INTERNATIONAL TELECOMMUNICATION UNION

ITU-T E.452

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

TELEPHONE NETWORK AND ISDN

QUALITY OF SERVICE, NETWORK MANAGEMENT AND TRAFFIC ENGINEERING

FACSIMILE MODEM SPEED REDUCTIONS AND TRANSACTION TIME

ITU-T Recommendation E.452

(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 E.452 was prepared by the ITU-T Study Group II (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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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Recommendation E.452

FACSIMILE MODEM SPEED REDUCTIONS AND TRANSACTION TIME

(Helsinki, 1993)

1 Introduction

Facsimile modem speed reductions and increased transaction time are important parameters when measuring the performance of networks carrying group 3 facsimile. The purpose of this Recommendation is to develop modem speed and transaction time metrics that can be used to describe the performance of transmission networks with respect to group 3 facsimile. At present, only the performance parameters are defined. In future values for these parameters from international network measurements will be provided.

Group 3 facsimile machines are capable of transmitting image data using a wide range of transmission speeds. Currently approved speeds are:

S1 – 2 400 bps

S2 – 4 800 bps

S3 – 7 200 bps

S4 – 9 600 bps

S5 – 12 000 bps

S6 – 14 400 bps

During the initial exchange of DIS and DCS signals, the originating and terminating terminals exchange data regarding the maximum speeds at which they can transmit and receive. Initial transmission attempts are made at the agreed upon speed (S_i). Note that in some cases, terminals may be set by the user to use a speed below the maximum speed of the terminal and S_i will be taken as the speed of the initial TCF as indicated by the DCS message (see Note).

NOTE – When measuring performance using test, transactions, modem speed reductions are most easily detected by an examination of the V.21 protocol messages exchanged between the terminals. In some cases, where transactions occur between machines from the same manufacturer, the modem speed information is not carried in the DIS/DCS messages. For these cases, the modem speed information will be carried in the proprietary NSF/NSS messages, and may not be easily decoded. Protocol data can be collected by using external fax protocol monitors.

Modem speed reductions from S_i can take place prior to the sending of any pages in response to failure to train (FTT) messages. FTTs are sent by the receiving terminal when it declares that the reception of TCF was unsatisfactory. Modem speed reductions can also take place between pages. This is often due to the receipt of an RTP or RTN message causing the originating terminal to return to phase B.

2 Definitions

The following definitions apply where test transactions are exchanged between a pair of transmitting and receiving test terminals using a fixed number of standard test pages. Application of these metrics in instances where the data is collected by monitoring actual facsimile traffic, is for further study.

2.1 Modem speed reductions measured on a transaction basis

The following metrics represent modem speed reduction data on a transaction basis. Measured parameters are expressed as a percentage of the number of completed transactions (T_c).

calls without modem speed reduction (C_I): This is the number of completed transactions where all pages were sent at S_i.

Represented as a percentage of the number of completed transactions:

$$\%C_I = C_I/T_c * 100$$

calls with some modem speed reductions (C_r): This is the number of completed transactions that had one or more pages sent at a speed less than S_i.

Represented as a percentage of the number of completed transactions:

$$\%C_r = C_r/T_c * 100$$

calls with modem speed reduction during initial phase B (C_B): This is the number of completed transactions that had all pages sent at a speed less than S_i.

Represented as a percentage of the number of completed transactions:

$$\%C_B = C_B/T_c * 100$$

This parameter may also be expressed as a percentage of all calls with some modem speed reduction (C_{Br}):

$$\%C_{Br} = C_B/C_r * 100$$

2.2 Modem speed reduction measured on a page basis

The following metrics expresses modem speed reduction on a page basis.

number of pages at speed S_n (N_{sn}) for $S_n = S_i, S_{i-1}, S_{i-2}$, etc.: This is the number of pages sent at each of the possible speeds.

This performance parameter can be expressed as a percentage of the total number of pages associated with completed transaction (N_t).

$$\%N_{Si,Sn} = N_{Sn}/N_t * 100$$

2.3 Transaction efficiency rating

The following metric expresses the impact of modem speed reductions on a transaction. Information regarding the number of pages transmitted at different speeds is combined to produce a single metric that represents an efficiency rating for the transaction.

For a single transaction the efficiency rating E_t is given by:

$$\%E_t = 100 - ((1/N_t * \sum N_{Sn} * ((S_i - S_n)/S_i)) * 100)$$

An efficiency rating can be calculated for all completed transactions:

$$\%E_t = (\sum \%E_t)/T_c$$

2.4 Transaction time metrics

The impact of modem speed reductions can be measured by examining transaction times.

transaction time for completed transactions without modem speed reductions below S_i (T_{r1}): This is the average transaction time for all completed transactions without any modem speed reductions.

transaction time for all completed transactions with modem speed reductions below S_i (T_{r2}): This is the average transaction time for all completed transactions that had modem speed reductions below S_i.

transaction time for all completed transactions regardless of modem reductions (T_{r3}): This is the average transaction time for all completed transactions.

The impact of modem speed reduction on transaction time (T_{r4}) can be presented as follows:

$$T_{r4} = T_{r3}/T_{r1} * 100$$

3 Remarks

a) All transaction based metrics other than C_{Br} can be measured by an examination of transaction times from terminal provided reports. C_{Br} requires facsimile protocol information.

b) The page based metric S_n requires facsimile protocol information.

c) The frequency of modem speed reductions will be conditional on S_i. For example, when S_i = 14 400 bps there might be more speed reductions than if S_i = 4800 bps.

d) The frequency of modem speed reductions may vary with CPE. This is because criteria for returning FTT, RTP and RTN are manufacturer specific and are in some cases set by the user. Also, the performance of the modem internal to the fax machine may vary by manufacturer.

e) All metrics, except for the page based metric, apply to both ECM and non-ECM transaction. The question of a page or partial page based metric for ECM transaction requires further study.

f) In general, only pages that are part of successfully completed transactions are included when measuring modem speed reductions. However, modem speed reduction data for transactions that suffered cut-offs can be useful when troubleshooting facsimile call cut-offs.

g) The presence of modem speed reductions can be detected by examining transaction times provided as part of CPE generated transaction reports. Because page transmission times are long compared to the protocol message transmission time, it is possible to distinguish increased transaction time due to modem speed reductions from an increase due to some inefficiency in the protocol signaling.