

**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**

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## Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Speech Processing, Transmission and Quality Aspects (STQ), and is now submitted for the ETSI standards Membership Approval Procedure.

The present document is part 2 of a multi-part deliverable covering Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements, as identified below:

Part 1: "General";

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

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

Part 4: "Internet access".

EG 202 057-1 [i.21] contains general user related QoS parameter definitions and measurement methods that can be applied to any service.

EG 202 057-2 (the present document) contains user related QoS parameter definitions and measurement methods for voice, Group 3 fax, modem data services and SMS accessed via the public telecommunication network. The data parameters are specified for the case where an ITU-T Recommendations V.90 [i.18] and V.92 [i.19], compliant modem is used since this kind of modem is in common use.

EG 202 057-3 [i.22] contains user related QoS parameter definitions and measurement methods specific to public land mobile networks (PLMN).

EG 202 057-4 [i.23] contains user related QoS parameter definitions and measurement methods specific to Internet access.

The present document takes into account as far as practicable the following eight principles:

- 1) QoS parameters should be easily understood by the public, and be useful and important to them.
- 2) All parameters are applicable at the network termination point (where appropriate).
- 3) Where measurements are possible they should be made on the customer's premises, using in-service lines.

**NOTE:** Literally principles 2 and 3 imply that all measurements should be carried out at the NTP, which would require co-operation by users and be excessively intrusive, as it would require many visits to the premises of users. Measurements at the subscriber side of the local exchange (e.g. at the MDF or other possible connection point/distribution frame in the access network) generally give an adequate representation of the quality that would be perceived at the NTP for the parameters defined in the present document, and so this approach is used because it is more practicable and meets the underlying objectives of these principles.

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

- 5) Parameters should be capable of verification by independent organizations. This verification might be made by direct measurements or by audit of service provider's measurements.
- 6) The accuracy of QoS values should be set to a level consistent with measurement methods being as simple as possible with costs as low as possible.
- 7) The parameters are designed for both statistical and individual application. The statistical values should be derived by the application of a simple statistical function to the individual values. The statistical function should be specified in this multi-part deliverable. This multi-part deliverable should also contain guidelines on how statistically significant samples should be selected.
- 8) The statistical functions should be designed so QoS figures from different service providers can be compared easily by users and in particular consumers.

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# 1 Scope

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

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

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

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

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

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

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

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# 2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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

## 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] 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".
- [i.2] ETSI ETS 300 905: "Digital cellular telecommunications system (Phase 2+) (GSM); Teleservices supported by a GSM Public Land Mobile Network (PLMN) (GSM 02.03)".
- [i.3] ETSI EN 300 659 (all parts): "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services".
- [i.4] Directive 98/10/EC of the European Parliament and of the Council of 26 February 1998 on the application of open network provision (ONP) to voice telephony and on universal service for telecommunications in a competitive environment.
- [i.5] ITU-T Recommendation E.180: "Technical characteristics of tones for the telephone service".
- [i.6] ITU-T Recommendation E.425: "Internal automatic observations".
- [i.7] ITU-T Recommendation E.451: "Facsimile call cut-off performance".
- [i.8] ITU-T Recommendation E.452: "Facsimile modem speed reductions and transaction time".
- [i.9] ITU-T Recommendation E.453: "Facsimile image quality as corrupted by transmission-induced scan line errors".
- [i.10] ITU-T Recommendation E.800: "Terms and definitions related to quality of service and network performance including dependability".
- [i.11] ITU-T Recommendation G.107: "The E-model, a computational model for use in transmission planning".
- [i.12] ITU-T Recommendation P.862.1: "Mapping function for transforming P.862 raw result scores to MOS-LQO".
- [i.13] ITU-T Recommendation P.862.2: "Wideband extension to Recommendation P.862 for the assessment of wideband telephone networks and speech codecs".
- [i.14] ITU-T Recommendation G.109: "Definition of categories of speech transmission quality".



- [i.15] ITU-T Recommendation T.4: "Standardization of Group 3 facsimile terminals for document transmission".
- [i.16] ITU-T Recommendation I.210: "Principles of telecommunication services supported by an ISDN and the means to describe them".
- [i.17] ITU-T Recommendation T.22: "Standardized test charts for document facsimile transmissions".
- [i.18] 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".
- [i.19] ITU-T Recommendation V.92: "Enhancements to Recommendation V.90".
- [i.20] ITU-T Recommendation Q.850: "Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part".
- [i.21] ETSI EG 202 057-1: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 1: General".
- [i.22] ETSI EG 202 057-3: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 3: QoS parameters specific to Public Land Mobile Networks (PLMN)".
- [i.23] ETSI EG 202 057-4: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 4: Internet access".
- [i.24] ITU-T Recommendation P.862: "Perceptual evaluation of speech quality (PESQ): An objective method for end-to-end speech quality assessment of narrow-band telephone networks and speech codecs".
- [i.25] ITU-T Recommendation P.561: "In-service non-intrusive measurement device - Voice service measurements".
- [i.26] ITU-T Recommendation P.562: "Analysis and interpretation of INMD voice-service measurements".
- [i.27] ITU-T Recommendation P.563: "Single-ended method for objective speech quality assessment in narrow-band telephony applications".
- [i.28] ETSI TR 101 949: "Speech Processing, Transmission and Quality Aspects (STQ); QoS parameter definitions and measurements for use in network-to-network narrowband interconnection".
- [i.29] ITU-T Recommendation G.114: "One-way transmission time".
- [i.30] ITU-T Recommendation G.113: "Transmission impairments due to speech processing".

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## 3 Definitions and abbreviations

### 3.1 Definitions

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

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

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

**access network operator:** organization that provides the access line

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

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

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

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

NOTE: Customers can generally be categorized as business or residential; the definition of business and residential customers is left to individual service providers. Service providers who receive interconnect services from other service providers are not considered to be customers for the purpose of the present document. The term "customer" is equivalent to "subscriber", which is used in Directive 98/10/EC [i.4].

**data service:** telecommunications service involving the transport of data via the PTN such that any user can use equipment connected to a network termination point to exchange data with another user of equipment connected to another termination point

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

**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

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

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

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

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

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

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

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

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

NOTE: See ITU-T Recommendation E.800 [i.10].

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

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

**Short Message Service (SMS):** telecommunications service involving the transport of a short alphanumeric message (160 alphanumeric characters) via the PTN such that any user can use equipment connected to a network termination point to exchange these messages with another user of equipment connected to another termination point

NOTE: See also ETS 300 905 [i.2] (GSM networks) and EN 300 659 [i.3] (fixed networks).

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

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

NOTE: Consequently, it cannot be offered to a customer as a stand-alone service; it has to be offered in association with a basic telecommunication service. The same supplementary service may be common to a number of basic telecommunication services. (See ITU-T Recommendation I.210 [i.16]).

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

**telecommunication services:** provision of telecommunications and the provision of other additional services that are closely related to the provision of telecommunications like

EXAMPLE: Billing, directory services.

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

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

NOTE: See Directive 98/10/EC [i.4].

**voice service:** telecommunications service of direct transport of real-time speech via the PTN such that any user can use equipment connected to a network termination point to communicate with another user of equipment connected to another termination point

## 3.2 Abbreviations

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

AMR	Adaptive Multi-Rate
ATM	Asynchronous Transfer Mode
BAS	Broadband Access
DECT	Digital European Cordless Telephone
DSLAM	Digital Subscriber Line Access Multiplexor
EFR	Enhanced Full Rate
FR	Full Rate
GMSC	Gateway Mobile Switching Centre
GSM	Global System for Mobile communications
HLR	Home Location Register
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
MDF	Main Distribution Frame
MOS	Mean Opinion Score
MSC	Mobile Switching Centre
MVNO	Mobile Virtual Network Operator
NER	Network Effectiveness Ratio
NRA	National Regulatory Authority
NTP	Network Termination Point
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
PTN	Public Telecommunications Network
QDU	Quantization Distortion Unit
QoS	Quality of Service
RLR	Receive Loudness Rating
SAP	Service Access Point
SLR	Send Loudness Rating
SMS	Short Message Service
STQ	Speech Transmission and Quality (Technical Committee)
TELR	Talker Echo Loudness Rating
TrFO	Transcoder Free Operation

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## 4 General considerations

### 4.1 Services covered

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

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

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

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

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

### 4.2 Use of the parameters

The parameters may be used for various purposes including:

- Specifying the level of quality of service in customer telecommunication service contracts or in the description or terms and conditions of the service.
- Comparing the quality of service of different service providers.
- Comparing the quality of service aspects of different service offers.
- Preparing long term studies on the quality of service aspects of a specific service.

### 4.3 Reporting for different classes of customers

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

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

## 4.4 Non standard levels of QoS

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

## 4.5 Reporting for directly- and indirectly-serviced customers

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

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

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

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

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

## 4.6 Data processing issues

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

For one parameter the statistic required is "X % of ...". This statistic is explained in annex B.

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

## 4.7 Data collection period

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

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

## 4.8 Sampling and test calls

Where sampling and test calls are used the approach should ensure that the results adequately reflect the QoS perceived by customers for the period under review.

Guidance on the choice of adequate test calls with respect to choice of origin, destination, traffic variations etc. may be found in annex G.