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Technical Report

**Technical Specification Group Services and System Aspects;
Universal Mobile Telecommunications System (UMTS);
Quality of Service and Network Performance
(UMTS 22.25 version 3.1.1)**

Approved draft under TSG SA change control

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Intellectual Property Rights

TBD

Foreword

This draft Technical Specification has been produced by 3GPP.

The contents of this TS is subject to continuing work within TSG SA and may change following formal TSG SA approval. Should TSG SA modify the contents of this TS, it will be re-released by TSG SA with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

- x the first digit:
 - 1 presented to TSG SA for information;
 - 2 presented to TSG SA for approval;
 - 3 Indicates TSG SA approved UMTS document.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

Introduction

The Quality of Service of the Universal Mobile Telecommunications System UMTS is an important factor when introducing the system to the customers. When UMTS is ready to be launched to the mass market, several other mobile telecommunication services exist as an alternative for the general public. A high quality experienced by the user of UMTS is essential in order to promote the idea of UMTS as a global all-purpose communication tool for millions of people with mass produced low price terminal equipment.

A possibility to use multi media services via UMTS in a practical and reliable manner is even more important in the near future than today. There is also a tendency that a larger amount of traffic is taking place between mobile terminals, i.e. traffic within UMTS and between UMTS and other networks. This gives more importance to transcoding and delay quality requirements.

1 Scope

This TR identifies the parameters and parameter values which are to be used as targets when producing UMTS standards and which are to serve as guidelines to operators and service providers for network design and service provision.

2 Normative 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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- | | |
|-----|---|
| [1] | ITU-T Recommendation I.350 |
| [2] | ITU-T Recommendation E.800 |
| [3] | ITU-T Recommendation G.711 |
| [4] | ITU-T Recommendation G.721 |
| [5] | ITU-T Recommendation T.30 |
| [6] | UMTS 22.05: "Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities" |
| [7] | UMTS 22.60: "Universal Mobile Telecommunications System (UMTS); Service aspects; Mobile multimedia services including mobile Intranet and Internet services". |

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions from the ITU-T Recommendation E.800 apply:

Network performance: The ability of a network or network portion to provide the functions related to communications between users.

Quality of service: The collective effect of service performance which determine the degree of satisfaction of a user of the service.

3.2 Abbreviations

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

| | |
|-----|---------------------|
| BER | Bit error ratio |
| EFS | Error free seconds |
| NP | Network Performance |
| MOS | Mean Opinion Score |

| | |
|------|-----------------------------------|
| PSTN | Public Switched Telephone Network |
| PDNs | Public Data Networks |
| QoS | Quality of Service |

4 General

Quality of service

Quality of service is defined in ITU-T Recommendation E.800 as the collective effect of service performances which determines the satisfaction of a user of a service. It is characterised by the combined aspects of performance factors applicable to all services, such as:

- service support performance;
- service operability performance;
- service accessibility performance;
- service retainability performance;
- service integrity performance;
- service security performance;

Within this report the aspects of Quality of Service that are covered are restricted to the identification of parameters that can directly observed and measured at the point at which the service is accessed by the user. Other types of QoS parameters which are subjective in nature, i.e. depend upon user actions or subjective opinions are not subject of this report.

Network performance

Network performance is defined in ITU-T Recommendation E.800 as the ability of a network or network portion to provide the functions related to communications between users; it contributes to service accessibility, service retainability and service integrity. Network performance parameter values are usually derived from quality of service parameter values (c.f. for example ITU-T Recommendation I.350).

The QoS and NP parameters identified within this report should be used as targets when producing UMTS standards and should serve as a guideline to service provider and network providers for service provision and network design. Therefore the mentioned parameters reflect the main aspects of the UMTS systems, especially those which distinguish UMTS from other e.g. 2 generation systems. The parameters are only valid for UMTS systems not when roaming in 2 generation systems.

The identified QoS parameters focus on user perceivable effects and therefore give the framework for the network design. The NP parameters describe the performance of a particular connection element, hence they determine the QoS.

4.1 Basic Requirement

From the user perspective UMTS is characterized by the following main aspects;

- Services will be provided by multiple service provider and multiple network provider with different levels of QoS.
- The individual service profile will be agreed between the user and the service provider
- The user has the same service environment independent from the serving network by support of VHE.
- Service continuity is required on handover when roaming at various geographical areas (UMTS and 2nd generation areas), i.e. the user should be unaware of roaming and/or handover.

These UMTS aspects lead to some general requirements for QoS and NP **parameters**.

- The user should have the possibility to choose the service quality package best suitable for his needs (e.g. lowest bit error rate, highest transmission speed, ...).
- The QoS parameters should be set within the VHE of the customer, when obtaining a service from the service provider. Thus the customer is given choice with regard to service quality and the service provider is able to provide the network operators with the predicted volumes of the different service packages enabling the network operator to dimension his network.
- Negotiating the service quality between the terminal and the network before invoking a service shall be possible. The service quality packages are obtainable from the service provider and are supported through the VHE. E.g., if the customer wishes to pay less for a lower service quality package or more for higher service quality package, this should be possible by selecting such a package from the service provider
- Information of the user about the offered service quality before service execution. If a quality as perceived by the user is expected to degrade e.g. due to the use of an additional service in a multimedia environment, the user shall also be informed.

The basic requirement for quality of service parameter **values** over UMTS is that they should be closely comparable to the corresponding values achieved when using the contemporary fixed networks (e.g. PSTN/ISDN/B-ISDN and PDNs) alone.

4.1.1 QoS Parameters

Following parameters describe to above mentioned requirements are: (speed, accuracy, dependability)

time for network access, (time to attach)

The time between the user action in order to access the network and the positive acknowledgement received by the user. This time period includes all necessary procedures performed

time to invoke service (Service access, get alerting, ringing indication),

time to change service profile

seamless service retainability when roaming

Time to receive service quality information

4.1.2 NP Parameters

Answer/connect time- when called party accepts the call

Release time

Interruption of services

4.2 Support of Speech Services

A standardised speech codec will be adopted for UMTS. It shall be possible for proprietary speech codecs standardised elsewhere to be deployed as well as the codec standardised for UMTS (Quality at least as good as that provided by fixed networks as defined in G.711). This TR specifies requirements related to the speech codec to be standardised for UMTS.

4.2.1 QoS Parameters

- subjective quality (Noting age, sex, language, etc.);
- speaker recognition;
- natural speech quality;
- ease of conversation;

- perception of echo;
- interruption of service;

4.2.2 NP Parameters

- loss of interactivity due to delay:
 - two party conversations;
 - delay in the two-way speech path, dual talk;
 - multi-party and multi-speaker;
 - background noise.

4.3 Support of Data Transmission Services

Some QoS values that the user experiences are dependent on the application used.

The quality of a service the user perceives is influenced by the network as well as by the terminal equipment. As the intelligence and complexity of an application used in UMTS increases, application performance becomes an important factor in determining the quality perceived by the user. Within this report, the identified parameters for data transmission do not include the influence by the terminal equipment and used application.

4.3.1 QoS Parameters

- delay (round trip);
- duration (of data transfer);
- throughput;
- percentage of transmission errors.

4.3.2 NP Parameters

- bit error ratio (BER),
- information transfer rate,
- transfer delay,
- decay variation
- probability of loss

4.4 Support of Messaging Services

A standardised way of supporting messaging services will be defined for UMTS. It is assumed that messaging services can be provided via a store and forward implementation and therefore units which constitute a message can be subject to delays and delay variations during transmission. Any service centre providing store and forward services is considered outside the scope of this report. Quality of Service parameters apply to overall messages. Network performance parameters apply to the underlying transmission.

4.4.1 QoS Parameters

- delivery delay;
- probability of error in the message;

- probability of delivery to a wrong address;
- throughput;
- probability of loss of message.

4.4.2 NP Parameters

- delivery accuracy;

see data transmission service for other parameters

4.5 Support of Facsimile Services

A standardised way of supporting facsimile service will be defined for UMTS e.g. via a store and forward service or via support of ITU-T T.30.

4.5.1 QoS Parameters

- transmission delay;
- throughput;
- resolution.

4.5.2 NP Parameters

- bit error rate;
- lines in error;
- delay variation;
- transmission delay.

4.6 Support of Multimedia Services

4.6.1 QoS Parameters

- synchronisation (skew) between media components (see TR 22.60)

4.6.2 NP Parameters

- see data transmission performance

5 Quality of Service and Network Performance Parameter Values

The parameters and values in the following sections are necessary for the support of UMTS.

Furthermore, for mobile communication systems, network performance parameter values also depend on dependability factors (essentially, availability factors) expressed in terms of time availability (% of the time) and radio coverage availability (% of the radio coverage)

Service-specific quality of service parameters may include, for the telephony service as an example, speech quality, level of background noise, level of echo, delay, etc.. Section 5 provides indicative values calibrating the parameters using the following arguments:

- 95% probability;
- mean;
- target value;
- least acceptable value (LAV).

This forms the basis of candidate material for standardisation, and must be aligned with the work of the ITU-T.

5.1 General

(Applicable to all services)

5.1.1 QoS Parameters Values

Table 1: QoS Parameters Values

| User Perspective | Mean | 95% |
|---|-------|------|
| Time for network access | 5 s | 10 s |
| - automatic | 5 s | 2 s |
| - manual | 2 s | 5 s |
| Time to invoke service | | 5 s |
| Time to change Service Profile | 100 % | |
| Time to receive service quality information | | |
| Seamless service retainability when roaming | | |

5.1.2 NP Parameters Values

Table 2: NP Parameters Values

| | | |
|--------------------------------------|----------------------|----------------------|
| Answer/connect time | | |
| - when called party accepts the call | < 100 ms, see Note 1 | < 200 ms, see Note 1 |
| Release time | < 100 ms, see Note 1 | < 200 ms, see Note 1 |
| Interruption of services | 0 | 0 |

| Probability of | Probability value | Note |
|--|-------------------|---|
| Premature disconnection | 0.005 | No disconnection desired even if temporary loss of network coverage |
| NOTE 1: < 0.5 seconds is the target in the satellite environment | | |

For bearer services in general, issues related to extra delay and loss of data due to handover need to be considered as well as maintaining synchronisation (e.g. between video and speech) in case of multiple simultaneous bearers.

5.2 Support of Speech Services

5.2.1 QoS Parameters Values

Subjective criteria for assessing quality:

- subjective quality (Noting age, sex, language, etc.),
as in G.711 (objective) and at least as good as G.721
- speaker recognition, as in G.711 (objective) and at least as good as G.721
- natural speech quality, as in G.711 (objective) and at least as good as G.721
- ease of conversation. as in G.711 (objective) and at least as good as G.721
- perception of echo,

5.2.2 NP Parameters Values

This is for the default speech codec to be standardised for UMTS. As a guideline for speech, the break should be less than [40 ms]. Interruption of service (e.g. due to handover) 40 ms (this also applies to GSM/UMTS handover).

Delay (one way end-to-end) 40 ms <to be checked>

Mean Opinion Score as in G.711 (objective) and at least as good as G.721

5.3 Support of Data Transmission Services

5.3.1 QoS Parameters Values

- delay (round trip) for interactive services < 2 s
- duration (of data transfer), negotiable
- throughput, negotiable
- percentage of transmission errors: error free transmission

5.3.2 NP Parameters Values

See TS 22.05 for values of parameters:

- bit error ratio (BER),
- information transfer rate,
- transfer delay,
- decay variation
- probability of loss

5.4 Support of Messaging Services

5.4.1 QoS Parameters Values

- delay negotiable: 1 s to 12 h (possibly higher)
- probability of error in the message 0
- probability of delivery to a wrong address 10E-6
- probability of loss of message 0

5.4.2 NP Parameters Values

- accuracy of delivery to the right address - > 1 - 10E-6
- throughput, see 22.05

see data transmission service for other parameters

5.5 Support of Facsimile Services

5.5.1 QoS Parameters Values

- transmission delay < 1 minute/page
- resolution negotiable as defined in ITU-T T.4/T.30
- lines in error < 5%

5.5.2 NP Parameters Values

- delay variation derived from ITU-T T.4/T.30

- transmission delay derived from ITU-T T.4/T.30

See data transmission network performance for other parameters.

5.6 Support of Multimedia Services

5.6.1 QoS Parameters Values

- synchronisation (skew) of media components < 10 ms

5.6.2 NP Parameters Values

See data transmission performance

Annex A: General Quality Considerations

Music:

The sound quality of music shall be acceptable and not annoying.

The system shall be capable of performing seamless handover not detectable via the audio path by the user.

Echo: not perceptible

Multiple speakers:

The codec should be able to handle multiple simultaneous speakers in cases like:

- several users at a single terminal
- multiparty call

Background noise:

It is desirable eliminate background noise so that the discontinuous nature of speech can be fully exploited.

Tandeming:

The quality achieved when the UMTS codec is interworking with any other standardised codec (n other UMTS codec, GSM codec or fixed network codec etc.) should be no worse than the quality of the worst of the two codecs.

The codec shall facilitate speaker recognition of different sexes, and not discriminate between languages, ages or ethnic groups.

Graceful degradation in deteriorating radio conditions:

For the UMTS speech codec it is required that it can adapt to provide good quality speech even when radio conditions deteriorate. The codec should adapt to good quality speech even if there is a temporary deterioration of the radio environment. Graceful speech quality degradation is required if speech quality degradation is not unavoidable. If the deterioration of the radio environment is more permanent any degradation in speech quality should not be annoying to the user.

Annex B: Change history

| Change history | | | | | |
|-------------------------------|------------------|----------------|--------------------------------------|--------------------|---|
| SMG No. | TDoc. No. | CR. No. | Section affected | New version | Subject/Comments |
| SMG#25 Sophia Antipolis | 98-067 | A001 | 3.1, 4, 4.1, 4.1.1, 4.3, 5, 5.1.1 | 3.1.0 | Improving readability and adding QoS Parameters |
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