (measure)
Rate of accessibility to resources at the provider to carry out alteration to the service as requested by the customer	Hours staff can be accessed. Percentage of orders with a claim for not being available as announced by the provider. Audit.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of first time failure	Number of times the alteration has not been implemented satisfactorily at the first time with respect to the total number of alterations.
Rate of compliance with the customer request	Ability of the provider to carry out any alteration order in compliance to the customer request: Percentage of claims for non-compliance to the contractual specifications with respect to the total number of alterations.
Timeliness in appointments	Standard accuracy for keeping appointments (if applicable). Number of delays in appointments with respect to the total number of appointments in percentage.

Speed

Indicator	Parameter (measure)
Response time of the alteration service	<p>The time taken from the request to the provider for an alteration to a service to the instant the altered service is available for use:</p> <p>a) the times by which the fastest 50 %, 95 % and 99 % of orders are completed;</p> <p>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.</p> <p>separately for each type of alteration. {Supply time for fixed network access; Reference: EG 202 057-1 [25]} {Supply time for Internet access; Reference: EG 202 057-1 [25]}</p>

Capability

Indicator	Parameter (measure)
Efficiency of the services in charge of carrying out alterations	<p>Ability to deal with the number of customers' requests:</p> <p>a) Load rate of the employees in charge of service alteration (Survey).</p> <p>b) Percentage of time the hardware needed to implement the service is unavailable (Survey).</p>

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Overall quality of the alteration process	<p>Assessment of the overall quality of the alteration process by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}</p>

Flexibility

Indicator	Parameter (measure)
Provider ability to match the customer's wishes for conditions of achievement	<p>Assessment of the provider ability to match the customer's wishes by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}</p>

Usability

Indicator	Parameter (measure)
User friendliness of the means available to the customer for the operations he has to perform	<p>Assessment of the user friendliness by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}</p>

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against unexpected customer's data modifications	
Compliance to the specific customer premises security conditions if the provider staff has to work in these premises	

6.3.2 Technical upgrade

All QoS assessments related to activities associated with the alteration of a telecommunication service, from the time the user is informed of a technical upgrade by the provider to the time this upgrade is carried out to the satisfaction of the customer.

Availability

Indicator	Parameter (measure)
Rate of accessibility to technical upgrade	Provider capability to take into account the technology evolution: Assessment of the provider ability to take into account the technology evolution by a representative user panel. (MOS value) Hours staff can be accessed - (Audit)

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of first time failure	Number of times the upgrade has not been implemented satisfactorily at once with respect to the total number of upgrades.
Rate of conformity of the technical upgrade	Conformity of the technical performances after upgrade to those previously announced: a) Percentage of claims for non-compliance to the contractual specifications with respect to the total number of upgrades. b) Non regression of the service features after the upgrade.
Timeliness in appointments	Number of delays in appointments with respect to the total number of upgrade in percentage.

Speed

Indicator	Parameter (measure)
Upgrade duration	Time elapsed between the instant the related function is down to the instant it is up again for the fastest 50 %, 95 % and 99 % of upgrades.

Capability

Indicator	Parameter (measure)
Efficiency of the services in charge of carrying out upgrades	Ability of the services in charge of carrying out upgrades to deal with the number of upgrades to perform: a) Load rate of the employees in charge of service upgrades (Survey). b) Percentage of time the hardware needed to implement the service is unavailable (Survey).

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Overall quality of the technical upgrade process	Assessment of the overall quality of the technical upgrade process by a representative user panel (MOS value). {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Provider ability to match the customer's wishes for conditions of achievement	Assessment of the provider ability to match the customer's wishes by a representative user panel - (MOS value). {Quality of customer relations; Reference: EG 202 057-1 [25]}

Usability

Indicator	Parameter (measure)
User friendliness of the means available to the customer for the operations he has to perform	Assessment of the user friendliness of the technical upgrade process by a representative user panel - (MOS value). {Quality of customer relations; Reference: EG 202 057-1 [25]}

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against unexpected customer's data modifications	
Compliance to the specific customer premises security conditions if the provider staff has to work in these premises.	

6.4 QoS parameters for service support

All QoS assessments related to activities associated with the support of a telecommunication service to enable the customer's use of the service.

6.4.1 QoS parameters for documentation

All QoS assessments related to activities associated with provision of documentation to install, set-up and use the various features of the service as well as to identify and fix possible troubles.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the documentation	Availability of the appropriate documentation including common information on the equipment in the customer premises, conditions of use, service features, use of the service, and, if any, data specific to the particular user configuration: a) Timely delivery: ratio of service provisioning without the appropriate documentation to the total number of service provisioning separately for documentation for installation and set-up, documentation for use. An update of the documentation should be provided simultaneously with any change in service features. b) Ratio of service alteration or upgrade without the appropriate documentation to the total number of service alteration and upgrade.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of correctness and completeness of the documentation	Assessment of the correctness and completeness of the description in the documentation available to the customer of the features of the service and related equipment actually implemented (release, version, etc.) via an audit.

Speed

Indicator	Parameter (measure)
Documentation delivery time	Time taken from the effective contract to the instant the relevant documentation is available: a) the time by which the fastest 50 %, 95 % and 99 % of documentation have been sent (expressed in clock hours); or b) the percentage of documentation sent any time stated as an objective by the service provider (Survey).

Capability

Indicator	Parameter (measure)
Efficiency of the documentation services	Ability of the services in charge of documentation provisioning to deal with the number of orders: a) Load rate of the employees in charge of documentation preparation. b) Percentage of time the documentation material needed is unavailable (Survey).

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.

Flexibility

Indicator	Parameter (measure)
Range of available information channels (paper, phone, Internet, information desk, etc.)	List of channels available Audit.

Usability

Indicator	Parameter (measure)
Legibility of the documentation	Assessment of the legibility of the documentation (Size of the print font, ease of reading, use of words from the common language) by a representative user panel. (MOS value)

Security

Indicator	Parameter (measure)
Compliance to the customer security specifications as given in the contract	Robustness of the customer's private data protection mechanism: Certificate from an entitled body.

6.4.2 QoS parameters for technical support

All QoS assessments related to activities associated with the technical support of a telecommunication service to help users experiencing problems in the use of the service.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the technical support	a) Percentage of attempts where an operator was not reach in less than 3 minutes. b) Hours staff can be accessed. (Survey)

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of recognition of the customer request	Exhaustiveness and clarity of the recognition of the customer request: Rate of call to the support due to an issue not solved after the first call. (Survey) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Rate of first time failure	Number of times the fault was not solved satisfactorily at once with respect to the total number of faults

Speed

Indicator	Parameter (measure)
Response time of the technical support	Time elapsed between the end of dialling and reaching a technical operator (The average of and variation in the time taken to establish a call) a) the times by which the fastest 50 %, 95 % and 99 % of calls reach an operator. b) percentage of calls answered within 2 minutes. (Information from switchboard (PABX)). {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}
Customer complaints resolution time	a) the time by which the fastest 80 % and 95 % of complaints have been resolved (expressed in clock hours); or b) the percentage of complaints resolved any time stated as an objective by the service provider. {Customer complaints resolution time; Reference: EG 202 057-1 [25]}

Capability

Indicator	Parameter (measure)
Efficiency of the technical support	Ability of the services in charge of technical support to deal with the number of calls: a) Load rate of the employees at the helpdesk (Survey). b) Load rate of the Web-servers dedicated to on-line help (monitoring).

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Frequency of customer complaints	Number of complaints logged per customer. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Professionalism of help line	Assessment of the professionalism of help line by a representative user panel. (MOS value) {Professionalism of help line; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available technical support means (phone, Internet, FAQ, e-mail, chat, support at home, etc.)	List of available support means: Audit

Usability

Indicator	Parameter (measure)
Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence	Assessment of the assurance, dependability, empathy and responsiveness of the technical support by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Dependability: The ability to provide what was promised, dependably and accurately	
Empathy: The degree of caring and individual attention provided to customers	
Responsiveness: The willingness to help customers and provide prompt services	
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body.

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication and protection mechanisms: Certificate from an entitled body.
Protection against unexpected customer's data modifications	
Compliance to the specific customer premises security conditions if the provider staff has to work in these premises	

6.4.3 QoS parameters for commercial support

All QoS assessments related to activities associated with the commercial support of a telecommunication service.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the commercial support	a) Percentage of attempts where the operator was not reach in less than 3 minutes. b) Hours staff can be accessed. (Survey)

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of recognition of the customer request	Exhaustiveness and clarity of the recognition of the customer request: Rate of call to the support due to an issue not solved after the first call. {Quality of customer relations; Reference: EG 202 057-1 [25]}

Speed

Indicator	Parameter (measure)
Response time of the commercial support	Time elapsed between the end of dialling and reaching a commercial operator: (The average of and variation in the time taken to establish a call) a) mean time to answer; and b) percentage of calls answered within 20 seconds; {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]} c) percentage of calls answered within 2 minutes (Information from switchboard (PABX)).
Customer complaints resolution time	a) the time by which the fastest 80 % and 95 % of complaints have been resolved (expressed in clock hours); or b) the percentage of complaints resolved any time stated as an objective by the service provider. {Customer complaints resolution time; Reference: EG 202 057-1 [25]}

Capability

Indicator	Parameter (measure)
Efficiency of the commercial support	Ability of the services in charge of commercial support to deal with the number of calls. a) Load rate of the employees at the counter (Survey). b) Load rate of the servers dedicated to on-line customer care.

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Frequency of customer complaints	Number of complaints logged per customer. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Overall quality of the commercial support	Assessment of the overall quality of the commercial support by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available commercial support means (phone, Internet, FAQ, e-mail, chat, etc.)	Audit
Provider capability to propose the most suited solution to the customer needs	Assessment of the provider ability to take into account the technology evolution by a representative user panel. (MOS value)

Usability

Indicator	Parameter (measure)
Dependability: The ability to provide what was promised, dependably and accurately.	Assessment of the commercial support dependability, assurance, empathy and responsiveness by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence	
Empathy: The degree of caring and individual attention provided to customers	
Responsiveness: The willingness to help customers and provide prompt services	
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against unexpected customer's data modifications	

6.4.4 QoS parameters for complaint management

All QoS assessments related to activities associated with the customer's complaints to the provider about the service provided.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the complaint management desk	a) Percentage of attempts where the operator was not reach in less than 3 minutes. b) Hours staff can be accessed. (Survey)

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of recognition of the customer claim	Exhaustiveness and clarity of the recognition of the customer claim: Rate of call to the support due to an issue not solved after the first call.
Dependability	Assessment of the dependability by a representative user panel. (MOS value)

Speed

Indicator	Parameter (measure)
Response time of the complaint management desk	Time elapsed between the end of dialling and reaching an operator dedicated to complaint management: (The average of and variation in the time taken to establish a call) a) mean time to answer; and b) percentage of calls answered within 20 seconds; {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}; c) percentage of calls answered within 2 minutes. (Information from the switchboard (PABX)).
Customer complaints resolution time:	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: a) the time by which the fastest 80 % and 95 % of complaints have been resolved (expressed in clock hours); or b) the percentage of complaints resolved any time stated as an objective by the service provider. {Customer complaints resolution time; Reference: EG 202 057-1 [25] }

Capability

Indicator	Parameter (measure)
Efficiency of the complaint management	Ability of the services in charge of complaint management to deal with the number of requests: a) Load rate of the employees at the counter (Survey). b) Load rate of the employees at the call centre in charge of complaint management (Information from the switchboard (PABX)). c) Number of attempts before reception of any kind of acknowledgment from the provider. d) Number of attempts before the complaint is actually solved.

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body.
Frequency of customer complaints	Number of complaints logged per customer for unsolved complaints. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Professionalism of help line	Assessment of the professionalism of help line by a representative user panel. (MOS value) {Professionalism of help line; Reference: EG 202 057-1 [25]}
Overall quality of the complaint management process	Assessment of the overall quality of the complaint management process by a representative user panel - (MOS value). {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Range of available complaint channels (phone, Internet, e-mail, chat, etc.)	List of available complaint channels. Audit.

Usability

Indicator	Parameter (measure)
Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence	Assessment of the complaint management desk assurance, empathy and responsiveness by a representative user panel. (MOS value)
Empathy: The degree of caring and individual attention provided to customers	
Responsiveness: The willingness to help customers and provide prompt services	
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body.

Security

Indicator	Parameter (measure)
Robustness of the customer authentication	Efficiency and robustness of the authentication: Certificate from an entitled body.
Protection against unexpected customer's data modifications	

6.5 QoS parameters for repair services

All QoS assessments related to activities associated with the restoration of a telecommunication service to the customer after a fault resulting in partial or complete loss of service or part of service features.

Availability

Indicator	Parameter (measure)
Rate of accessibility to resources at the provider to carry out repair as requested by the customer	Hours staff can be accessed. Percentage of repairs with a claim for not being available as announced by the provider. Audit.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of first time failure	a) Number of times the outage has not been solved satisfactorily at the first time with respect to the total number of repairs. b) Rate of call to the support due to an issue not solved after the first call.
Rate of restoration to the contractual specifications	Conformity of the technical performances after repair to the contractual specifications: a) Percentage of claims for non-compliance to the contractual specifications with respect to the total number of repairs. b) Non regression of the service features after the repair.
Timeliness in appointments	a) Standard accuracy for keeping appointments. b) Number of delays in appointments with respect to a threshold stated as an objective by the service provider in percentage.

Speed

Indicator	Parameter (measure)
Fault repair time	The duration from the instant a fault has been notified by the customer to the published point of contact of the service provider to the instant when the service element or service has been restored to normal working order: a) Time to repair 80 % and 95 %, and %age on target date for any category of faults. b) The percentage of faults cleared any time stated as an objective by the service provider. {Fault repair time; Fault repair time for fixed access lines; References: EG 201 769 [21], EG 202 057-1 [25]}

Capability

Indicator	Parameter (measure)
Efficiency of the repair service	Ability of the repair service to deal with the number of requests: Load rate of the employees dedicated to repair.

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Frequency of customer complaints	Number of complaints logged per customer {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Professionalism of the repair staff	Assessment of the repair staff professionalism by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Provider ability to match the customer's wishes for conditions of achievement	Assessment of the provider ability to match the customer's wishes by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Usability

Indicator	Parameter (measure)
Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence	Assessment of the repair staff assurance, dependability, empathy and responsiveness by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Dependability: The ability to provide what was promised, dependably and accurately	
Empathy: The degree of caring and individual attention provided to customers	
Responsiveness: The willingness to help customers and provide prompt services	
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body.

Security

Indicator	Parameter (measure)
Robustness of the customer authentication Protection against unexpected customer's data modifications	Efficiency and robustness of the authentication: Certificate from an entitled body.
Compliance to the specific customer premises security conditions if the provider staff has to work in these premises	

6.6 QoS parameters for metering/charging/billing

All QoS assessments related to relevant activities associated with the metering, charging and billing for a telecommunication service to a customer.

The parameters given in the following tables should be applied separately to the different services:

- Fixed service.
- Mobile services.
- ISP.
- Etc.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the documents enabling for expense control	Number of occurrences where the documents were not available as stated in the contract or regulations.
Rate of accessibility to the expense signal (beyond fixed rate expenses)	Audit.
Rate of accessibility to the real time expense information (beyond fixed rate expenses)	Audit.

Fidelity/accuracy

Indicator	Parameter (measure)
Counting accuracy	Audit and certification of the charging/billing system by a trusted third party.
Discrepancy between the actual use of the service and the accounting	
Accuracy of the compliance to the published tariff	
Limited account undue overrun	
Errors in detailed bill	
Errors in real time expense information	

Speed

Indicator	Parameter (measure)
Rate of late bills	Percentage of bills issued behind the contractual date (Audit).
Expense (beyond fixed rate expenses) signal delay	The percentage of signals sent any time stated as an objective by the service provider. Audit and certification of the charging/billing system by a trusted third party.
Real time expense information delay	Mean delay and maximum delay to make public the real time expense information (web or voice server). Audit and certification of the charging/billing system by a trusted third party.
Rate of bill available after the standing order	Percentage of bills issued behind the standing order (Audit).

Capability

Indicator	Parameter (measure)
Efficiency of the billing service (provider)	Ability of the services in charge of billing to deal with the volume of bills to be issued at any time: a) Load rate of the employees in charge of billing (Survey). b) Load rate of the computers dedicated to billing.

Reliability

Indicator	Parameter (measure)
Rate of bill correctness complaints	Percentage of bills resulting in a customer complaint per point of billing per year. {Bill correctness complaints; References: EG 201 769 [21] and EG 202 057-1 [25]}
Rate of prepaid account credit correctness complaints	Percentage of all prepaid accounts resulting in a customer complaint {Prepaid account credit correctness complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Provider ability to match the customer's wishes for charging/billing conditions (e.g. outstanding debt, last bills, etc.)	Assessment of the provider ability to match the customer's wishes by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Range of available means for charging/billing information (phone, Internet, e-mail, chat, etc.)	List of available means (Survey).

Usability

Indicator	Parameter (measure)
Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence	Assessment of the assurance, empathy and responsiveness of the commercial support by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Empathy: The degree of caring and individual attention provided to customers	
Responsiveness: The willingness to help customers and provide prompt services	
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body.
Bill presentation quality	a) How easy is it to find exactly which tariffs and optional services you are subscribing to? b) How easy is it to locate the record of a specific call to a specific number? c) How easy is it to find the exact price paid including VAT and any discounts, for a specific call? d) How easy is it to find which charge band and which rate (peak/off-peak) is applied to a specific call? e) How do you rate the bill overall in terms of clarity, understandability and ease of use? (MOS) value {Bill presentation quality; Reference: EG 202 057-1 [25]}

Security

Indicator	Parameter (measure)
Robustness of the customer authentication Protection against unexpected customer's data modifications	Efficiency and robustness of the authentication: Certificate from an entitled body.

6.7 QoS parameters for network/service management by the customer

All QoS assessments related to activities associated with the customer's control of predefined changes to telecommunication services or network configurations.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the network/service management facility	a) Hours staff can be accessed (human operator) - (Survey). b) Percentage of attempts where an operator was not reach in less than 3 minutes. c) Percentage of successful log-ins to the server with regard to the total attempt number required. {Successful log-in ratio; Reference: EG 202 057-4 [28]}
Outage rate	Total sum of access outage durations by agreed period of time.
Outage frequency	Number of access outages by agreed period of time.

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of correctness and completeness in taking the customer request into account	a) First time failure: Number of times the request has not been completed satisfactorily at the first time with respect to the total number of requests. b) Rate of call to the support due to an issue not solved after the first call. c) Number of attempts before reception of any kind of acknowledgment from the provider. d) Number of requests that are not completed satisfactorily within a given period of time stated as an objective by the service provider.
Compliance of the server features to the specifications	(Audit or survey)

Speed

Indicator	Parameter (measure)
Response time of the operator of the network/service management facility	Time elapsed between the end of dialling and reaching an operator: (The average of and variation in the time taken to establish a call) a) mean time to answer; and b) percentage of calls answered within 20 seconds; {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]} c) percentage of calls answered within 2 minutes. Information from switchboard (PABX).
Access time	Time in seconds within the fastest 80 % and 95 % of logins to the network/service management server. {Login time; Reference: EG 202 057-4 [28]}
Request response time	Time between requiring a change and obtaining the change completed satisfactorily. (Survey)

Capability

Indicator	Parameter (measure)
Efficiency of the network/service management service	Ability of the services in charge of network/service management to deal with the number of requests: a) Load rate of the employees at the counter (Survey). b) Load rate of the employees at the call centre in charge of network/service management (Information from the switchboard). c) Load rate of the network/service management server.
Range of parameters accessible by the user	List of parameters (Audit).

Reliability

Indicator	Parameter (measure)
Rate of overall reliability	Proportion of time during which, over a given period, all the parameters of availability, fidelity/accuracy, speed and capability are complying to the specified ratings if any.
Frequency of customer complaints	Number of complaints logged per customer. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}
Overall quality of the network/service management process	Assessment of the overall quality of the network/service management process by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
Provider ability to match the customer's wishes for network/service management conditions (e.g. range of parameters manageable, etc.)	Assessment of the provider ability to match the customer's wishes by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Range of available means for network/service management (phone, Internet, specific workstation, etc.)	List of available means (Survey).

Usability

Indicator	Parameter (measure)
User friendliness of the means available to the customer for the operations he has to perform	Assessment of the user friendliness by a representative user panel - (MOS value). {Quality of customer relations; Reference: EG 202 057-1 [25]}

Security

Indicator	Parameter (measure)
Robustness of the customer authentication Protection against unexpected customer's data modifications	Efficiency and robustness of the authentication: Certificate from an entitled body.

6.8 QoS parameters for cessation

All QoS assessments related to activities associated with the cessation of a telecommunication service from the time it was requested by a customer, to the time it was completed to the satisfaction of the customer.

Availability

Indicator	Parameter (measure)
Rate of accessibility to the cessation facility	a) Percentage of attempts where an operator was not reach in less than 3 minutes. b) Hours staff can be accessed (human operator). (Survey)

Fidelity/accuracy

Indicator	Parameter (measure)
Rate of correctness and completeness in taking the customer request into account.	a) First time failure: Number of times the request has not been completed satisfactorily at the first time with respect to the total number of requests. b) Rate of call to the support due to an issue not solved after the first call. c) Number of attempts before reception of any kind of acknowledgment from the provider. d) Number of cessation requests that are not completed satisfactorily within a given period of time stated as an objective by the service provider. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}

Speed

Indicator	Parameter (measure)
Response time of the cessation facility	Time elapsed between the end of dialling and reaching an operator: (The average of and variation in the time taken to establish a call) a) mean time to answer; and b) percentage of calls answered within 20 seconds. {Response time for admin/billing enquiries; Reference: EG 202 057-1 [25]}
Cessation response time	a) the time by which the fastest 80 % and 95 % of cessation acknowledgments have been sent (expressed in clock hours); or b) the percentage of cessation acknowledgments sent any time stated as an objective by the service provider. (Survey)
Cessation achievement delay	a) the time by which the fastest 80 % and 95 % of cessations have been completed (expressed in clock hours); or b) the percentage of cessations completed any time stated as an objective by the service provider. (Survey)

Capability

Indicator	Parameter (measure)
Efficiency of the cessation facility.	Ability of the services in charge of cessation to deal with the number of requests: a) Load rate of the employees at the counter (Survey). b) Load rate of the employees at the call centre in charge of cessation (Information from the switchboard (PABX)).

Reliability

Indicator	Parameter (measure)
Qualification of the Customer Relationship Management (CRM)	Certificate from an entitled body.
Overall quality of the cessation process	Assessment of the overall quality of the cessation process by a representative user panel. (MOS value) {Quality of customer relations; Reference: EG 202 057-1 [25]}
Frequency of customer complaints	Number of complaints logged per customer. {Frequency of customer complaints; Reference: EG 202 057-1 [25]}

Flexibility

Indicator	Parameter (measure)
N/A	

Usability

Indicator	Parameter (measure)
Ease of the cessation process	Assessment of the ease of the cessation process by a representative user panel: a) Ease with which all activities associated with the cessation of the contract may be carried out with the provider. b) Ease with which forms can be filled and ease with which they are taken into account by the provider. (MOS value) - {Quality of customer relations; Reference: EG 202 057-1 [25]}
Range of available access mode (phone, Internet, information desk, etc.)	List of available channels.

Security

Indicator	Parameter (measure)
Robustness of the customer authentication Protection against unexpected customer's data modifications	Efficiency and robustness of the authentication: Certificate from an entitled body.

7 Specific aspects of the general public users' criteria

Unlike QoS measurements concerning business users which results are intended to be checked privately with respect to a SLA, measurements related to the general public users are expected to be made publicly available.

Since general public users do not have the resources needed to make their own QoS measurements they have to rely on publicly available QoS information, the way the QoS measurements are performed and results made available is obviously a regulatory issue.

The tables of clauses 5 and 6 allow to identify the indicators and parameters relevant to any kind of users, in particular the general public. Nevertheless, two aspects particularly important to the users have to be pointed out:

- The QoS thresholds given there, when available, should be taken as guidance when choosing the most suited supplier and not an obligation; unless a regulatory target is defined.
- Survey and MOS should be carried out among a carefully selected panel of the general public.

In addition, the general public do not want to enter in all details of the QoS and need an information focused on his current concerns. As a general principle, to provide such information a set of indicators should be usefully chosen using up-to-date statistics on the users' complaints as well as available surveys on issues of their dissatisfaction. This should enable to focus on the most relevant QoS indicators depending on the market conditions from the users' perspective. Hence, it would be easier to publish a limited set of indicators more convenient to understand and use by the common end-users.

As well it would be useful to make available QoS indicators value according to the various timeframes, e.g. business hours, busiest hours, evening, etc.

8 Conclusion

There are obvious lacks at this stage of the document that could hopefully be filled with a further revision. For example, there are several services listed but without parameter table. Further work is needed to have better indicators and parameters defined. This will be done in a later revision.

The ETSI User Group hopes that, nevertheless, the present document provides useful guidance to the standard makers, regulators and providers on the users expectations on the QoS of ICT services. It is expected also that the users themselves can find here some help, e.g. private users when choosing a provider or business users when establishing an SLA with their chosen provider. EG 202 009-3 [24] is intended to provide useful additional support on this last aspect.

The present document aims at providing indicators and parameters on every aspect of the available ICT services. This does not mean that all these indicators should be measured all the time on all communications. Instead, these measurements should focus on the current users' concerns with a reduced set of indicators related to a carefully selected user panel. It is crucial to notice that the choice of this user panel is critical to ensure that the results provide the actual QoS perceived by the users.

Regulation is crucial in the QoS area. Although some big users can have a specific private contract with a provider dedicated to QoS measurements, most users have to rely on third party to monitor the QoS either via information made publicly available by a trusted party or via information provided by their own provider in a SLA context. Therefore, the accuracy and truthfulness of the process of the QoS measurements should be certified by a trusted party so that users can have confidence on the reliability of these measurements.

In addition, it is of tremendous importance that a focus point be available to the public for such information.

Annex A (informative): Bibliography

- i ETSI EG 201 050 (V1.2.2): "Speech Processing, Transmission and Quality Aspects (STQ); Overall Transmission Plan Aspects for Telephony in a Private Network".
- ii ETSI EG 201 377-1: "Speech Processing, Transmission and Quality Aspects (STQ); Specification and measurement of speech transmission quality; Part 1: Introduction to objective comparison measurement methods for one-way speech quality across networks".
- iii ETSI EG 201 474: "Speech Processing, Transmission and Quality Aspects (STQ); Future approaches to speech transmission quality across multiple interconnected networks".
- iv ETSI EG 202 103: "Methods for Testing and Specification (MTS); Guide for the use of the second edition of TTCN".
- v ETSI ES 201 168: "Speech processing, Transmission and Quality aspects (STQ); Transmission characteristics of digital Private Branch eXchanges (PBXs) for interconnection to private networks, to the public switched network or to IP gateways".
- vi ETSI ETR 016: "Business Telecommunications (BT); Serviceability performance objectives for Private Telecommunications Networks (PTN)".
- vii ETSI ETR 076: "Integrated Services Digital Network (ISDN); Standards Guide".
- viii ETSI ETR 301: "Users' Expectations; Virtual Private networks".
- ix ISO/IEC 9646-3 (1998): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation (TTCN)".
- x Report of the AFUTT QoS WG (12-2000): "La problématique qualité Télécom".
- xi Quality of Service Parameters for Internet Service Provision, final report of Bannock Consulting's project for the European Commission's DG Information Society.
- xii ITU-T Recommendation I.112: "Vocabulary of terms for ISDNs".
- xiii Livre Blanc sur la Qualité de Service d'Internet et des Télécommunications, Olivier Couly, Imprimerie du Sud, Mars 2001.
- xiv Draft Report of Round Table # 3 work on 'Quality needs in electronic information and communication services' A.Oodan. <http://www.uninfo.polito.it/WS-QoIS/Oodan.zip>.
- xv IUT-R Handbook on satellite communication operating in the Fixed Satellite Services (FSS).
- xvi ITSEC: Information Technology Security Evaluation Criteria - Provisional Harmonized Criteria - June 1991.
- xvii ETSI TR 101 329-1: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 1: General aspects of Quality of Service (QoS)".
- xviii ETSI TR 121 905: "Universal Mobile Telecommunications System (UMTS); Vocabulary for 3GPP Specifications (3G TR 21.905 version 3.0.0 Release 1999)".
- xix ITU-T Recommendation G.108: "Application of the E-model: A planning guide".
- xx ITU-T Recommendation G.121: "Loudness ratings (LRs) of national systems".
- xxi ITU-T Recommendation P.64: "Determination of sensitivity/frequency characteristics of local telephone systems".
- xxii ITU-T Recommendation P.76: "Determination of loudness ratings; fundamental principles".
- xxiii ITU-T Recommendation P.79: "Calculation of loudness ratings for telephone sets".

- xxiv 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".
- xxv ETSI TS 101 113: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Service description; Stage 1 (GSM 02.60 version 7.5.0 Release 1998)".
- xxvi ETSI TS 101 329-2: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON Systems; Part 2: Definition of Speech Quality of Service (QoS) Classes".
- xxvii 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. (article 12 & annex III).
- xxviii IETF RFC 854: "Telnet Protocol Specification".

History

Document history		
V1.1.1	February 2002	Publication
V1.2.1	January 2007	Publication