INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

T.4
Amendment 1
(07/97)

SERIES T: TERMINALS FOR TELEMATIC SERVICES

Standardization of Group 3 facsimile terminals for document transmission

Amendment 1

ITU-T Recommendation T.4 – Amendment 1

(Previously CCITT Recommendation)

ITU-T T-SERIES RECOMMENDATIONS

TERMINALS FOR TELEMATIC SERVICES

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION T.4

STANDARDIZATION OF GROUP 3 FACSIMILE TERMINALS FOR DOCUMENT TRANSMISSION

AMENDMENT 1

Summary

This Amendment covers the inclusion of capabilities to provide a secure communication mode and the capability to enable colour and gray-scale extension using lossless coding scheme defined in Recommendation T.43.

Source

Amendment 1 to ITU-T Recommendation T.4 was prepared by ITU-T Study Group 8 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 2nd of July 1997.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. 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, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had/had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

STANDARDIZATION OF GROUP 3 FACSIMILE TERMINALS FOR DOCUMENT TRANSMISSION

AMENDMENT 1

(Geneva, 1997)

The base text is Recommendation T.4 (07/1996)

1)   Amend 2.1 to read as follows:

"Optionally, colour and gray-scale images may be transmitted using Group 3 facsimile terminals as described in Annex E/T.4 (in lossy mode) and Annex G/T.4 (in lossless mode). A vertical resolution of 3.85 lines/mm is not supported by Annex E/T.4 and Annex G/T.4."

2)   Add the following new clauses to the end of Recommendation T.4:

"14   Secure communication mode

A capability to provide a secure communication mode is provided as a standardized option. There are two independent technical solutions for this option and these are defined in Annex G/T.30 and Annex H/T.30.

15   Lossless transmission mode of one bit per colour, palette-colour, continuous-tone colour and gray-scale images using Recommendation T.43

Lossless transmission of one bit per colour, palettized colour, continuous-tone colour and gray-scale image mode is an optional feature of Group 3. This mode is specified in Annex G/T.4."

3)   Amend E.6.1 to read as follows:

"E.6.1   Overview

The data stream is encoded for facsimile transfer using the Error Correction Mode (ECM) specified in Annex A/T.4 and Annex A/T.30. Pad characters (X'00', the null character) may be added after EOI within the last ECM frame of the page to complete the last frame, in alignment with Annex A/T.4."

4)   Add a new subclause E.6.9 to read as follows:

"E.6.9   Bit order of coded data transmission on the communication line

Arrangement of bit stream into octet sequence is defined in C.3/T.81.

Arrangement of octet sequence is defined in B.1.1.1/T.81.

The bit order of the coded JPEG data on the communication line is LSB first for each octet.

For example, the coded data stream for APP1 marker which is shown as an example in E.6.5 is transmitted following the bit order shown below on the communication line:

Coded data stream:

SOI	APP1	length	G	3	F	A	X	version 200 ppi
FF D8	FF E1	00 0C	47	33	46	41	58 00	07 CA 00 C8

Bit expression:

FF	D8	FF	E1	00	0C	47 ....
11111111	11011000	11111111	11100001	00000000	00001100	01000111 ...
MSB LSB	MSB LSB					

Bit order on the communication line:

First   last

| 11111111 | 00011011 | 11111111 | 10000111 | 00000000 | 00110000 | 11100010" |

5) *Add new Annex G to read as follows:*

"**Annex G**

Transmission of colour and gray-scale images using lossless coding scheme

G.1   Introduction

This Annex specifies the technical features of transmission of colour and gray-scale images using lossless coding scheme for Group 3 facsimile. This mode of operation supports lossless transmission of one bit per colour, palettized colour, and continuous-tone colour and gray-scale images. This Recommendation is an optional colour and gray-scale mode which shall only be implemented if the associated base colour and gray-scale mode defined in Annex E/T.4 is also implemented. Implementation of the gray-scale mode of Recommendation T.43 requires implementation of the associated gray-scale mode of Annex E/T.4. Similarly implementation of the colour mode of Recommendation T.43 requires implementation of the associated colour mode of Annex E/T.4.

The method for image encoding is based upon the colour space representation method in which Recommendations T.42 and T.43 are referred, and bit-plane decomposition and coding in which Recommendation T.43 is referred. Together, with Annex I/T.30, this Annex provides specification of the telecommunication protocol and coding for lossless transmission of colour, continuous-tone colour and gray-scale images via Group 3 facsimile service.

G.2   Definition of image type and mode of operation

G.2.1   Image types to be transmitted

Three image types are referred to in this Annex, namely, one bit per colour CMY(K)/RGB image, palettized colour image and continuous-tone colour and gray-scale image. These images are encoded by lossless coding scheme defined in Recommendation T.82 (JBIG). Colour representation bit-plane decomposition and coding methods of these images are defined in Recommendations T.43 and T.42.

G.2.1.1   One bit per colour CMY(K)/RGB image

This type of image is expressed by the precision of 1 bit/colour component using CMY(K) or RGB colour primaries. For this type of image, it is considered to be more desirable to map each colour onto one of primary colours of receiver's side, rather than trying to reproduce the original colour by sending the co-ordinates in CIELAB space. The detail specification for this mode such as colour transmission order is defined in Recommendation T.43.

In 1 bit/colour image using three or four primaries [CMY(K) or RGB], 8 or 16 kind of colours can be expressed. The colour representation is defined in Table 1-3/T.43. Encoders can encode using either 3 or 4 bit-planes, and decoders shall support both 3 and 4 bit-planes.

G.2.1.2 Palettized colour image

In this type of image, the colour image is expressed by colour indices of the palette-table, in which each entry is expressed by the combination of three values of CIELAB colour components defined in Recommendation T.42. The number of indices of palettized colour is classified into two classes, 12 bits or less indices and up to 16 bits indices. Each colour component value precision is also classified into two classes, 8 bits/component precision and 12 bits/component precision.

The resultant coding sub-mode of palettized colour image is classified into two classes by the combination of these two parameters. The first one is basic palettized colour sub-mode, in which the number of indices of palettized colour is 12 bits or less and colour co-ordinate precision is 8 bits/component. The other is the extended palettized sub-mode, in which either the number of indices of palettized colour is 13 to 16 bits and 8 bits/component precision table or 16 bits or less and 12 bits/component precision table. A more detailed specification for the palettized colour image is defined in Recommendation T.43.

G.2.1.3 Continuous-tone colour and gray-scale image

In this type of image, the colour image is represented by CIELAB colour space specified in Recommendation T.42, and the gray-scale image is represented by only L component of CIELAB colour space specified in Recommendation T.42. Two classes are specified for its data precision, 8 bits or less per component and 9 to 12 bits/component precision. In order to obtain high encoding efficiency, Gray-code conversion is applied for this type of image in bit-plane coding. Detailed coding specification for this type of image is defined in Recommendation T.43.

G.2.2 Image mode classification

As described above, the three types of image are further divided into seven coding sub-mode classes as shown in Table G.1/T.4.

Table G.1/T.4 – Image mode classification

Image type	Coding sub-mode class	Image specification	Number of bit-planes to be coded
One bit per colour image	One bit per colour image	One bit per colour image using RGB or CMY(K) primaries	CMY(K) image : 4 bit-planes CMY image : 3 bit-planes RGB image : 3 bit-planes
Palettized colour image	Basic palettized colour	Palettized image using 12 bits or less entries and 8 bits/comp. precision table	1 to 12 bit-planes (palette-table: up to 4096 entries 3 octets/entry)
	Extended palettized colour	Palettized image using 13 to 16 bits entries and 8 bits/comp. precision table or 16 bits or less entries and 12 bits/comp. precision table	13 to 16 bit-planes (palette-table: 4097 to 65 536 entries 3 octets/entries) "or 1 to 16 bit-planes (palette-table: up to 65 536 entries 6 octets/entry)"
Continuous-tone image	Colour 8 bits/comp. colour 12 bits/comp. colour	2-8 bits/comp. 9 to 12 bits/comp. colour image	2×3-8×3 bit-planes 9×3-12×3 bit-planes
	Gray-scale 8 bits gray-scale 12 bits gray-scale	2-8 bits 9 to 12 bits gray-scale image	2-8 bit planes 9-12 bit-planes

G.2.3 Coding mode classification

The information required to establish the availability of this mode of operation is transmitted in the DIS/DTC and DCS frames as specified in Annex I/T.30. Specifically, the choice of the data precision needs to be negotiated.

The gray-scale FAX terminals supporting the applications described in this Annex are classified into two classes. The lower class will support 8 bits precision, the higher class will support 12 bits precision. The lower class is the basic mode of this Recommendation. See Table G.2/T.4.

Table G.2/T.4 – Colour and gray-scale coding mode classification

Coding mode		Mode class	Supporting coding sub-mode classes
Gray-scale	8 bits	Basic and default	8 bits gray-scale image
	12 bits	Optional	8 bits gray-scale image 12 bits gray-scale image
Colour	8 bits	Optional	One bit per colour image Basic palettized colour image 8 bits gray-scale image 8 bits/comp. colour image
	12 bits	Optional	One bit per colour image Basic palettized colour image 8 bits gray-scale image 8 bits/comp. colour image Extended palette colour image 12 bits gray-scale image 12 bits/comp. colour image

The colour FAX terminals supporting the applications described in this Annex are classified into two classes. The lower class will support one bit per colour image (4 or 3 plane multi-colour image), 8 bits/component images in Lab, and also basic colour palettized images. The higher class has to support the lower class and 12 bits/component images and also extended palettized colour images.

The 8 bit gray-scale images are considered to be the special case of 8 bits/component colour, and the 12 bit gray-scale images are considered to be the special case of 12 bits/component colour. Therefore 8 bit gray-scale transmission is supported by the lower class colour terminals and also by the higher class colour terminals. Similarly 12 bit gray-scale transmission is supported by the higher class colour terminals.

G.2.4   Coding of the image description

The necessary image description to decode the image data is specified within the headers as specified in clause 7/T.43. Other information, such as the usage of Gray-code conversion, colour component sequence, are defined in Recommendation T.43. In addition, some information required to establish the availability of this service is transmitted as specified in Annex I/T.30. Specifically, the transfer of T.43 coded data, the use of gray-scale or colour and use of 8 or 12 bits/component/pel precision is negotiated and specified in the DIS/DTC and DCS frames as stated in Annex I/T.30.

G.3   Data format

Data format for this application is specified in Recommendation T.43.

The data stream of this extension should use the Error Correction Mode (ECM) specified in Annex A/T.4 and Annex A/T.30. Pad characters (X"00", the null character) may be added after EOI within the last ECM frame of the page to complete the last frame, in alignment with Annex A/T.4."

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