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**TELEPHONE NETWORK AND ISDN
QUALITY OF SERVICE, NETWORK MANAGEMENT
AND TRAFFIC ENGINEERING**

**FACSIMILE QUALITY OF SERVICE
ON PSTN – GENERAL ASPECTS**

ITU-T Recommendation E.450

(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.450 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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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FACSIMILE QUALITY OF SERVICE ON PSTN – GENERAL ASPECTS

(Helsinki, 1993)

1 Purpose

Facsimile is the most important non-voice application on international PSTN and the most widely used standard is group 3 facsimile. This Recommendation is aimed at forming a framework for Recommendations on facsimile quality of service on PSTN.

2 Introduction

The following aspects of facsimile performance issues are considered:

- 1) connection establishment and disconnection;
- 2) message transmission;
- 3) methods, procedures and instrumentation for facsimile performance characterization;
- 4) facsimile troubles.

Facsimile terminal performance issues not related to the network are not considered in this Recommendation. Uniformly, the terminology of Recommendations T.30 and T.4 have been employed.

In the following clauses, each of these major issues are considered in detail.

3 Connection establishment and disconnection

Facsimile connection establishment is defined in phase A of Recommendation T.30. Usually in PSTN (see Notes 1 and 2) no distinction is made between the connection establishment and the disconnection performance for voice and facsimile calls.

NOTES

1 Certain Administrations give special treatment to facsimile by special numbering/access/methods. Such special treatments could produce performance and performance issues that are different from those of normal PSTN facsimile calls. These special treatments are not considered here.

2 It is assumed that in manual operation at the receive terminal there are no operator errors or equipment malfunction after off-hook and that the CED is transmitted as specified in Recommendation T.30. In automatic operation, it is assumed that the machine is working and goes off-hook and transmits the CED signal. It is further assumed that the terminals operate in accordance with all other aspects of Recommendation T.30.

The following parameters can be studied under connection establishment:

- 1) start dial signal delay and post dialling delay (using the terminology in proposed Recommendation E.431 for calls on PSTN);
- 2) facsimile phase A completion rate.

3.1 Start dial signal delay and post dialling delay

Start dial signal delay (SDSD) and post dialling delay (PDD) issues for voice and facsimile are similar for PSTN calls (see Note 1 in clause 3). At present, we shall follow proposed Recommendation E.431 for these parameters, and facsimile specific issues for these parameters, if any, will be considered in the future.

3.2 Facsimile phase A completion rate

Usually facsimile phase A completion rate is the same as call completion rate for voice calls [see Notes 1 and 2 in clause 3) and see the Note below].

NOTE – There could be facsimile phase A completion failure because of interaction between the network and facsimile protocol. Such failures will be considered in the future Handbook of facsimile performance.

The phase A completion rate depends on such factors as end-to-end blocking, dialling of the correct number by the customer (see Notes 1 and 2), the ability of the network to deliver the call to the correct B-party number without wrong numbers, etc. Voice call completion rates are extensively studied in other E-Series Recommendations and will therefore not be studied separately except in those cases where there is a facsimile specific issue.

4 Message transmission

The key performance parameters considered under message transmission are:

- 1) facsimile call cut-offs (phases B through D);
- 2) facsimile modem speed and transaction times;
- 3) facsimile image quality as impacted by transmission impairments.

Facsimile call cut-offs (phases B through D) are discussed in detail in proposed Recommendation E.451. In that Recommendation a set of rules for facsimile test calls are formulated. Based on these test calls, certain types of call failure modes are discussed and cut-off ratios defined. While the focus is on cut-off measurements from test calls, comments are also made on cut-off data obtained from other sources such as facsimile terminal reports.

Facsimile modem speed distributions and transaction times are studied under proposed Recommendation E.452. Facsimile modem speed reductions and increased transaction time are important parameters when measuring the performance of networks carrying group 3 facsimile. The purpose of Recommendation E.452 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.

Further work is planned to study the impact of transmission impairment induced scan line errors on facsimile image quality. Facsimile image quality issues dependent purely on the terminal characteristics, are not planned to be studied in this Recommendation. Error correction mode based image quality metrics, are for further study.

5 Methods, procedures and instrumentation for facsimile performance characterization

Facsimile performance may be characterized by

- 1) measurements made using test facsimile machines using test procedures specified in Recommendations E.451, E.452 and other future Recommendations;
- 2) in-service performance measurements using network based performance analysis systems;
- 3) facsimile terminal reports.

Each of these methods has its own advantages and disadvantages. The general methodology for each of these methods of characterization, preferred modes of operation, range of validity of results, etc., are for further study.

6 Facsimile troubles

Facsimile has a complex protocol that can interact with a variety of network elements and impairments to produce unsatisfactory quality. Frequently, the troubles are severe enough that specific actions to identify and resolve troubles have to be taken. In early 1990's, many of the severe troubles have been associated with facsimile call cut-offs; however, severe troubles related to poor image quality and excessive transaction times are also known. This matter is planned to be discussed in the future Handbook of facsimile performance.

Annex A

Glossary of terms and abbreviations for E.450-Series Recommendations

(This annex forms an integral part of this Recommendation)

CED	Called station identification
CFR	Confirmation to receive
CFS	Conditional facsimile success ratios
CIG	Calling subscriber identification
CNG	Calling tone
CPE	Customer premises equipment
CRP	Command repeat
CSI	Called subscriber identification
CTC	Continue to correct
CTR	Response to continue to correct
DCN	Disconnect
DCS	Digital command signal
DIS	Digital identification signal
DTC	Digital transmit command
ECM	Error correction mode
EOM	End-of-message
EOP	End-of-procedure
EOR	End-of-retransmission
ERR	Response for end-of-transmission
FCF	Facsimile control field
FCS	Frame check sequence
FIF	Facsimile information field
FTT	Failure to train
GC	Group command
GI	Group identification
HDLC	High level data link control
LCS	Line conditioning signals

MCF	Message confirmation
MPS	Multipage signal
NSC	Non-standard facilities command
NSF	Non-standard facilities
NSS	Non-standard facilities set-up
PACR	Phase A completion rate
PDD	Post dialling delay
PIN	Procedure interrupt negative
PIP	Procedure interrupt positive
PIS	Procedure interrupt signal
PPR	Partial page request
PPS	Partial page signal
PRI	Procedure interrupt
PSTN	Public switched telephone network
RNR	Receiver not ready
RTN	Retrain negative
RTP	Retrain positive