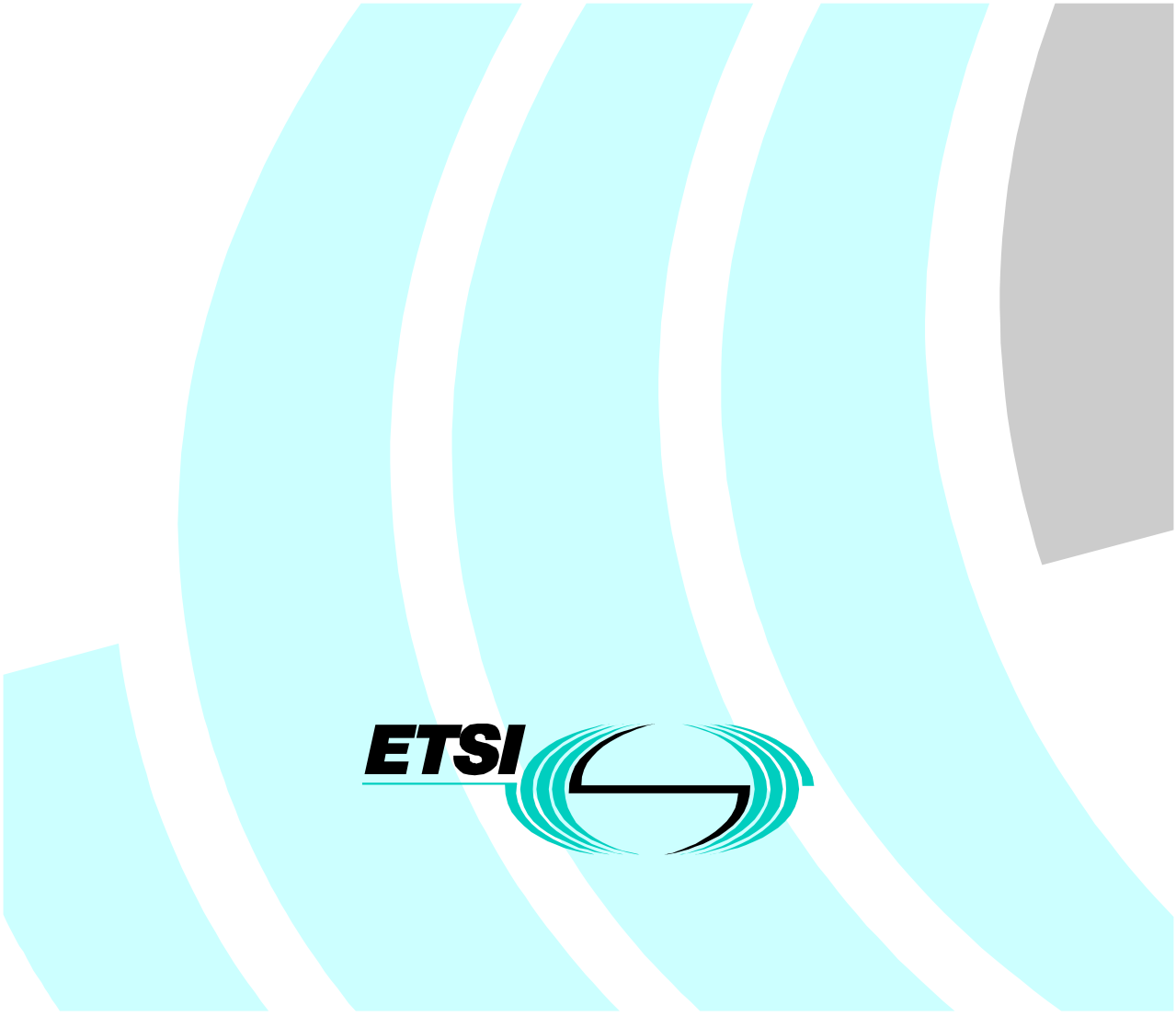
ETSI TS 101 329-2 V2.1.2 (2001-07)

Technical Specification

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



Reference
RTS/TIPHON-05012a

Keywords
E-Model, internet, IP, network, quality, service, telephony

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

Contents

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://www.etsi.org/ipr).

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 Technical Specification (TS) has been produced by ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON).

The present document is part 2 of a multi-part deliverable covering end-to-end Quality of Service in TIPHON Systems, as identified below:

Part 1: "General aspects of Quality of Service (QoS)";

Part 2: "Definition of Speech Quality of Service (QoS) Classes";

Part 3: "Signalling and Control of end-to-end Quality of Service";

Part 4: "Quality of Service Management";

Part 5: "Quality of Service (QoS) measurement methodologies";

Part 6: "Actual measurements of network and terminal characteristics and performance parameters in TIPHON networks and their influence on voice quality";

Part 7: "Design Guide for elements of a TIPHON connection from an end-to-end speech transmission performance point of view";

Part 8: "QoS of multimedia services in TIPHON systems";

Part 9: "Call performance Classification".

Introduction

The present document forms one of a series of technical specifications and technical reports by TIPHON Working Group 5 for TIPHON Quality of Service (QoS) classification. The structure of this work is illustrated in figure 1.

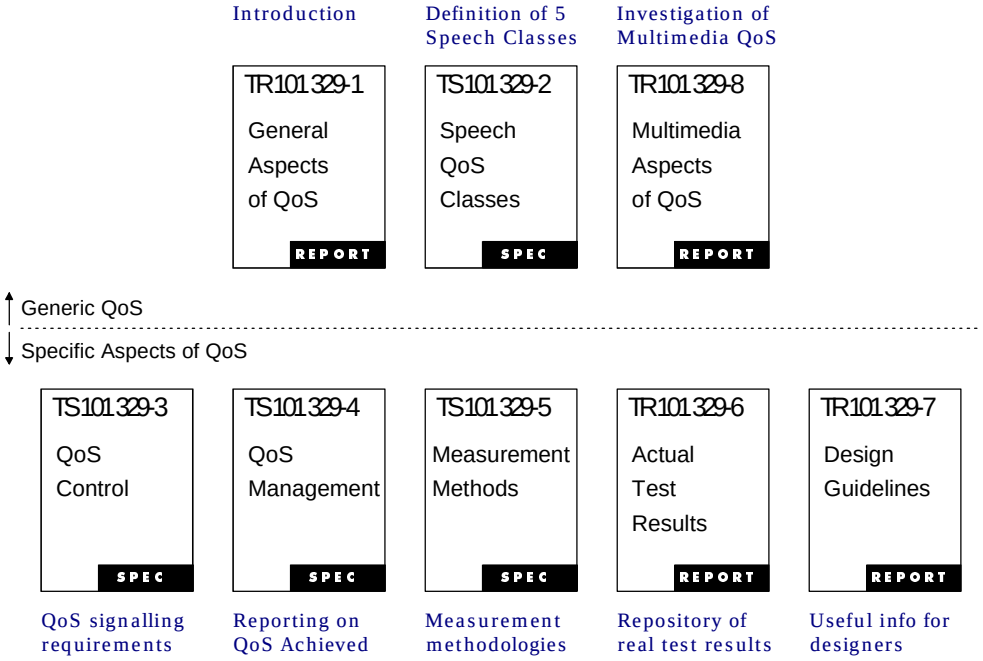


Figure 1: Structure of TIPHON QoS Documentation

1 Scope

The present document defines five classes of Quality of Service for characterizing the speech performance of TIPHON compliant IP voice telephony networks.

The classes of service apply to all the defined TIPHON Scenarios and are specified in terms of the following parameters:

- "Overall Transmission Quality Rating";
- "Listener Speech Quality" (one-way non-interactive speech quality); and
- "End-to-end Delay".

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, 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.

[1] ETSI EN 300 961 (V7.0.2): "Digital cellular telecommunications system (Phase 2+) (GSM); Full rate speech; Transcoding (GSM 06.10 version 7.0.2 Release 1998)".

[2] ETSI EN 300 726 (V7.0.2): "Digital cellular telecommunications system (Phase 2+) (GSM); Enhanced Full Rate (EFR) speech transcoding (GSM 06.60 version 7.0.2 Release 1998)".

[3] ETSI TS 101 329-5: "Telecommunications and Internet protocol Harmonization Over Networks (TIPHON) Release 3; Technology Compliance Specification; Part 5: Quality of Service (QoS) measurement methodologies".

[4] ITU-T Recommendation G.107 (2000): "The E-Model, a computational model for use in transmission planning".

[5] ITU-T Recommendation G.109 (1999): "Definition of categories of speech transmission quality".

[6] ITU-T Recommendation G.711 (1988): "Pulse code modulation (PCM) of voice frequencies".

[7] ITU-T Recommendation G.726 (1990): "40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)".

[8] ITU-T Recommendation P.310 (1996): "Transmission characteristics for telephone-band (300-3 400 Hz) digital telephones".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definition applies:

codec: combined speech encoder and decoder

3.2 Abbreviations

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

EFR	Enhanced Full Rate
FR	Full Rate
GSM	Global System for Mobile communications
IP	Internet Protocol
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector (former CCITT)
PSTN	Public Switched Telephone Network
QoS	Quality of Service

4 Definition of TIPHON Speech QoS Classes

Three classes of end-to-end speech QoS are defined for TIPHON systems. The following TIPHON speech QoS classes are defined from mouth-to-ear and therefore include both the network and the TIPHON terminal characteristics:

- WIDEBAND: This is a type of IP telephony service will provide a user experience better than the PSTN. It is expected that these systems will be implemented using wideband codecs (codecs encoding analogue signals with bandwidth in excess of 3,1 kHz) and QoS-engineered IP networks;
- NARROWBAND: This is a type of IP telephony service will provide a user experience similar to PSTN. It is expected that such systems would also be implemented over QoS–engineered IP networks:
  - NARROWBAND/HIGH: This quality is equivalent to recent ISDN services;
  - NARROWBAND/MEDIUM: This quality is equivalent to recent wireless mobile telephony services in good radio conditions, for instance GSM networks using EFR codecs [2], or systems using G.726 at 32 kbit/s [7] codecs;
  - NARROWBAND/ACCEPTABLE: This quality is equivalent to common wireless mobile telephony services, for instance GSM networks using FR codecs [1] or systems including a geostationary satellite.
- BEST EFFORT: This type of service will provide a usable communications service but will not provide guarantees of performance. There may be periods of significantly impaired speech quality, and large end-to-end delays which are likely to impact the overall conversational interactivity. It is expected such communications will operate over non QoS-engineered IP networks such as the public Internet.

The TIPHON speech QoS classes WIDEBAND and NARROWBAND will provide performance guarantees for 95 % of all connections. The BEST EFFORT class provides no speech performance guarantees.

5 TIPHON Speech QoS Performance Metrics

Each of the classes defined in clause 4 is specified by three performance metrics:

- Overall Transmission Quality Rating (R);
- Listener Speech Quality (One-way non-interactive end-to-end Speech Quality); and
- End-to-end (mean one-way) Delay.

To comply with a specific speech QoS class a TIPHON system shall meet the limits of "Overall Transmission Quality Rating [R]"given in table 1. In addition the limits of "End-to-end Delay" and "Listener Speech Quality" given in tables 3 and 4 respectively shall be met in the very same class.

NOTE: The measurement of "Overall Transmission Quality Rating (R)", "Listener Speech Quality" and "End-to-end Delay" are described in TS 101 329-5 [3].

5.1 Overall Transmission Quality Rating

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

The overall transmission quality rating is calculated using the E-Model (ITU-T Recommendation G.107 [4]). For calculation purposes the use of traditional telephone handsets (ITU-T Recommendation P.310 [8]) at both sides of the connection is assumed.

Table 1: Overall Transmission Quality Rating (R) for TIPHON Systems

	3 (WIDEBAND)	2 (NARROWBAND)			1 (BEST EFFORT)
		2H (HIGH)	2M (MEDIUM)	2A (ACCEPTABLE)	
Overall Transmission Quality Rating (R)	(see note 2)	> 80	> 70	> 50	> 50, (see note 3)
NOTE 1: The R-value incorporates all degradations, including the effects of packet loss. NOTE 2: The R-value characterization of systems employing wideband codecs is under study. NOTE 3: The rating for the best effort class is a target value.					

The relation between overall transmission quality rating (R) and user perception of quality is defined in ITU-T Recommendation G.109 [5]. Table 2 is extracted from this recommendation.

Table 2: Categories of Speech Transmission Quality as defined in ITU-T

Overall Transmission Quality Rating	90 ≤ R < 100	80 ≤ R < 90	70 ≤ R < 80	60 ≤ R < 70	50 ≤ R < 60
User's satisfaction	Very satisfied	Satisfied	Some users dissatisfied	Many users dissatisfied	Nearly all users dissatisfied

5.2 Listener Speech Quality of TIPHON Systems

Specifications of listener speech quality for TIPHON QoS classes are given in table 3.

Table 3: Listener Speech Quality of TIPHON Systems

	3 (WIDEBAND)	2 (NARROWBAND)			1 (BEST EFFORT)
		2H (HIGH)	2M (MEDIUM)	2A (ACCEPTABLE)	
Relative Speech Quality (one way, non interactive speech quality)	Better than G.711 [6]	Equivalent or better than ITU-T Recommendation G.726 at 32 kbit/s [7]	Equivalent or better than GSM-FR [1]	Not defined	Not defined
Resultant Overall Transmission Quality Rating (R)	n.a.	> 86	> 73	> 50	> 50
NOTE 1: The R values above are derived from E-Model calculations assuming that perfect echo control is deployed, that there is zero delay through the system, that standard terminals are used, also that all impairments related to low bit-rate coding - including the effects of packet loss - are taken into account. NOTE 2: "Relative speech quality" does not describe the Listener Speech Quality (the full acoustic-to-acoustic (mouth to ear) quality that will be experienced by a user). This will be dependent on the acoustic quality of the individual TIPHON terminal as well as the quality of the TIPHON network.					

NOTE: The use of codec examples in table 3 indicates a relative speech quality, not a recommended codec for implementation. The performance levels include any degradation caused by network or terminal, such as packet loss.

5.3 End-to-end Delay

Specifications of end-to-end (mean one-way) delay for TIPHON QoS classes are given in table 4.

Table 4: End-to-end Delay for TIPHON Systems

	3 (WIDEBAND)	2 (NARROWBAND)			1 (BEST EFFORT)
		2H (HIGH)	2M (MEDIUM)	2A (ACCEPTABLE)	
End-to-end Delay	< 100 ms	< 100 ms	< 150 ms	< 400 ms	< 400 ms
NOTE: The delay for best effort class is a target value.					

History

Document history		
V1.1.1	July 2000	Publication
V2.1.1	June 2001	Publication (withdrawn)
V2.1.2	July 2001	Publication