INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.725

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

SPECIFICATIONS OF SIGNALLING SYSTEM No. 7

SIGNALLING SYSTEM NO. 7 – SIGNALLING PERFORMANCE IN THE TELEPHONE APPLICATION

ITU-T Recommendation Q.725

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q725 was revised by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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SIGNALLING SYSTEM No. 7 – SIGNALLING PERFORMANCE IN THE TELEPHONE APPLICATION

(Geneva, 1980; modified at Helsinki, 1993)

1 Introduction

This Recommendation gives the requirements of the telephone application of Signalling System No. 7 (SS No. 7).

In Recommendation Q.706, the Message Transfer Part (MTP) performance is described. The MTP is the basis of the telephone application of SS No. 7 and provision of a signalling network to serve the telephone service must take account of the performance of the Message Transfer Part and the requirements of the telephone application. For example, taking account of the message transfer times detailed in Recommendation Q.706 the signalling Hypothetical Reference Connection (Q.709) and the requirements for message transfer times between two telephone exchanges, a figure may be derived for the total permissible number of signalling links in signalling relations in tandem for a particular call. See also Recommendation Q.709.

2 Unsuccessful calls due to signalling malfunction

The proportion of calls that are unsuccessful due to signalling malfunction should be less than 1 in 10^5.

By means of error detection (see Recommendation Q.703) as well as transmission fault indication (see Recommen-dations G.732 [1] and G.733 [2]), it is ensured that, overall, not more than one error in 10^8 of all signal units transmitted is accepted and will cause false operation.

Unsuccessful calls may be caused by undetected errors, loss of messages or messages delivered out of sequence (during emergency situations within the signalling network) and may result in:

- incomplete call set-up;
- misrouted calls (e.g. connection of wrong numbers);
- calls routed correctly but mishandled (e.g. false clearing).

3 Unavailability of a signalling route set

The overall unavailability of a signalling route set causing the unavailability of a signalling relation should not exceed a total of 10 minutes per year.

NOTE – The availability of a signalling route set within a signalling network may be enhanced by replication of signalling links, signalling paths and signalling routes.

4 Labelling potential

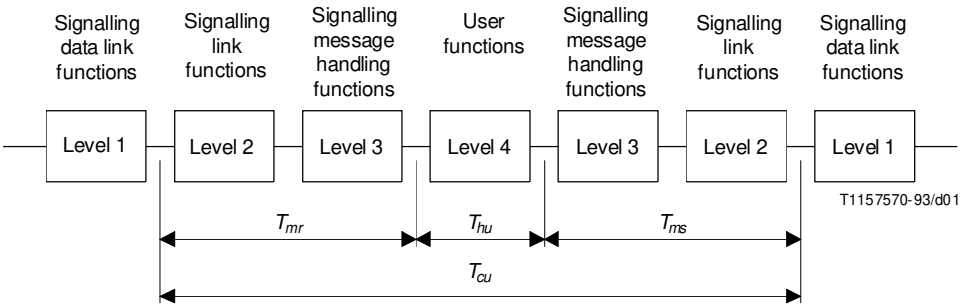
The label of the Telephone User Part of SS No. 7 provides the potential to identify 16 384 signalling points and up to 4096 speech circuits for each signalling relation.

5 Cross-office transfer time

5.1 Functional reference points and transfer time components

Delays concerning data base query functions are not included at this time. The delays corresponding to those functions are for further study.

Figure 1 shows the time components associated with the handling and transfer of a TUP message at a transit exchange.



T_{cu} Cross-office transfer time
T_{hu} Telephone User Part handling time
T_{mr} MTP receiving time [a)]
T_{ms} MTP sending time [a)]

[a)] The definitions of these times are given in Recommendation Q.706.

FIGURE 1/Q.725

Functional diagram of the cross-office transfer time

5.2 Definitions

For the purposes of this Recommendation, the following definitions apply.

cross-office transfer time, T_{cu}: T_{cu} is the period which starts when the last bit of the signal unit leaves the incoming signalling data link and ends when the last bit of the signal unit enters the outgoing signalling data link for the first time. It includes the user handling time T_{hu}. It also includes the queueing delay in the absence of disturbances but not the additional queueing delay caused by retransmission. It does not include the data channel propagation time.

user handling time, T_{hu}: T_{hu} is the period which starts when the last bit of the message has entered the Telephone User Part and ends when the last bit of the derived message has left the Telephone User Part.

5.3 Queueing delay

The formulae for the queueing delays are described in 4.2/Q.706. The queuing delay does not include the data channel propagation time.

The telephone traffic model assumed is given in Table 1, from which the proportion of signal messages may be obtained as shown in Table 2. Using Table 2, examples of queueing delays are calculated as shown in Figures 2 to 5, where one call attempt per second per 64 kbit/s signalling data link may yield 0.00577 Erlang of the traffic loading of each channel.

These values, based on a mean message length of 15 bytes, apply only for configurations where no User Part other than the TUP uses the links of the SP in consideration.

If the load on these links is mixed with messages of significantly different length (e.g. from other User Parts), or if long delay links are used, then the increase in outgoing link delay (T_{od}) as shown in 4.3.4/Q.706 will have to be taken into account.

TABLE 1/Q.725

Traffic model

Sending procedure			En-bloc				Overlap			
Type of call			AW	SB	CC	AB	AW	SB	CC	AB
Percent calls			30	10	5	5	30	10	5	5
Messages per call		Length (bits)								
	12-digit IAM	176	1	1	1	0				
	6-digit IAM	152					1	1	1	1
	3-digit SAM	128					1	1	0	1
	1-digit SAM	112					3	3	0	0
	Address complete	112	1	1	0	0	1	1	0	0
	Others	104	3,5	2	3	0	3,5	2	3	2

AW Answered

SB Subscriber busy and not answered

CC Circuit congestion

AB Abortive

IAM Initial address message

SAM Subsequent address message

NOTE – The assumptions used in this model are chosen for illustrative purposes, and should not be considered to be typical.

TABLE 2/Q.725

Proportion of messages

Length (bits)	176	152	128	112	104	Total
Messages per call in both directions	0.45	0.5	0.45	2.0	2.9	6.3
Percent	7.1	7.9	7.1	31.7	46.0	100
Mean message length (T_m)	117.2 bits					
k_1	1.032					
k_2	1.107					
k_3	1.239					

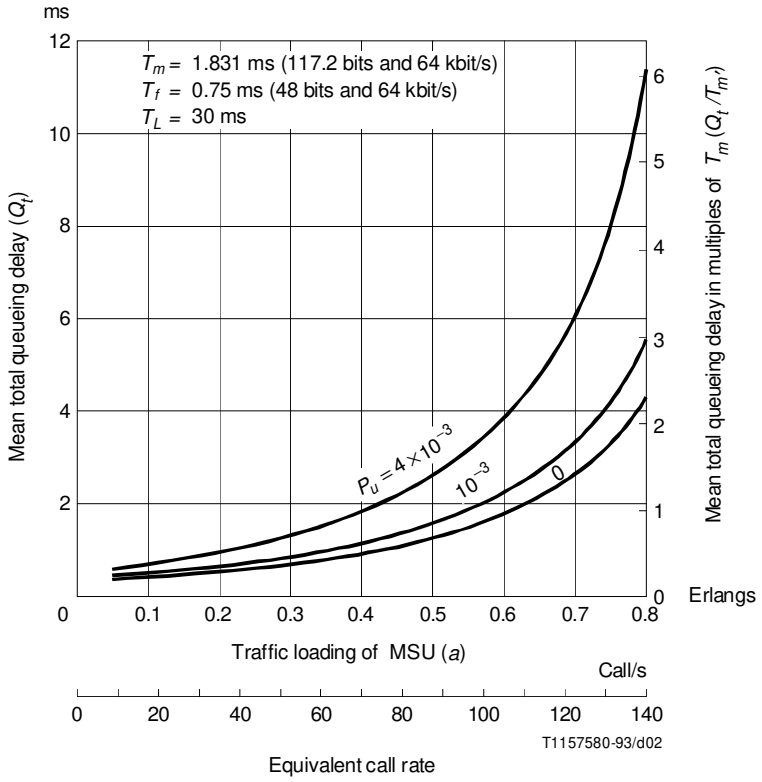


FIGURE 2/Q.725

Mean total queueing delay of each channel of traffic – Basic error correction method

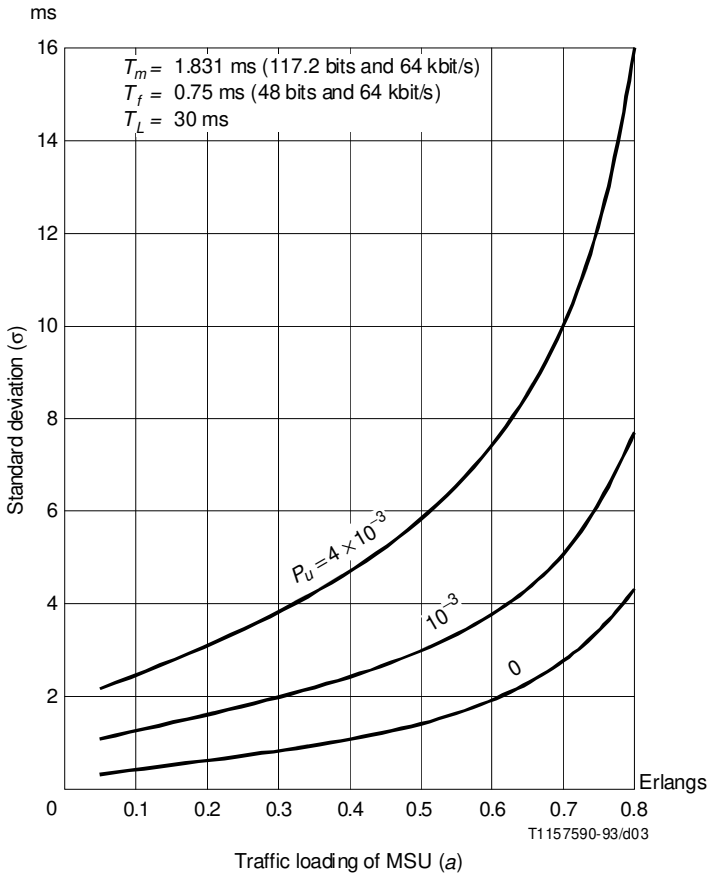


FIGURE 3/Q.725

Standard deviation of queueing delay of each channel of traffic – Basic error correction method

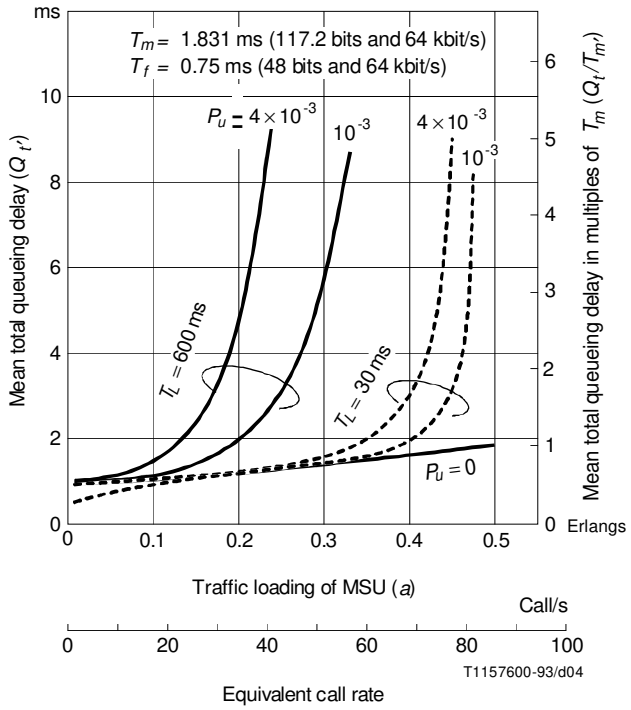


FIGURE 4/Q.725

Mean total queueing delay of each channel of traffic – Preventive cyclic retransmission error correction method

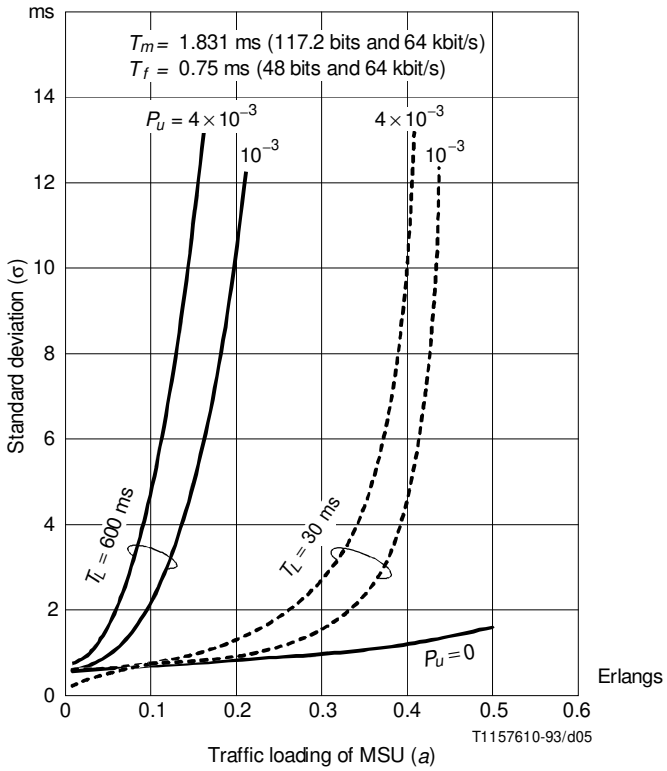


FIGURE 5/Q.725

Standard deviation of queueing delay of each channel of traffic – Preventive cyclic retransmission error correction method

5.4 Estimates for message transfer time

The figures in Table 3 are related to a signalling bit rate of 64 kbit/s.

TABLE 3/Q.725

Cross-office transfer time T_{cu}

Message type	Exchange call attempt loading	T_{cu} (ms) [a]	
		Mean	95%
Simple (e.g. answer)	Normal +15% +30%	110 165 275	220 330 550
Processing intensive (e.g. IAM)	Normal +15% +30%	180 270 450	360 540 900

[a] Provisional values.

5.5 Answer delay

As a consequence of correction by retransmission, not more than one in 10^4 signals should be delayed more than 300 ms as a long-term average. This requirement refers to each signalling link.

This requirement is laid down in order to ensure satisfactory answer delays. Further study is required to determine if this value is sufficient if satellite working is used.

These values, based on a mean message length of 15 bytes, apply only for configurations where no other MTP Users, generating longer messages or higher dynamic loads than the TUP, use the links of the signalling point in consideration.

If the load on the links is mixed with messages of significantly different lengths (e.g. from other User Parts) then the increase in the outgoing delay T_{od} as shown in 5/Q.706, has to be taken into consideration. If satellite links are used in this case, the relevant increase is shown in 3/Q.706.

5.6 Delays due to data base queries

Delays relating to data base query functions have not been included. These delays are for further study, but information relating to these delays can be found in 7/Q.709.

References

[1] CCITT Recommendation G.732 *Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s*.

[2] CCITT Recommendation G.733 *Characteristics of primary PCM multiplex equipment operating at 1544 kbit/s*.