

European Telecommunications Standards Institute
STQ#14
11th to 14th March 2003
Bonn, Germany

Source: John Horrocks, STQ chairman
Title: Liaison Statement to 3GPP SA on Quality of Service
Date: 13th March 2003
Document for: Discussion
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STQ is working on definitions and measurement methods for QoS parameters. In general we are taking a user orientated approach and covering only parameters where there may be a need to monitor performance. This means that our choice and formulation of parameters, especially for fixed networks, is slightly different from the work undertaken in the past in ITU-T.

We have already published two EGs:

- EG 202 057-1 "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 1: General"
- 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 and modem data services"

and we have just produced a draft for mobile access parameters for circuit switched services, i.e. those parameters that are affected by the use of radio (EG 202 057-3 "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part-3: QoS parameters specific to mobile services"). This work has drawn on more detailed technical work in the QoS WP of IREG in the GSM Association.

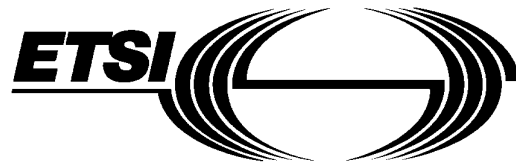
We invite SA to send us any comments that it may have on this draft by the end of May.

We are also starting some work on Internet access and would like to include access from mobiles. Members from SA would be most welcome to join this work and we invite you to identify a person as a point of contact.

European Telecommunications Standards Institute
STQ#14
11th to 14th March 2003
Bonn, Germany

Source: Klemens Adler
Title: Fourth Draft for STQ-031.doc
Date: 2003-02-19

**User related Quality of Service parameters;
Definitions and measurement methods;
Part 3: QoS parameters specific to public land mobile
networks (PLMN)**



Reference

DEG/STQ-00031'

Keywords

mobile, quality, user

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

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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.

Part 1 of this EG contains general user related QoS parameter definitions and measurement methods that can be applied to any service. This part of the EG contains user related QoS parameter definitions and measurement methods for voice, data and fax services accessed via the public telecommunication network.

Part 2 of this Guide contains user related QoS parameter definitions and measurement methods for voice, data and fax services accessed via the public telecommunication network. The data parameters are specified for the case where a V.9x series modem is used since this kind of modem is in common use.

Part 3 of this EG contains user related QoS parameter definitions and measurement methods specific to public mobile telecommunication networks (PLMN).

This Guide 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 must be carried out at the NTP. However, the NTP in PLMNs is not precisely defined. Other methods must be used to achieve an adequate representation of the quality that would be perceived at the NTP for the parameters defined in this part.

- 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 organisations. 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 the standard. The standard 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.

[Editor's note: Insert ETSI description of EG]

Introduction

This clause is optional. If it exists, it is always the third unnumbered clause.

1 Scope

This Guide 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. This Guide applies to any telecommunication service however some parameters may have a limited application.

The Guide 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 outside the scope of this Guide. The QoS parameters listed in this Guide are also not intended to assess the complete QoS of a telecommunication service. This guide 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 this 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 should be used in their particular situation. This decision should take account of:

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

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

Part 2 of this EG contains user related QoS parameter definitions and measurement methods for voice, data and fax services accessed via public telecommunication networks. The QoS parameters in Part 2 are focused on call related QoS aspects. The data parameters are specified for the case where a V.9x series modem is used.

Part 3 of this EG (this part) contains user related QoS parameter definitions and measurement methods specific to public land mobile networks (PLMN).

2 References

This Guide incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this EG only when incorporated in this Guide by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] EG 201 769: Speech Processing, Transmission and Quality Aspects (STQ); QoS parameter definitions and measurements; Part 1: parameters for the voice telephony service required under the ONP Voice Telephony Directive 98/10/EC

[2] GSM Association PRD IR.42

[3]

3 Definitions and abbreviations

3.1 Definitions

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

Mobile service: The term mobile service is used for various telecommunication services when access via a PLMN is provided.

Note: Since the purpose of this document is to formulate definitions for QoS parameters, these definitions are given in the main body of the text and are not repeated here.

3.2 Abbreviations

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

MO	Mobile originated
NTP	Network Termination Point
PLMN	Public Land Mobile Network
QoS	Quality of Service
SMS	Short Message Service

4 General considerations

All these quality of service parameters and their computations are based on measurements via the air interface in order to be representative of the experience of the user.

5 QoS parameters specific to PLMNs

5.1 General

The air interface of a PLMN is to a large extent equivalent to the NTP of a fixed network. Measurements of some of the parameters defined in this Guide can only be made using special test equipment and the results obtained may depend to some extent on the design of this test equipment.

The QoS experienced by users will also be influenced to some extent by the design of their terminals and therefore may differ somewhat from the results of formal tests.

There are several factors that could affect the comparability of measurements of different networks:

- use of different measurement equipment
- use of different design settings in the networks that deliberately trade one aspect of quality against another
- the locations where measurements are made
- the time when measurements are made
- weather conditions and date when measurements are made (~~for example~~ the performance of the radio access will be affected by weather conditions, seasons (extent of tree foliage), and recent weather history (wetness of the ground and foliage).

Consequently any measurements that are intended to compare the quality of different networks should use a common measurement system and the different networks should be sampled simultaneously from the same locations, and the number of different locations should be sufficiently large to provide some statistical averaging to take account of the different locations of the base stations.

In some countries national roaming is provided between operators as a means of achieving coverage. Whilst measurements should normally be made using a mobile or test equipment that is registered on the network that is being measured, in some cases networks achieve the coverage required under their licence through national roaming arrangements and in these cases the measurements will need to include roaming. When roaming the target network indicator identifies the operator on whose network the mobile is roaming. Where roaming is supported, information should be given in conjunction with the results to indicate whether or not the results include the effects of roaming.

Measurements should be made when the network is in its normal configuration and traffic loading ie measurements should not be made when special events are in progress that are likely to result in abnormal network loadings or special network configurations.

It is important to understand the interaction between:

- network accessibility
- service accessibility and
- voice quality (covered in Part 2).

Each network can set its own value of the threshold for radio signal strength for accessing its network, ie the network will only allow access if it estimates that the radio signal strength is above this threshold. When the threshold is exceeded the network identity is displayed on the mobile (eg "Vodafone"). The network will not allow access at lower

radio signal strengths even if the mobile is capable of operating at such strengths. Network accessibility, which is the basic estimate of radio coverage, is based on the display of the network identity and is therefore influenced by the level of the threshold set by the network.

Service accessibility is the accessibility to a service when there is network access. Where there is network access, service access may not be possible because:

- There are no available radio channels to support the service
- There are no available transmission links between the base station and the mobile switching centre.

The availability of a service is therefore a combination of network accessibility and service accessibility.

Measurements of voice quality on a PLMN will be influenced by both the transmission capabilities of the network and the state of the radio access. A network with a higher access threshold will support better speech quality but poorer network accessibility in an area of weak coverage.

5.2 Network parameter

5.2.1 Network Accessibility (radio coverage by land mass)

5.2.1.1 Definition

Ratio of the geographical land area where the target network indicator, or the corresponding network name or logo, of the mobile network is displayed on the Mobile Equipment when in idle mode, to the total land area specified in the operator's licence or authorisation.

5.2.1.2 Measurement and statistics

Measurements should be made out of doors at a representative sample of locations throughout the land area [specified in the licence concerned](#). ~~The result at each location should be weighted by the land area represented by the sample.~~

Ratio= ~~{Sum over area weighted (Result (1 or 0))*of the areas for which the area covered by sample showed coverage}~~/total area specified in licence

[Note: In some countries the licences are restricted to specific areas.](#)

[A temporary absence of coverage may occur due to a fault of the base station or temporary congestion on signalling channels. In these cases the samples should be discarded.](#)

The mobile terminal used for the measurements should have an antenna configuration and radio sensitivity representative of mobile terminals first placed on the market one year before the measurements are taken. Details of the type of equipment used should be given in conjunction with the results. Results should be given separately for hand held mobiles and mobiles installed in vehicles.

In determining the locations to be used and the areas that they represent, account should be taken of the intended coverage and the effect of the local geography. For example:

- Large areas can be covered by a single sample if the area is known to be outside coverage
- Flat areas where coverage is likely to be relatively uniform need fewer sample locations than hilly or mountainous areas
- The areas that relate to samples need not be rectangular but could be shaped according to the local geography (eg one sample covers a valley and another a hill-top)

The results will be comparable for networks that cover the same area only if the same locations and the same mobile terminals are used and if measurements are made at approximately the same time.

Measurements may in practice be made from a moving vehicle.

5.2.1.3 Further considerations

The results do not indicate what coverage is available in a specific location. This information is normally given through coverage maps that are commonly calculated theoretically from propagation information. Annex A gives information on the preparation and presentation of this information.

Measurements are commonly made with mobiles that are specifically adapted for measurement purposes.

~~In some countries national roaming is provided between operators. When roaming the target network indicator identifies the operator on whose network the mobile is roaming. Where roaming is supported, information should be given in conjunction with the results to indicate whether or not the results include the effects of roaming.~~

5.2.2 Network Accessibility (radio coverage by resident population distribution)

5.2.2.1 Definition

Ratio of:

- the number of the resident population for whom the normal residential location is such that the target network indicator, or the corresponding network name or logo, of the mobile network would be displayed on the Mobile Equipment when in idle mode, to
- the total residential population in the land area specified in the operator's licence or authorisation.

5.2.2.2 Measurement and statistics

Measurements should be made out of doors at a representative sample of locations throughout the land area specified in the licence.

Ratio= Sum over all samples of the population in the area represented by those samples that showed coverage/total population in the area specified in licence

Note: In some countries the licences are restricted to specific areas.

A temporary absence of coverage may occur due to a fault of the base station or temporary congestion on signalling channels. In these cases the samples should be discarded.

The mobile terminal used for the measurements should have an antenna configuration and radio sensitivity representative of mobile terminals first placed on the market one year before the measurements are taken. Details of the type of equipment used should be given in conjunction with the results. Results should be given separately for hand held mobiles and mobiles installed in vehicles.

In determining the locations to be used and the areas that they represent, account should be taken of the intended coverage and the effect of the local geography. For example:

- Large areas can be covered by a single sample if the area is known to be outside coverage
- Flat areas where coverage is likely to be relatively uniform need fewer sample locations than hilly or mountainous areas
- The areas that relate to samples need not be rectangular but could be shaped according to the local geography (eg one sample covers a valley and another a hill-top)

The results will be comparable for networks that cover the same area only if the same locations and the same mobile terminals are used and if measurements are made at approximately the same time.

Measurements may in practice be made from a moving vehicle.

as 5.1 but with population weighting

5.2.2.3 Further considerations

as 5.4The results do not indicate what coverage is available in a specific location. This information is normally given through coverage maps that are commonly calculated theoretically from propagation information. Annex A gives information on the preparation and presentation of this information.

Measurements are commonly made with mobiles that are specifically adapted for measurement purposes.

The distribution of the population varies significantly during the day and night as people travel to work, stay at work of travel for work, return home and engage in social activities. Changes in distribution also are different for weekdays and weekends. Mobile operators normally design their coverage to maximise the utility of their networks taking account of the locations from which users normally wish to make calls and so in practice the coverage will appear to users to be better than indicated by these measurements.

5.2.2 Service Accessibility for Telephony

Note: This is meant to measure congestion in the access radio channels

5.2.2.1 Definition

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

~~Test call timings to be representative of the distribution of traffic during the day~~

~~Geographic location to be representative of call traffic distribution~~

~~Include mention of roaming~~

~~Measures if enough capacity within coverage~~

~~Special events~~

5.2.2.3 Measurement and statistics

The measurement has to be performed as described in IR.42 [2] subclause 'Computation' of the related clause.

The following statistics should be provided:

The percentage of successful Mobile Telephony Service accesses when requested while it is offered by display of the network indicator on the Mobile Station, together the number of observations used and the absolute accuracy limits for 95% confidence calculated from this number.

The statistics should be calculated from:

Tests in a representative geographical area.

Measurements should be scheduled so as to reflect accurately traffic variations over the hours of a day, the days of the week and the months of the year.

5.2.3 Service Accessibility SMS MO

5.2.3.1 Definition

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

5.2.3.2 Application

The QoS parameter is applicable to directly accessed mobile services.

5.2.3.3 Measurement and statistics

The measurement has to be performed as described in IR.42 [2] subclause 'Computation' of the related clause.

The following statistics should be provided:

The percentage of successful accesses of the Short Message Service when requested while it is offered by display of the network indicator on the Mobile Equipment, together the number of observations used and the absolute accuracy limits for 95% confidence calculated from this number.

The statistics should be calculated from:

Tests in a representative geographical area.

Measurements should be scheduled so as to reflect accurately traffic variations over the hours of a day, the days of the week and the months of the year.

Annex A: Mobile service coverage at specific location

A.1 Background

A single measure of mobile telephony coverage (network accessibility) has been covered in subclause 5.2.1 of this document. This annex gives details on the facilities that a service provider should provide to enable users to determine the expected coverage at a specific location in the country. (The reasons for being aware of the coverage status are various; e.g. availability of emergency services, business reasons while on travel, leisure activities in out of the way areas etc). Clause A.2 specifies the parameter to express service coverage status. Clause A.3 specified two methods of making this information available to the users.

The coverage information should be based to some extent on measurements but may be supplemented by radio propagation modelling. Although special equipment will normally be used for the tests, the coverage-coverage results should be the coverage that would apply to a typical hand held mobile terminal with radio sensitivity typical of a one-year old model. ~~(the specification of this handset to be discussed at the STQ meeting).~~

A.2 Parameters to express coverage

Three categories of coverage status are recommended;

Base on 25%, 75% of samples within area used assessment

Status 0: negligible or no coverage (terminology for discussion at STQ). < 25% samples are in coverage

Status 1: partial coverage, 25-75% of samples are in coverage

Status 2: normal or good coverage, > 75% of samples are in coverage.

A.3 Methods of display of information on coverage status on specific locations

Two methods of making the information on coverage available to the user are described below. In both cases a simple explanation of the meaning of the coverage status should be given.

A.3.1 Phone-in with postcodes or geographical co-ordinates

Coverage information may be computerised and accessible by telephone. The locations whose coverage being queried may be specified by a postcode or geographical coordinates. The resulting coverage information may be given using voice synthesis.

A.3.2 Map illustrating coverage status

Maps of the country may be provided with colour-coded coverage illustrating the three categories of status.

Data for both methods of display should be updated when there is a change in the characteristics of the coverage arising from change in the systems responsible for the reception and transmission of mobile telephony.

History

Document history		
0.0.1	December 2001	First draft
0.0.2	March 2002	Second draft
0.0.4	September 2002	Third Draft
0.0.5	February 2003	Fourth Draft
0.0.6	March 2003	Fifth Draft