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TERMINAL EQUIPMENTS AND PROTOCOLS FOR TELEMATIC SERVICES

STANDARDIZATION OF GROUP 3 FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION

ITU-T Recommendation T.4

(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 T.4 was revised by the ITU-T Study Group VIII (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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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STANDARDIZATION OF GROUP 3 FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION

(Geneva, 1980; amended at Malaga-Torremolinos, 1984, Melbourne, 1988 and at Helsinki, 1993)

The CCITT,

considering

(a) that Recommendation T.2 refers to group 1 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately six minutes;

(b) that Recommendation T.3 refers to group 2 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately three minutes;

(c) that there is a demand for group 3 apparatus which enables an ISO A4 document to be transmitted over a telephone-type circuit in approximately one minute;

(d) that for a large number of applications black and white reproduction is sufficient;

(e) that such a service may be requested either alternatively with telephone conversation, or when either or both stations are not attended; in both cases, the facsimile operation will follow Recommendation T.30,

unanimously declares the view

that group 3 facsimile apparatus for use on the general switched telephone network, international leased circuits and integrated services digital network (ISDN) should be designed and operated according to the following standards.

1 Scanning track

The message area should be scanned in the same direction in the transmitter and receiver. Viewing the message area in a vertical plane, the picture elements should be processed as if the scanning direction were from left to right with subsequent scans adjacent and below the previous scan.

2 Dimensions of apparatus

NOTE – The tolerances on the factors of cooperation are subject to further study.

2.1 The following dimensions shall be used for ISO A4, ISO B4 and ISO A3:

a) a standard resolution of 3.85 line/mm ± 1% in vertical resolution;

b) optional higher resolution of 7.7 line/mm ± 1% and 15.4 line/mm ± 1% in vertical direction;

c) 1728 black and white picture elements along the standard scan line length of 215 mm ± 1%;

d) optionally, 2048 black and white picture elements along a scan line length of 255 mm ± 1%;

e) optionally, 2432 black and white picture elements along a scan line length of 303 mm ± 1%;

f) optionally, 3456 black and white picture elements along a scan line length of 215 mm ± 1%;

g) optionally, 4096 black and white picture elements along a scan line length of 255 mm ± 1%;

h) optionally, 4864 black and white picture elements along a scan line length of 303 mm ± 1%.

and, for equipment which provides A5 and/or A6 facilities:

i) optionally, 864 black and white picture elements along a scan line length of 107 mm ± 1%;

j) optionally, 1216 black and white picture elements along a scan line length of 151 mm ± 1%;

k) optionally, 1728 black and white picture elements along a scan line length of 107 mm ± 1%;

l) optionally, 1728 black and white picture elements along a scan line length of 151 mm ± 1%.

The normal method of interworking when transmitting from an A5 or A6 machine to an A4 machine not signalling such capabilities, is that the A5 or A6 content will be enlarged to fill the A4 page (see also Note 4). This means that if the document is then retransmitted, or if it has been stored for later retransmission, it will be received without additional reduction.

Where the full image contents being received from an A4 machine need to be maintained, k) or l) respectively should be used.

Interworking between equipments with A5/A6 and A4 facilities and between equipments with combinations of these facilities is shown in Table 1.

NOTES

1 In case of f), g) and h), those picture elements shall be used in combination with optional higher resolution of 15.4 line/mm ± 1% in vertical direction.

2 Cases i) to l) describe equipments which may be implemented singly or in any combination and would not, for A5/A6 facsimile equipments, require implementation of a) or b). These equipments may be implemented with cases different for sending and receiving.

3 In cases i) to l), 1728 pels will always be provided to the coder (see Table 1).

In cases i) and j), the additional pels required are produced by pel processing (i.e. either by picture processing or by adding white pels on each side of the central picture information) prior to coding.

4 It could be possible, by a setting on the A5/A6 transmitting machine, to send the document so that it is received equal size on an A4 machine not signalling such capabilities. In this case the vertical resolution will be 3.85 (or 7.7) line/mm. The user should be made aware that in this particular equal size case if the received copy is transmitted back to the A5/A6 machine the subsequent copy will be reduced.

5 Some Administrations may require that equipments using i) or j) dimensions, when working with a receiver not signalling such capabilities, insert a message e.g. “ISO A6” or “ISO A5”, as the case may be, into the picture at the transmitting side.

2.2 The following dimensions for inch based resolutions shall be used.

The optional inch based resolution requirements and their picture elements are given in Table 2. Specific values for the number of pels per line are given in Table 2 for all the group 3 resolutions for ISO A4, ISO B4 and ISO A3.

An alternative standard resolution of 200 pels/25.4 mm horizontally × 100 lines/25.4 mm vertically may be implemented provided that one or more of 200 × 200 pels/25.4 mm, 300 × 300 pels/25.4 mm and 400 × 400 pels/25.4 mm are included.

2.3 Input documents up to a minimum of ISO A4 size should be accepted.

NOTE – The size of the guaranteed reproductible area is shown in Appendix I.

3 Transmission time per total coded scan line

The total coded scan line is defined as the sum of data bits plus any required fill bits plus the end-of-line (EOL) bits.

For the optional two-dimensional coding scheme as described in 4.2, the total coded scan line is defined as the sum of data bits plus any required fill bits plus the EOL bits plus a tag bit.

To handle various printing methods, several optional minimum total coded scan line times are possible in addition to the 20 milliseconds standard.

TABLE 1/T.4

Interworking between equipments with A5/A6 and A4 facilities and between equipments with combinations of these facilities

Situation at transmission side				Terminal capabilities at reception side					
				Case from subclause 2.1	b)	e)	f)	g)	h)
				Horizontal resolution	1728 pels/ 215 mm	864 pels/ 107 mm	1216 pels/ 151 mm	1728 pels/ 107 mm	1728 pels/ 151 mm
				Vertical resolution	3.85 l/mm 7.7 l/mm	7.7 l/mm 15.4 l/mm	5.44 l/mm 10.9 l/mm	7.7 l/mm 15.4 l/mm	5.44 l/mm 10.9 l/mm
				Pel process	1728 Original	864 (≈ 1728 × 0.70) (Note 1)	1216 (≈ 1728 × 0.70) (Note 2)	1728 Original	1728 Original
Case from subclause 2.1	Horizontal resolution	Vertical resolution	Pel process	DIS-DTC→ DCS ↓	–	Bit 33 = 1 Bit 35 = 1	Bit 33 = 1 Bit 34 = 1	Bit 33 = 1 Bit 37 = 1	Bit 33 = 1 Bit 36 = 1
b)	1728 pels/ 215 mm	3.85 l/mm 7.7 l/mm	Original 1728	(Notes 1, 2) Bit 17 = 0 Bit 18 = 0 Bit 33 = 0	Equal (A4)	Reduced (A4 → A6)	Reduced (A4 → A5)	Reduced (A4 → A6)	Reduced (A4 → A5)
e)	864 pels/ 107 mm	7.7 l/mm 15.4 l/mm	864 × 2 (Note 1)		Enlarged (A6 → A4)	Equal (A6) (Note 1)	Enlarged (A6 → A5)	Equal (A6)	Enlarged (A6 → A5)
f)	1216 pels/ 151 mm	5.44 l/mm 10.9 l/mm	1216 × 1.42 (Note 2)		Enlarged (A5 → A4)	Reduced (A5 → A6)	Equal (A5) (Note 2)	Reduced (A5 → A6)	Equal (A5)
g)	1728 pels/ 107 mm	7.7 l/mm 15.4 l/mm	Original 1728		Enlarged (A6 → A4)	Equal (A6)	Enlarged (A6 → A5)	Equal (A6)	Enlarged (A6 → A5)
h)	1728 pels/ 151 mm	5.44 l/mm 10.9 l/mm	Original 1728		Enlarged (A5 → A4)	Reduced (A5 → A6)	Equal (A5)	Reduced (A5 → A6)	Equal (A5)

NOTES

1 Bit 33 = 1 Transmit pel process = 432(W) + 864 + 432(W)
Bit 35 = 1 Receive pel process extracts central 864 pels

2 Bit 33 = 1 Transmit pel process = 256(W) + 1216 + 256(W)
Bit 34 = 1 Receive pel process extracts central 1216 pels

(W) White pels
l Line

TABLE 2/T.4

Resolution (pels/25.4 mm)	Tolerance	Number of picture elements along a scan line		
		ISO A4	ISO B4	ISO A3
Horizontal 200 Vertical 200	± 1%	1728/219.46 mm	2048/260.10 mm	2432/308.86 mm
Horizontal 300 Vertical 300	± 1%	2592/219.46 mm	3072/260.10 mm	3648/308.86 mm
Horizontal 400 Vertical 400	± 1%	3456/219.46 mm	4096/260.10 mm	4864/308.86 mm
NOTE – The resolutions 200 × 200 pels/25.4 mm and 8 × 7.7 lines/mm can be considered as being equivalent. Similarly, the resolutions 400 × 400 pels/25.4 mm and 16 × 15.4 lines/mm can be considered also as being equivalent. Consequently, conversion between mm based terminals and inch based terminals is not required for the communications in these cases. However, communication between these resolutions will cause the distortion and the reduction of reproducible area.				

3.1 The minimum transmission times of the total coded scan line should conform to the following:

1) Alternative 1, where the minimum transmission time of the total coded scan line is the same both for the standard resolution and for the optional higher resolution:

   a) 20 milliseconds recommended standard;

   b) 10 milliseconds recognized option with a mandatory fall-back to the 20 milliseconds standard;

   c) 5 milliseconds recognized option with a mandatory fall-back to the 10 milliseconds option and the 20 milliseconds standard;

   d) 0 millisecond recognized option with a mandatory fall-back to the 5 milliseconds option, the 10 milliseconds option and the 20 milliseconds standard, and an optional fall-back to the 40 milliseconds option;

   e) 40 milliseconds recognized option.

2) Alternative 2, where the minimum transmission time of the total coded scan line for the optional higher resolution is half of that for the standard resolution (see Note). These figures refer to the standard resolution:

   a) 10 milliseconds recognized option with a mandatory fall-back to the 20 milliseconds standard;

   b) 20 milliseconds recommended standard;

   c) 40 milliseconds recognized option.

The identification and choice of this minimum transmission time is to be made in the pre-message (phase B) portion of Recommendation T.30 control procedure.

NOTE – Alternative 2 applies to equipment with printing mechanisms which achieve the standard vertical resolution by printing two consecutive, identical higher resolution lines. In this case, the minimum transmission time of the total coded scan line for the standard resolution is double the minimum transmission time of the total coded scan line for the higher resolution. The minimum transmission time for the optional resolutions of 15.4 lines/mm and 400 lines/25.4 mm can be a quarter of that for the standard resolution.

3.2 The maximum transmission time of any total coded scan line should be less than 5 seconds. When this transmission time exceeds 5 seconds, the receiver must proceed to disconnect the line.

3.3 Error correction mode

For the optional error correction mode, an HDLC frame structure is utilized to transmit the total coded scan line. This error correction mode is defined in Annex A.

4 Coding scheme

4.1 One-dimensional coding scheme

The one-dimensional run length coding scheme recommended for group 3 apparatus is as follows:

4.1.1 Data

A line of data is composed of a series of variable length code words. Each code word represents a run length of either all white or all black. White runs and black runs alternate. A total of 1728 picture elements represent one horizontal scan line of 215 mm length.

In order to ensure that the receiver maintains colour synchronization, all data lines will begin with a white run length code word. If the actual scan line begins with a black run, a white run length of zero will be sent. Black or white run lengths, up to a maximum length of one scan line (1728 picture elements or pels) are defined by the code words in Tables 3 and 4. The code words are of two types: terminating code words and make-up code words. Each run length is represented by either one terminating code word or one make-up code word followed by a terminating code word.

Run lengths in the range of 0 to 63 pels are encoded with their appropriate terminating code word. Note that there is a different list of code words for black and white run lengths.

Run lengths in the range of 64 to 1728 pels are encoded first by the make-up code word representing the run length which is equal to or shorter than that required. This is then followed by the terminating code word representing the difference between the required run length and the run length represented by the make-up code.

4.1.2 End-of-line (EOL)

This code word follows each line of data. It is a unique code word that can never be found within a valid line of data; therefore, resynchronization after an error burst is possible.

In addition, this signal will occur prior to the first data line of a page.

Format: 000000000001

4.1.3 Fill

A pause may be placed in the message flow by transmitting “fill”. Fill may be inserted between a line of data and an EOL, but never within a line of data. Fill must be added to ensure that the transmission time of data, fill and EOL is not less than the minimum transmission time of the total coded scan line established in the pre-message control procedure.

Format: variable length string of 0s.

4.1.4 Return to control (RTC)

The end of a document transmission is indicated by sending six consecutive EOLs. Following the RTC signal, the transmitter will send the post message commands in the framed format and the data signalling rate of the control signals defined in Recommendation T.30.

Format: 000000000001 000000000001
(total of 6 times)

Figures 1 and 2 clarify the relationship of the signals defined herein. Figure 1 shows several scan lines of data starting at the beginning of a transmitted page. Figure 2 shows the last coded scan line of a page.

The identification and choice of either the standard code table or the extended code table is to be made in the pre-message (phase B) portion of Recommendation T.30 control procedures.

TABLE 3/T.4

Terminating codes

White run length	Code word	Black run length	Code word
0	00110101	0	0000110111
1	000111	1	010
2	0111	2	11
3	1000	3	10
4	1011	4	011
5	1100	5	0011
6	1110	6	0010
7	1111	7	00011
8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100
11	01000	11	0000101
12	001000	12	0000111
13	000011	13	00000100
14	110100	14	00000111
15	110101	15	000011000
16	101010	16	0000010111
17	101011	17	0000011000
18	0100111	18	0000001000
19	0001100	19	00001100111
20	0001000	20	00001101000
21	0010111	21	00001101100
22	0000011	22	00000110111
23	0000100	23	00000101000
24	0101000	24	00000010111
25	0101011	25	00000011000
26	0010011	26	000011001010
27	0100100	27	000011001011
28	0011000	28	000011001100
29	00000010	29	000011001101
30	00000011	30	000001101000
31	00011010	31	000001101001
32	00011011	32	000001101010
33	00010010	33	000001101011
34	00010011	34	000011010010
35	00010100	35	000011010011
36	00010101	36	000011010100
37	00010110	37	000011010101
38	00010111	38	000011010110
39	00101000	39	000011010111
40	00101001	40	000001101100
41	00101010	41	000001101101
42	00101011	42	000011011010
43	00101100	43	000011011011
44	00101101	44	000001010100
45	00000100	45	000001010101
46	00000101	46	000001010110
47	00001010	47	000001010111
48	00001011	48	000001100100
49	01010010	49	000001100101
50	01010011	50	000001010010
51	01010100	51	000001010011
52	01010101	52	000000100100
53	00100100	53	000000110111
54	00100101	54	000000111000
55	01011000	55	000000100111
56	01011001	56	000000101000
57	01011010	57	000001011000
58	01011011	58	000001011001
59	01001010	59	000000101011
60	01001011	60	000000101100
61	00110010	61	000001011010
62	00110011	62	000001100110
63	00110100	63	000001100111

TABLE 3/T.4 *(cont.)*

Terminating codes

White run length	Code word	Black run length	Code word
64	11011	64	0000001111
128	10010	128	000011001000
192	010111	192	000011001001
256	0110111	256	000001011011
320	00110110	320	000000110011
384	00110111	384	000000110100
448	01100100	448	000000110101
512	01100101	512	0000001101100
576	01101000	576	0000001101101
640	01100111	640	0000001001010
704	011001100	704	0000001001011
768	011001101	768	0000001001100
832	011010010	832	0000001001101
896	011010011	896	0000001110010
960	011010100	960	0000001110011
1024	011010101	1024	0000001110100
1088	011010110	1088	0000001110101
1152	011010111	1152	0000001110110
1216	011011000	1216	0000001110111
1280	011011001	1280	0000001010010
1344	011011010	1344	0000001010011
1408	011011011	1408	0000001010100
1472	010011000	1472	0000001010101
1536	010011001	1536	0000001011010
1600	010011010	1600	0000001011011
1664	011000	1664	0000001100100
1728	010011011	1728	0000001100101
EOL	000000000001	EOL	000000000001

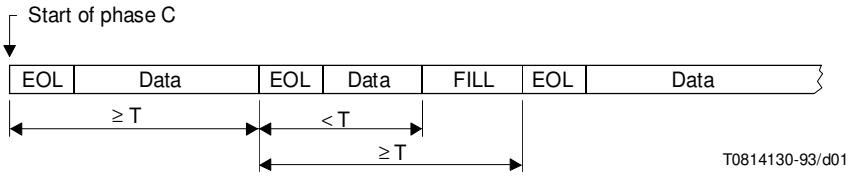
NOTE – It is recognized that machines exist which accommodate larger paper widths maintaining the standard horizontal resolution. This option has been provided for by the addition of the make-up code set defined in Table 4.

TABLE 4/T.4

Make-up codes

Run length (black and white)	Make-up codes
1792	00000001000
1856	00000001100
1920	00000001101
1984	000000010010
2048	000000010011
2112	000000010100
2176	000000010101
2240	000000010110
2304	000000010111
2368	000000011100
2432	000000011101
2496	000000011110
2560	000000011111

NOTE – Run lengths in the range of lengths longer than or equal to 2624 pels are coded first by the make-up code of 2560. If the remaining part of the run (after the first make-up code of 2560) is 2560 pels or greater, additional make-up code(s) of 2560 are issued until the remaining part of the run becomes less than 2560 pels. Then the remaining part of the run is encoded by terminating code or by make-up code plus terminating code according to the range as mentioned above.



T Minimum transmission time of a total coded scan line

FIGURE 1/T.4

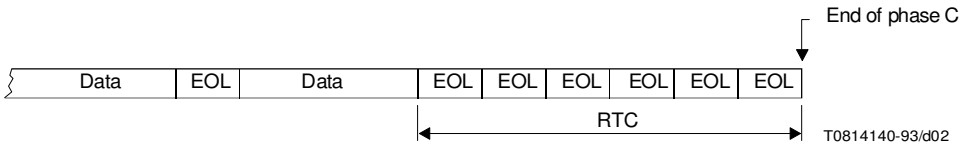


FIGURE 2/T.4

4.2 Two-dimensional coding scheme

The two-dimensional coding scheme is an optional extension of the one-dimensional coding scheme specified in 4.1 and is as follows:

4.2.1 Data

4.2.1.1 Parameter K

In order to limit the disturbed area in the event of transmission errors, after each line coded one-dimensionally, at most *K*-1 successive lines shall be coded two-dimensionally. A one-dimensionally coded line may be transmitted more frequently than every *K* lines. After a one-dimensional line is transmitted, the next series of *K*-1 two-dimensional lines is initiated. The maximum value of *K* shall be set as follows:

– Standard vertical resolution: $K = 2$

– Optional higher vertical resolution: $K = 4$.

NOTES

1 Some Administrations pointed out that for the optional higher vertical resolution *K* may optionally be set to a lower value.

2 Some Administrations reserve the right to approve only such apparatus for use in the facsimile service in their respective countries which will be able to produce a visible sign on its received facsimile message indicating that two-dimensional coding has been used in the transmission process.

4.2.1.2 One-dimensional coding

This conforms with the description of data in 4.1.1.

4.2.1.3 Two-dimensional coding

This is a line-by-line coding method in which the position of each changing picture element on the current or coding line is coded with respect to the position of a corresponding reference element situated on either the coding line or the reference line which lies immediately above the coding line. After the coding line has been coded it becomes the reference line for the next coding line.

4.2.1.3.1 Definition of changing picture elements (see Figure 3)

changing element: Element whose "colour" (i.e. black or white) is different from that of the previous element along the same scan line.

a_0 The reference or starting changing element on the coding line. At the start of the coding line a_0 is set on an imaginary white changing element situated just before the first element on the line. During the coding of the coding line, the position of a_0 is defined by the previous coding mode. (See 4.2.1.3.2.)

a_1 The next changing element to the right of a_0 on the coding line.

a_2 The next changing element to the right of a_1 on the coding line.

b_1 The first changing element on the reference line to the right of a_0 and of opposite colour to a_0.

b_2 The next changing element to the right of b_1 on the reference line.

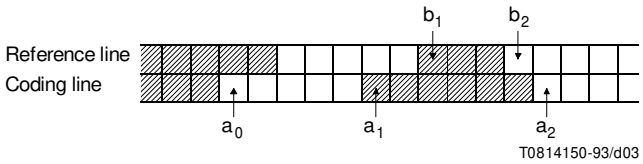


FIGURE 3/T.4

Changing picture elements

4.2.1.3.2 Coding modes

One of the three coding modes are chosen according to the coding procedure described in 4.2.1.3.3 to code the position of each changing element along the coding line. Examples of the three coding modes are given in Figures 4, 5 and 6.

a) *Pass mode*

This mode is identified when the position of b_2 lies to the left of a_1. When this mode has been coded, a_0 is set on the element of the coding line below b_2 in preparation for the next coding (i.e. on a'_0).

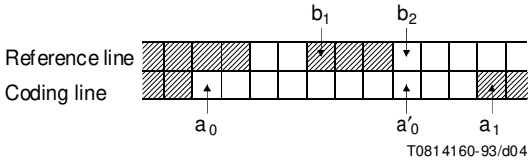


FIGURE 4/T.4

Pass mode

However, the state where b_2 occurs just above a_1, as shown in Figure 5 is not considered as a pass mode.

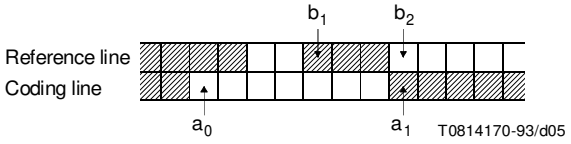


FIGURE 5/T.4

An example not corresponding to a pass mode

b) *Vertical mode*

When this mode is identified, the position of a_1 is coded relative to the position of b_1. The relative distance a_1b_1 can take on one of seven values V(0), $V_R(1)$, $V_R(2)$, $V_R(3)$, $V_L(1)$, $V_L(2)$ and $V_L(3)$, each of which is represented by a separate code word. The subscripts R and L indicate that a_1 is to the right or left respectively of b_1, and the number in brackets indicates the value of the distance a_1b_1. After vertical mode coding has occurred, the position of a_0 is set on a_1 (see Figure 6).

c) *Horizontal mode*

When this mode is identified, both the run-lengths a_0a_1 and a_1a_2 are coded using the code words H + M(a_0a_1) + M(a_1a_2). H is the flag code word 001 taken from the two-dimensional code table (Table 5). M(a_0a_1) and M(a_1a_2) are code words which represent the length and "colour" of the runs a_0a_1 and a_1a_2 respectively and are taken from the appropriate white or black one-dimensional code tables (Tables 3 and 4). After a horizontal mode coding, the position of a_0 is set on a_2 (see Figure 6).

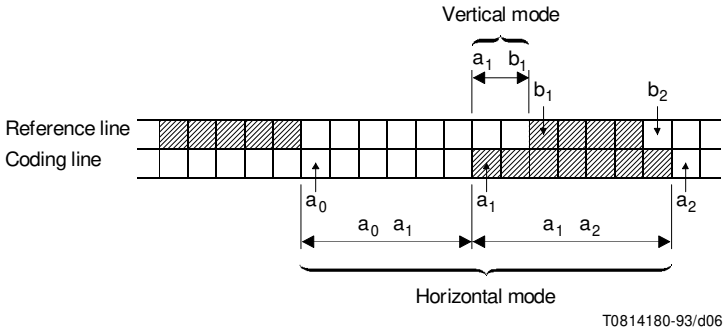


FIGURE 6/T.4

Vertical mode and horizontal mode

4.2.1.3.3 Coding procedure

The coding procedure identifies the coding mode that is to be used to code each changing element along the coding line. When one of the three coding modes has been identified according to step 1 or step 2 mentioned below, an appropriate code word is selected from the code table given in Table 5. The coding procedure is as shown in the flow diagram of Figure 7.

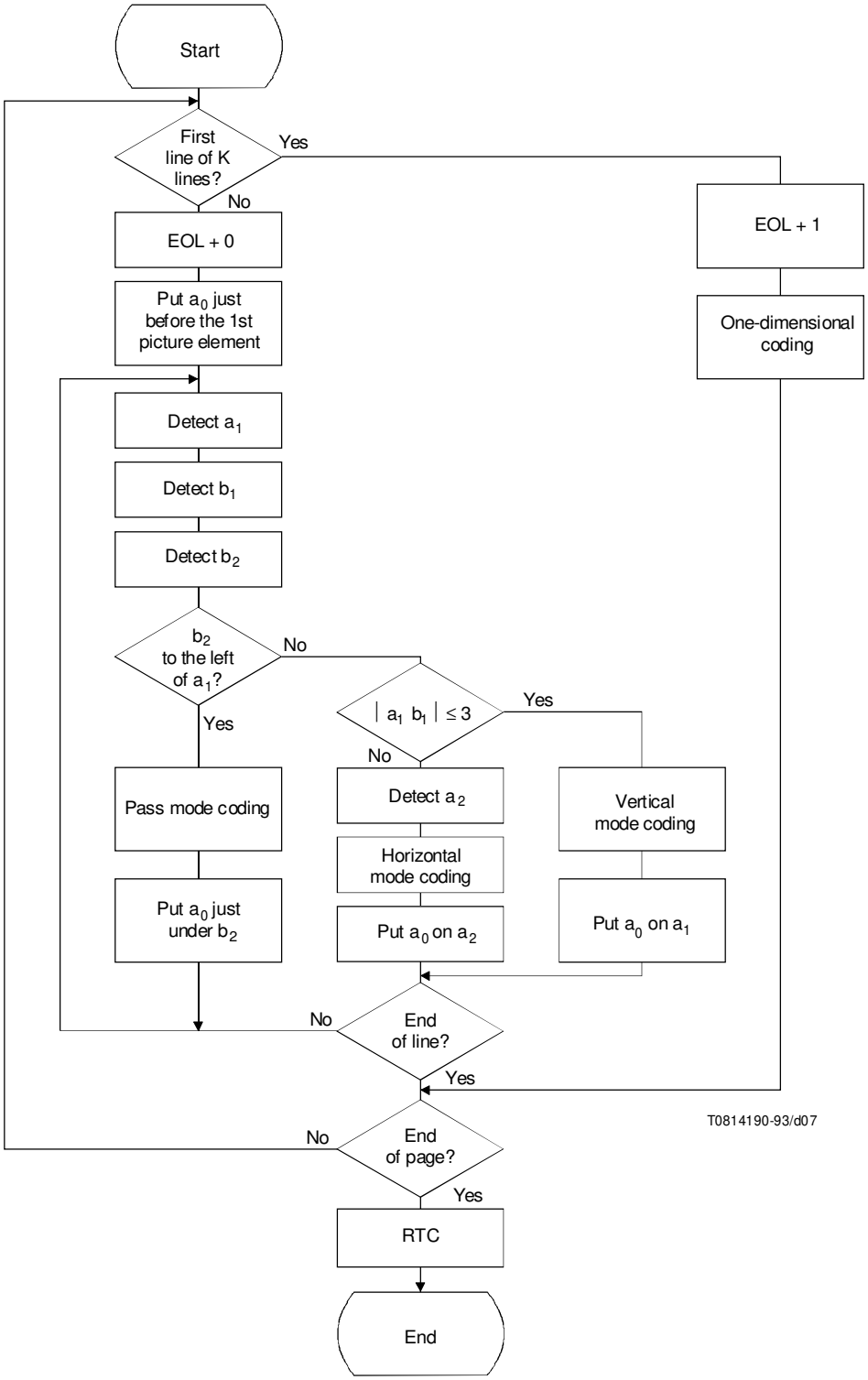


FIGURE 7/T.4

Two-dimensional coding flow diagram

NOTE – It does not affect compatibility to restrict the use of pass mode in the encoder to a single pass mode. Variations of the algorithm which do not affect compatibility should be the subject of further study.

Step 1

i) If a pass mode is identified, this is coded using the word 0001 (Table 5). After this processing, picture element a'_0 just under b_2 is regarded as the new starting picture element a_0 for the next coding (see Figure 4).

ii) If a pass mode is not detected then proceed to step 2.

Step 2

i) Determine the absolute value of the relative distance a_1b_1.

ii) If $|a_1b_1| \leq 3$, as shown in Table 5, a_1b_1 is coded by the vertical mode, after which position a_1 is regarded as the new starting picture element a_0 for the next coding.

iii) If $|a_1b_1| > 3$, as shown in Table 5, following horizontal mode code 001, a_0a_1 and a_1a_2 are respectively coded by one-dimensional coding. After this processing position a_2 is regarded as the new starting picture element a_0 for the next coding.

TABLE 5/T.4

Two-dimensional code table

Mode	Elements to be coded		Notation	Code word
Pass	b_1, b_2		P	0001
Horizontal	a_0a_1, a_1a_2		H	001 + M(a_0a_1) + M(a_1a_2) (see Note 1)
Vertical	a_1 just under b_1	$a_1b_1 = 0$	V(0)	1
	a_1 to the right of b_1	$a_1b_1 = 1$	$V_R(1)$	011
		$a_1b_1 = 2$	$V_R(2)$	000011
		$a_1b_1 = 3$	$V_R(3)$	0000011
	a_1 to the left of b_1	$a_1b_1 = 1$	$V_L(1)$	010
		$a_1b_1 = 2$	$V_L(2)$	000010
		$a_1b_1 = 3$	$V_L(3)$	0000010
Extension	2-D (extensions) 1-D (extensions)			0000001xxx 000000001xxx (see Note 2)

NOTES

1 Code M() of the horizontal mode represents the code words in Tables 3 and 4.

2 It is suggested the uncompressed mode is recognized as an optional extension of two-dimensional coding scheme for group 3 apparatus. The bit assignment for the xxx bits is 111 for the uncompressed mode of operation whose code table is given in Table 6.

3 Further study is needed to define other unspecified xxx bit assignments and their use for any further extensions.

4 If the suggested uncompressed mode is used on a line designated to be one-dimensionally code, the coder must not switch into uncompressed mode following any code word ending in the sequence 000. This is because any code word ending in 000 followed by a switching code 000000001will be mistaken for an end-of-line code.

TABLE 6/T.4

Uncompressed mode code words

Entrance code to uncompressed mode	On one-dimensionally coded line: 000000001111 On two-dimensionally coded line: 0000001111	
Uncompressed mode code	Image pattern 1 01 001 0001 00001 00000	Code word 1 01 001 0001 00001 000001
Exit from uncompressed mode code	 0 00 000 0000	0000001T 00000001T 000000001T 0000000001T 00000000001T
T denotes a tag bit which tells the colour of the next run (black = 1, white = 0).		

4.2.1.3.4 Processing the first and last picture elements in a line

a) *Processing the first picture element*

The first starting picture element a_0 on each coding line is imaginarily set at a position just before the first picture element, and is regarded as a white picture element (see 4.2.1.3.1).

The first run length on a line a_0a_1 is replaced by $a_0a_1 - 1$. Therefore, if the first run is black and is deemed to be coded by horizontal mode coding, then the first code word $M(a_0a_1)$ corresponds to a white run of zero length (see Figure 10, example 5).

b) *Processing the last picture element*

The coding of the coding line continues until the position of the imaginary changing element situated just after the last actual element has been coded. This may be coded as a_1 or a_2. Also, if b_1 and/or b_2 are not detected at any time during the coding of the line, they are positioned on the imaginary changing element situated just after the last actual picture element on the reference line.

4.2.2 Line synchronization code word

To the end of every coded line is added the end-of-line (EOL) code word 000000000001. The EOL code word is followed by a single tag bit which indicates whether one- or two-dimensional coding is used for the next line.

In addition, EOL plus the tag bit 1 signal will occur prior to the first data line of a page.

Format:

EOL + 1: one-dimensional coding of next line

EOL + 0: two-dimensional coding of next line

4.2.3 Fill

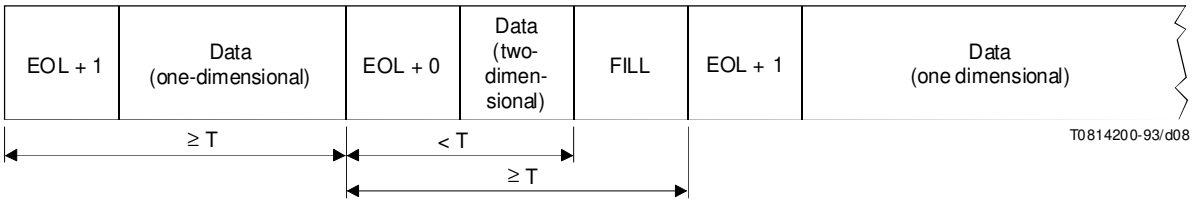
Fill is inserted between a line of data and the line synchronization signal, EOL + tag bit, but is not inserted in data. Fill must be added to ensure that the transmission time of data, fill and EOL plus tag bit is not less than the minimum transmission time of the total coded scan line.

Format: variable length string of 0s.

4.2.4 Return to control (RTC)

The format used is six consecutive line synchronization code words, i.e. 6 × (EOL + 1).

To further clarify the relationship of the signals defined herein, Figures 8 and 9 are offered in the case of K = 2. Figure 8 shows several scan lines of data starting at the beginning of a transmitted page. Figure 9 shows the last several lines of a page.



T Minimum transmit time of a total coded scan line

FIGURE 8/T.4

Message transmission (first part of page)

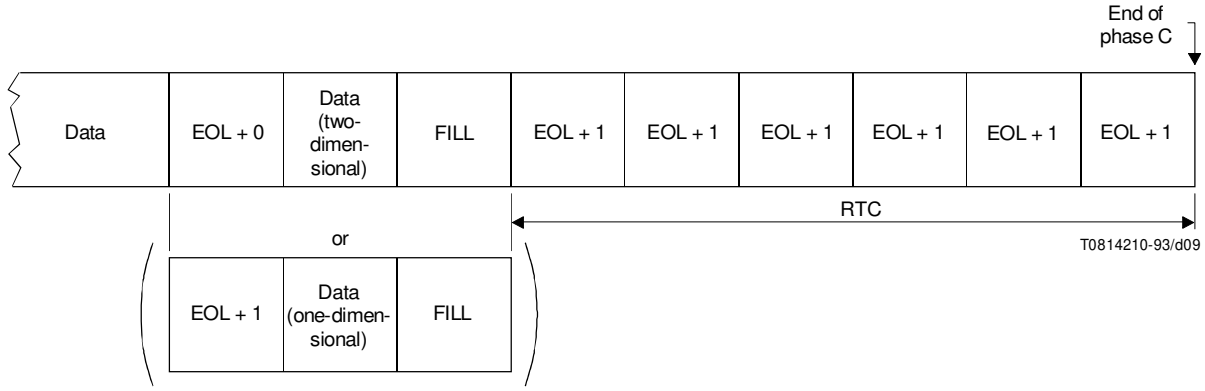


FIGURE 9/T.4

Message transmission (last part of page)

4.2.5 Coding examples

Figure 10 shows coding examples of the first part of scan lines and Figure 11 coding examples of the last part, while Figure 12 shows other coding examples. The notations P, H and V in the figures are, as shown in Table 5, the symbols for pass mode, horizontal mode and vertical mode respectively. The picture elements marked with black spots indicate the changing picture elements to be coded.

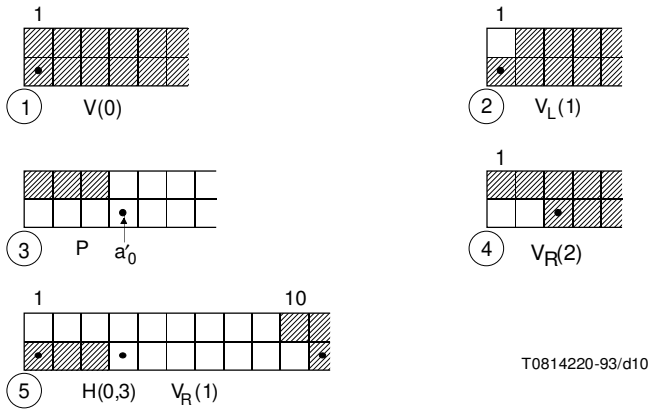


FIGURE 10/T.4

Coding examples: first part of scan line

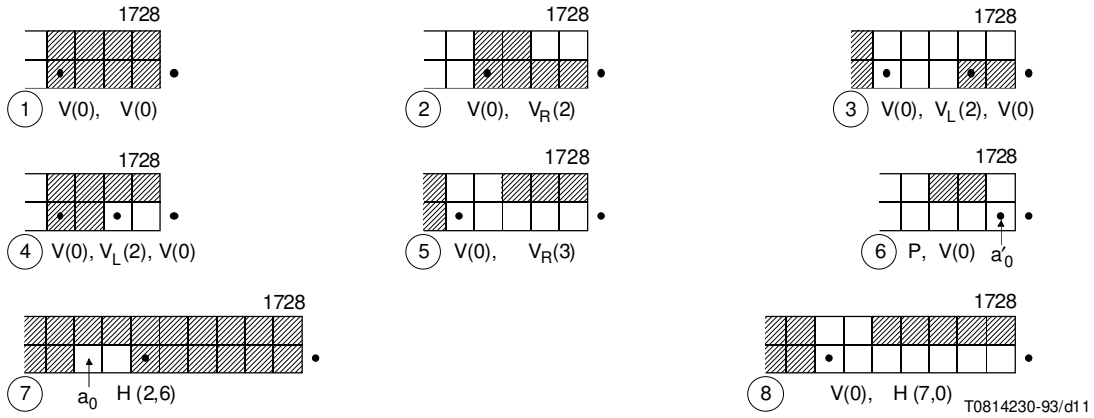


FIGURE 11/T.4

Coding examples: last part of scan line

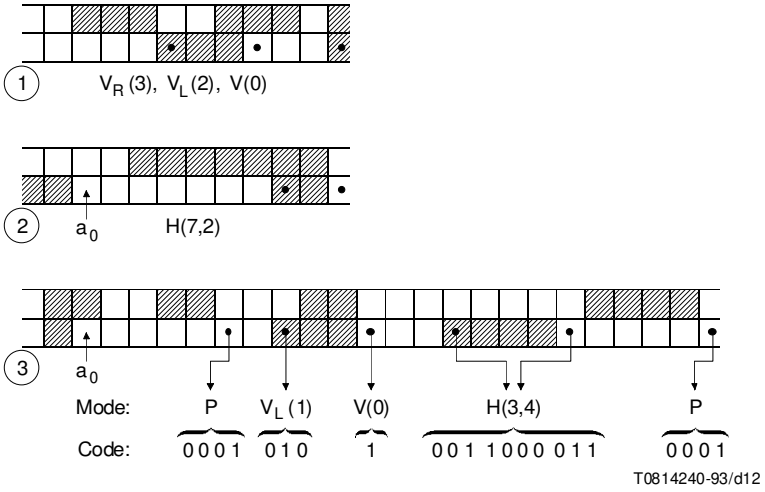


FIGURE 12/T.4

Coding examples

4.3 Extended two-dimensional coding scheme

The basic facsimile coding scheme specified in 2.2/T.6 may be used as an option in group 3 facsimile. This coding scheme is limited to the use of the error correction mode specified in 3.3.

4.4 Error limiting mode

One-dimensional coding scheme with the division of scan line into parts.

The one-dimensional coding scheme with the division of scan line into parts is an optional extension of the one-dimensional coding scheme specified in Annex B.

5 Modulation and demodulation

Group 3 apparatus operating on the general switched telephone network shall utilize the modulation, scrambler, equalization and timing signals defined in 2, 3, 7, 8, 9, 11/V.27 *ter* and in the Appendix I/V.27 *ter*.

5.1 The training signal to be used shall be the long training sequence with protection against talker echo (see 2.5.1/V.27 *ter* and Table 3/V.27 *ter*).

5.2 The data signalling rates to be used are 4800 bit/s and 2400 bit/s as defined in Recommendation V.27 *ter*.

NOTES

1 Some Administrations pointed out that it would not be possible to guarantee the service at a data signalling rate higher than 2400 bit/s.

2 It should be noted that there are equipments in service using, *inter alia*, other modulation methods.

3 When quality of communication service can successfully support higher speed operation, such as may be possible on leased circuits or high-quality switched circuits, group 3 apparatus may optionally utilize the modulation, scrambler, equalization and timing signals defined in Recommendations V.29, V.33 and V.17. For Recommendation V.29 this specifically refers to 1, 2, 3, 4, 7, 8, 9, 10 and 11. Under this option the data should be non-multiplexed and limited to the data signalling rates of 9600 bit/s and 7200 bit/s. For Recommendation V.33 this specifically refers to 1, 2, 3, 4, 7 and 8. Under this option the data should be non-multiplexed. For Recommendation V.17 this specifically refers to 1 through 5.

4 When V.33 signalling is used the training signal shall be preceded by a talker echo protection signal. The talker echo protection signal shall consist of an unmodulated carrier for a duration of 185 ms to 200 ms followed by a silent period of 20 to 25 ms.

5 When V.17 signalling is used the training signal shall include the talker echo protection (TEP) signal defined in 5.3/V.17.

6 Power at the transmitter output

The average power should be adjustable from –15 dBm to 0 dBm but the equipment should be so designed that there is no possibility of this adjustment being tampered with by an operator.

NOTE – The power levels over the international circuits will conform to Recommendation V.2.

7 Power at the receiver input

The receiving apparatus should be capable of functioning correctly when the received signal level is within the range of 0 dBm to –43 dBm. No control of receiver sensitivity should be provided for operator use.

8 Implementation of apparatus

Although paper sizes are referred to, this does not always require a physical paper scanner and/or printer to be implemented. Details may be defined by Administrations.

If the message is not generated from a physical scanner or displayed on paper, then the signals appearing across the network interface shall be identical to those which would be generated if paper input and/or output had been implemented.

9 File transfer for group 3

File transfer is an optional feature of group 3 which permits to transmit any data file with or without additional information concerning the file to be transmitted, by using error correction mode specified in Annex A and in Annex A/T.30.

This file transfer is defined in Annex C.

10 Character mode of group 3

Character mode is an optional feature of group 3 which permits to transmit character coded documents, by using error correction mode specified in Annex A and in Annex A/T.30.

This character mode is defined in Annex D.

11 Mixed mode for group 3

Mixed mode is an optional feature of group 3 which permits to transmit pages containing both character coded and facsimile coded information, by using error correction mode specified in Annex A and in Annex A/T.30.

This mixed mode is defined in Annex E.

12 64 kbit/s option for group 3

For group 3 facsimile, a capability to operate at a rate of 64 kbit/s over the integrated services didital network (ISDN) is provided as a standardized option. There are two technical solutions for this option. One, based on G4 class 1 protocol, is defined in Annex F and called group 3 64 kbit/s option F (G3F) which interworks with G4 class 1 terminals directly. The other, based upon T.30 ECM protocol, is defined in Annex C/T.30 and called group 3 64 kbit/s option C (G3C) which does not interwork directly with G4 class 1/G3F.

NOTE – Interworking between G3C terminals and G3F/G4 terminals may be provided by multiple mode terminals using the procedure defined in Annex F/T.90. The capability of group 3 terminals using the protocol defined in Annex C/T.30 to interwork directly with group 4 terminals is the subject of an urgent study under Question E/VIII.

Annex A

Optional error correction mode

(This annex forms an integral part of this Recommendation)

A.1 Introduction

This annex specifies the message format required for document transmission incorporating the optional error correction capability.

A.2 Definitions

The definitions contained in this Recommendation and in Recommendation T.30 shall be applied unless explicitly amended.

A.3 Message format

An HDLC frame structure is utilized for all binary coded facsimile message procedures. The basic HDLC structure consists of a number of frames each of which is subdivided into a number of fields. It provides for frame labelling and error checking.

Specific examples are given in Figures A.1 and A.2 of formats used for binary coded signalling. These examples show an initial partial page (PP) frame structure and a last PP frame structure.

In the following descriptions of the fields, the order in which the bits are transmitted is from the most to the least significant bit, i.e. from left to right as printed. The exception to this is the frame number (see A.3.6.1).

The equivalent between binary notation symbols and the significant condition of the signalling code should be in accordance with Recommendation V.1.

A.3.1 Synchronization

A synchronization sequence shall precede all binary coded information whenever a new transmission begins. The synchronization shall be a training sequence and a series of flag sequences for nominal 200 ms, tolerance + 100 ms.

NOTE – Continuous flags have two zeros as shown in the following diagram:

. . . 0111 1110 0111 1110 0111 1110 . . .

A.3.2 Flag sequence (F)

The eight bit HDLC flag sequence is used to denote the beginning and end of the frame for the facsimile message procedure. The flag sequence is also used to establish bit and frame synchronization. To facilitate this the synchronization defined in A.3.1 should be used prior to the first frame. Subsequent frames and end of the last frame need one or more than one flag sequence.

Format: 0111 1110

NOTE – The leading flag of a frame may be the trailing flag of the previous frame.

A.3.3 Address field (A)

The eight bit HDLC address field is intended to provide identification of specific station(s) in a multi-point arrangement. In the case of transmission on the general switched telephone network, this field is limited to a single format.

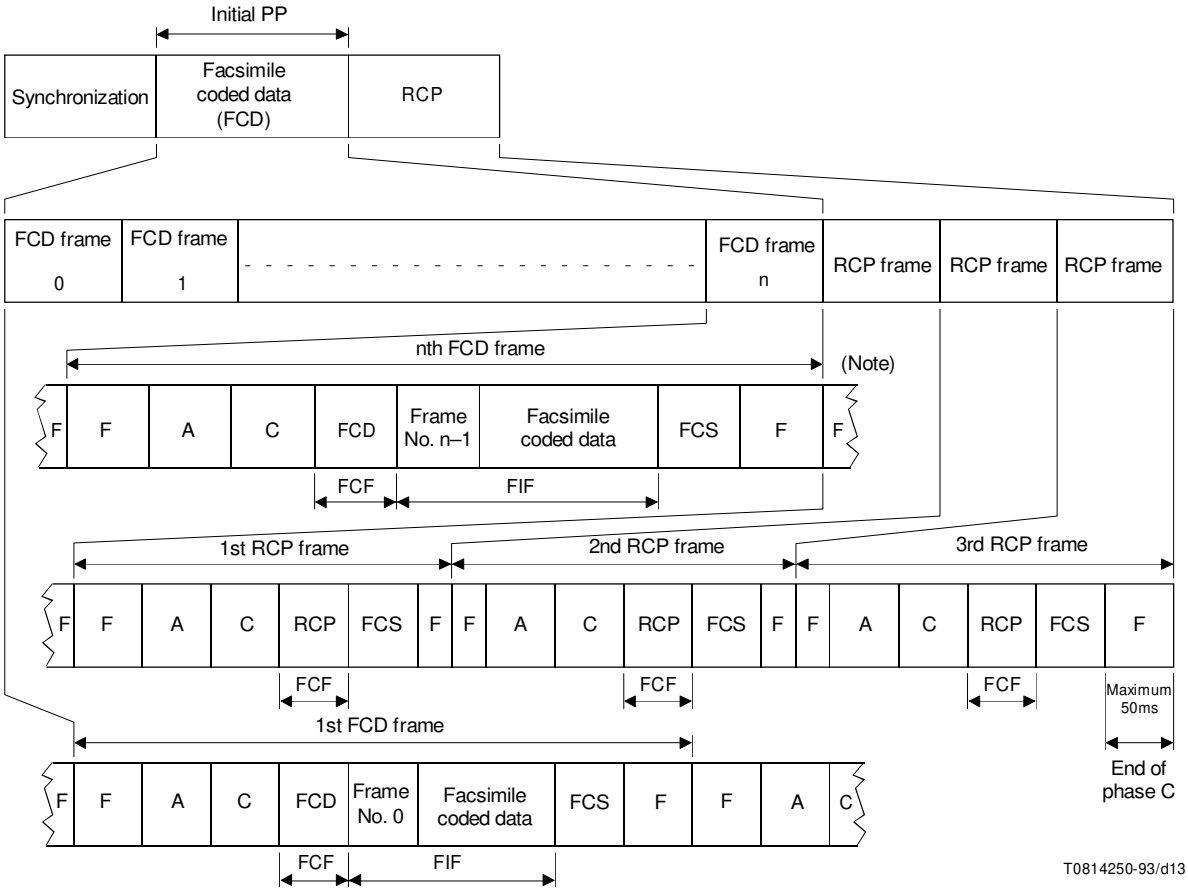
Format: 1111 1111

A.3.4 Control field (C)

The eight bit HDLC control field provides the capability of encoding the command unique to the facsimile message procedure.

Format: 1100 X000

The X bit is set to 0 for the FCD frame (facsimile coded data frame) and the RCP frame (return to control for partial page frame).



NOTE – See A.3.2.

FIGURE A.1/T.4

Initial partial page (PP) frame structure

A.3.5 Facsimile control field (FCF)

In order to distinguish between the FCD frame (facsimile coded data frame) and the RCP frame (return to control for partial page frame), the FCF for the in-message procedure is defined as follows:

1) FCF for the FCD frame

   Format: 0110 0000

2) FCF for the RCP frame

   Format: 0110 0001

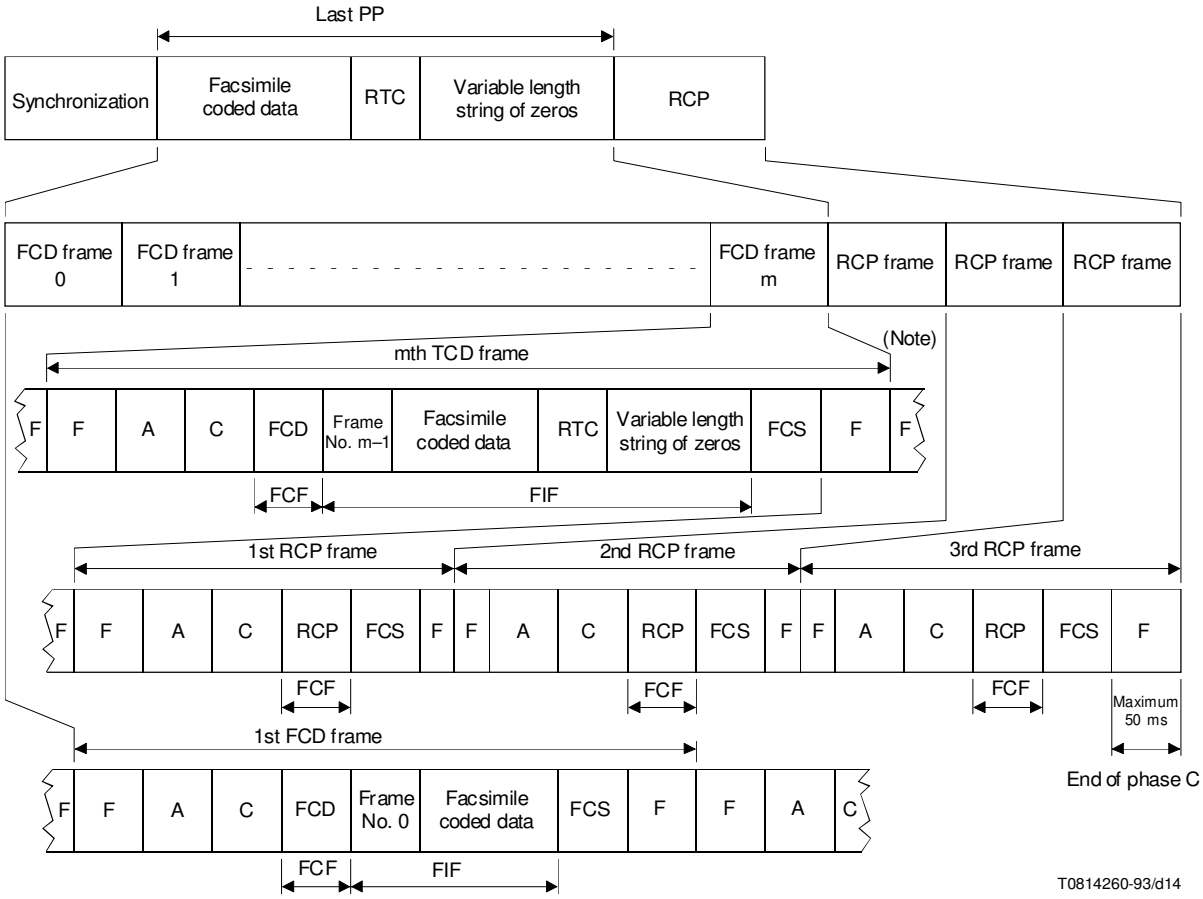
A.3.6 Facsimile information field (FIF)

The facsimile information field is a length of 257 or 65 octets (see Note 1) and is divided into two parts, the frame number and the facsimile data field (see Note 2).

NOTES

1 This does not include bit stuffing to preclude non-valid flag sequences.

2 There is no information field in the RCP frame.



NOTE – See A.3.2.

FIGURE A.2/T.4

Last partial page (PP) frame structure

A.3.6.1 Frame number

This is an eight bit binary number. The frame number is defined to be the first eight bits of the facsimile information field. The least significant bit is transmitted first.

The frame number 0-255 (maximum number is 255) is used to identify the facsimile data field (see Annex A/T.30).

The frame 0 is transmitted first in each block.

A.3.6.2 Facsimile data field

The coding schemes specified in 4 are valid with the following notes.

1) The facsimile data field is a length of 256 or 64 octets.

2) The total coded scan line is defined as the sum of data bits plus the EOL bits. For the optional two-dimensional coding scheme as described in 4.2, the total coded scan line is defined as the sum of data bits plus the EOL bits plus a tag bit.

3) At the end of facsimile data field, if necessary, pad bits may be used to align on octet boundaries and frame boundaries (see Notes 1 and 2). The format is a variable length string of zeros.

NOTES

1 The receiver is able to receive both pad bits and fill bits.

2 The facsimile data field length of the final frame including RTC signal may be less than 256 or 64 octets.

A.3.7 Frame checking sequence (FCS)

The FCS shall be a 16 bit sequence (see 5.3.7/T.30).

A.3.8 Return to control for partial page (RCP)

The end of a partial page transmission is indicated by sending three consecutive RCP frames (see Note).

Following these RCP frames, the transmitter will send the post message commands in the framed format and the data signalling rate of the control signals defined in Annex A/T.30.

NOTE – The flag sequence following the last RCP frame shall be less than 50 ms.

Annex B

Optional error limiting mode

(This annex forms an integral part of this Recommendation)

NOTE – The text of Annex B shall be refined and studied during the next study period.

B.1 Data

B.1.1 The division of a scan line into parts

In order to limit the disturbed area in the event of transmission error, the scan lines are divided into parts before coding.

The number of parts shall be used as follows:

a) standard, 12 parts in a line composed of 1728 black and white picture elements;

b) optionally, 15 parts in a line composed of 2048 black and white picture elements;

c) optionally, 17 parts in a line composed of 2432 black and white picture elements.

NOTE – For alternatives b) and c), the last part of a scan line can be shortened and then will contain 32 and 128 pels respectively.

B.1.2 Scan line coding

All parts of a scan line are divided into whites (W) if they are composed of all white picture elements and not-white (NW) if they contain at least one black element.

The coding procedure is as shown in the flow diagram of Figure B.1.

B.1.2.1 Shaping the extended description of a scan line

For each coded scan line the extended scan line description (ELD) is shaped. ELD represents a sequence, where the bit number is equal to the part number in a scan line, i.e. each part has corresponding bit in the sequence. This bit is equal to "1", if the part is "NW" and it is equal to "0" if the part is "W".

B.1.2.2 Scan line part coding

W-parts are not encoded. The coding of each NW-part is independent of the coding of other parts in the given scan line. In the NW-part the white and black runs alternate. The coding always begins with a white run. If the actual scan line begins with a black run then a white run length of zero will be sent. Run lengths are encoded using Table B.2. The last run of each NW-part is not encoded. Resulted coded run lengths (CRL) are sent directly one after another.

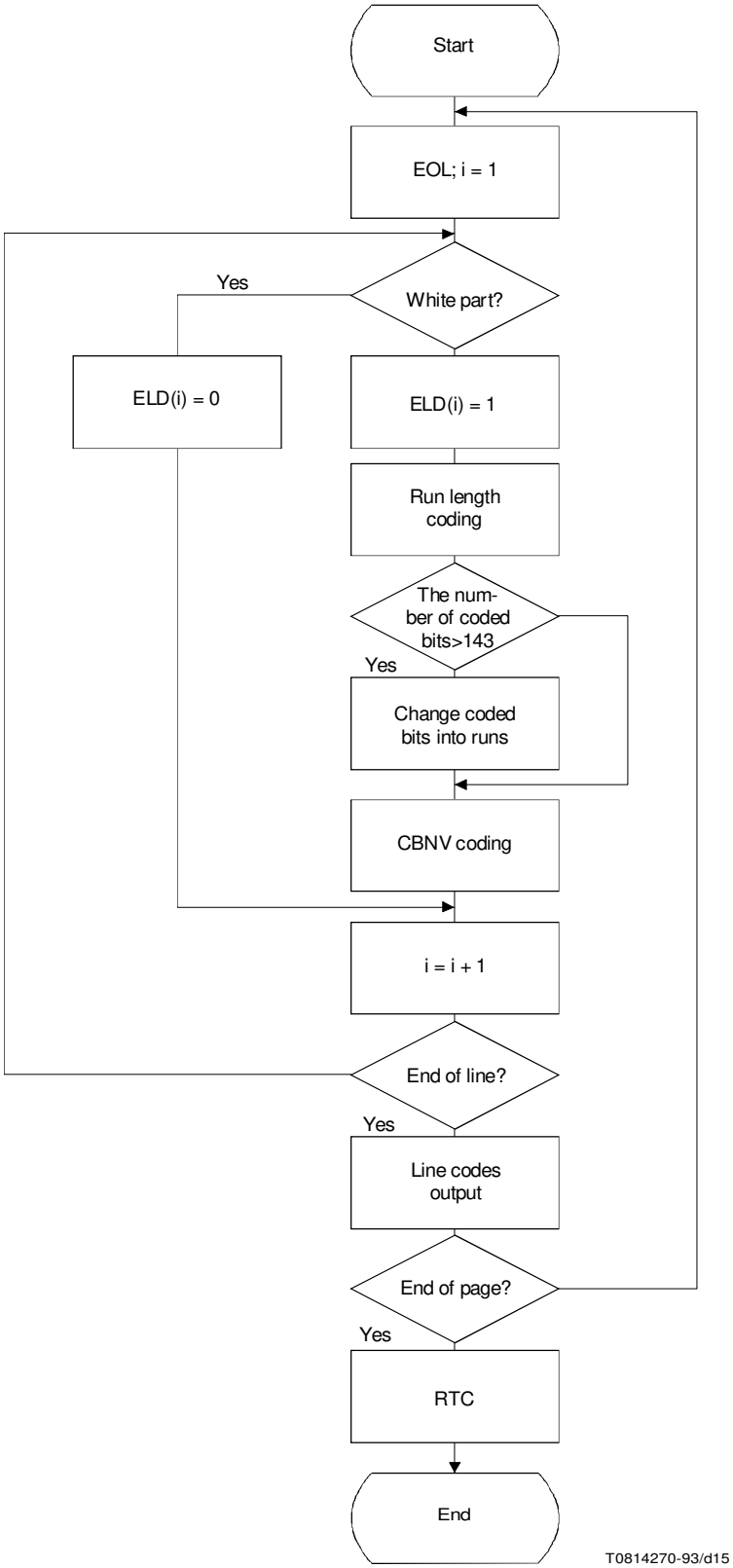

Start
EOL; i = 1
White part?
Yes
ELD(i) = 0
ELD(i) = 1
Run length coding
The num-ber of coded bits>143
Yes
Change coded bits into runs
CBNV coding
i = i + 1
End of line?
Yes
Line codes output
End of page?
Yes
RTC
End
T0814270-93/d15

FIGURE B.1/T.4

B.1.2.3 Code bit number variation (CBNV)

It is necessary to code and send the number of coded bits for each NW-part. For this purpose the code bit number of the previous NW-part q_{i-1} is subtracted from the code bit number of the given NW-part q_i. The resulting difference $q_i - q_{i-1}$ is coded by using code words listed in Table B.1. For the first NW-part in a scan line q_0 is taken to be 40. In the code words given in Table B.1 the bit X corresponds to the sign of the difference $q_i - q_{i-1}$. When the difference is positive, bit X equals "0", but when the difference is negative bit X equals "1". If the sum q_i appears to be more than 143, run length encoding will be stopped and this part will be sent directly without coding and the value q_i is taken to be 144.

B.1.3 Data format

The data format for the scan line containing several NW-parts is shown in Figure B.2 and containing only one NW-part is shown in Figure B.3. The data format for the scan line containing all whites is shown in Figure B.4.

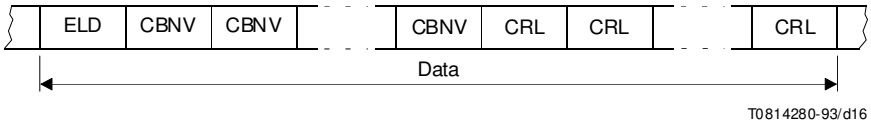


FIGURE B.2/T.4

Data format for the scan line containing several NW-parts

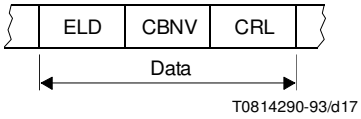


FIGURE B.3/T.4

Data format for the scan line containing one NW-part

FIGURE B.4/T.4

Data format for the scan line containing 1728 white picture elements

TABLE B.1/T.4

Code table for the code bit number variation

Absolute value of variation	Code	Absolute value of variation	Code
0	100000	51	X11111 010101
1	X00001	52	X11111 010110
2	X00010	53	X11111 010111
3	X00011	54	X11111 011000
4	X00100	55	X11111 011001
5	X00101	56	X11111 011010
6	X00110	57	X11111 011011
7	X00111	58	X11111 011100
8	X01000	59	X11111 011101
9	X01001	60	X11111 011110
10	X01010	61	X11111 100000
11	X01011	62	X11111 100001
12	X01100	63	X11111 100010
13	X01101	64	X11111 100011
14	X01110	65	X11111 100100
15	X01111	66	X11111 100101
16	X10000	67	X11111 100110
17	X10001	68	X11111 100111
18	X10010	69	X11111 101000
19	X10011	70	X11111 101001
20	X10100	71	X11111 101010
21	X10101	72	X11111 101011
22	X10110	73	X11111 101100
23	X10111	74	X11111 101101
24	X11000	75	X11111 101110
25	X11001	76	X11111 101111
26	X11010	77	X11111 110000
27	X11011	78	X11111 110001
28	X11100	79	X11111 110010
29	X11101	80	X11111 110011
30	X11110	81	X11111 110100
		82	X11111 110101
31	X11111 000001	83	X11111 110110
32	X11111 000010	84	X11111 110111
33	X11111 000011	85	X11111 111000
34	X11111 000100	86	X11111 111001
35	X11111 000101	87	X11111 111010
36	X11111 000110	88	X11111 111011
37	X11111 000111	89	X11111 111100
38	X11111 001000	90	X11111 111101
39	X11111 001001	91	X11111 111110
40	X11111 001010	92	X11111 X11111 000001
41	X11111 001011	93	X11111 X11111 000010
42	X11111 001100	94	X11111 X11111 000011
43	X11111 001101	95	X11111 X11111 000100
44	X11111 001110	96	X11111 X11111 000101
45	X11111 001111	97	X11111 X11111 000110
46	X11111 010000	98	X11111 X11111 000111
47	X11111 010001	99	X11111 X11111 001000
48	X11111 010010	100	X11111 X11111 001001
49	X11111 010011	101	X11111 X11111 001010
50	X11111 010100	102	X11111 X11111 001011

TABLE B.1/T.4 *(cont.)*

Code table for the code bit number variation

Absolute value of variation	Code	Absolute value of variation	Code
103	X11111 X11111 001100	119	X11111 X11111 011100
104	X11111 X11111 001101	120	X11111 X11111 011101
105	X11111 X11111 001110	121	X11111 X11111 011110
106	X11111 X11111 001111	122	X11111 X11111 100000
107	X11111 X11111 010000	123	X11111 X11111 100001
108	X11111 X11111 010001	124	X11111 X11111 100010
109	X11111 X11111 010010	125	X11111 X11111 100011
110	X11111 X11111 010011	126	X11111 X11111 100100
111	X11111 X11111 010100	127	X11111 X11111 100101
112	X11111 X11111 010101	128	X11111 X11111 100110
113	X11111 X11111 010110	129	X11111 X11111 100111
114	X11111 X11111 010111	130	X11111 X11111 101000
115	X11111 X11111 011000	131	X11111 X11111 101001
116	X11111 X11111 011001	132	X11111 X11111 101010
117	X11111 X11111 011010	133	X11111 X11111 101011
118	X11111 X11111 011011	134	X11111 X11111 101100
		135	X11111 X11111 101101
		136	X11111 X11111 101110
		137	X11111 X11111 101111
		138	X11111 X11111 110000
		139	X11111 X11111 110001
		140	X11111 X11111 110010

NOTE – Bit X corresponds to the sign of the variation.

B.2 End of line (EOL)

This code word follows each line of data. There is a slight probability of occurrence of the same bit combination for ELD and the code word EOL. This should be taken account in the decoding algorithm. In addition, EOL is sent prior to the format data line of the page.

Format: 000000000001

B.3 Fill

A pause in the message may be filled as described in 4.1.3.

B.4 Return to control (RTC)

The return to control should comply with 4.1.4.

NOTE – When decoding, the correction of the corrupted parts can be performed by replacing the corrupted part with the corresponding uncorrupted part from the previous line. The exceeding of the value 144 by the decoded part length or the absence of code word of the given part in the code table vocabulary can be shown as a sign for replacement (see Table B.2).

TABLE B.2/T.4

White run lengths	Code	Black run lengths	Code
0	0100	0	–
1	1000	1	01111
2	1010	2	001
3	0110	3	100
4	1110	4	11
5	1100	5	010
6	1111	6	1010
7	00100	7	0110
8	10010	8	10111
9	11010	9	10110
10	10110	10	01110
11	000110	11	00010
12	110110	12	000110
13	000100	13	000111
14	011100	14	000010
15	010100	15	0000110
16	001100	16	00000100
17	100110	17	00000110
18	0000100	18	000011100
19	0000001	19	000011110
20	0010100	20	000001010
21	0011111	21	0000001000
22	0011110	22	0000011100
23	0011100	23	0000111010
24	0101100	24	00001111110
25	0111111	25	00001111100
26	0111110	26	00001111111
27	0111100	27	00001110110
28	1001110	28	00000011000
29	1011111	29	00000111100
30	1011110	30	00000101100
31	1011101	31	00001111101
32	1011100	32	00001110111
33	1101111	33	000000101000
34	1101110	34	000001111100
35	0001111	35	000001110100
36	0001110	36	000001011100
37	00010100	37	000000111100
38	10011110	38	000000110100
39	10011111	39	000000101100
40	01110100	40	000000111000
41	01110101	41	0000001001000
42	01110110	42	0000011111111
43	01110111	43	0000011111110
44	01111010	44	0000011111101
45	01111011	45	0000011111100
46	01010100	46	0000011111011
47	01010101	47	0000011111010
48	01010110	48	0000011110111
49	01010111	49	0000011110110
50	01011010	50	0000011110101
51	01011011	51	0000011110100
52	01011100	52	0000011101111
53	01011110	53	0000011101110
54	00110100	54	0000011101101
55	00101100	55	0000011101100
56	00001100	56	0000011101011
57	00000100	57	0000011101010
58	00000101	58	0000010111111
59	00000110	59	0000010111110
60	00000111	60	0000010111101
61	000101100	61	0000010111100
62	010111010	62	0000010111011
63	010111011	63	0000010111010
64	010111110	64	0000010110111
65	010111111	65	0000010110110

TABLE B.2/T.4 *(cont.)*

White run lengths	Code	Black run lengths	Code
66	001101010	66	0000010110101
67	001101011	67	0000010110100
68	001101100	68	0000001111100
69	001101101	69	0000001110100
70	001110100	70	0000001101100
71	001010100	71	0000001011100
72	001011100	72	0000001010100
73	000010100	73	00000011111111
74	000011100	74	00000011111110
75	001010101	75	00000011111101
76	0000111100	76	00000011111100
77	0000110100	77	00000011111011
78	0000101100	78	00000011111010
79	0010111111	79	00000011110111
80	0010111110	80	00000011110110
81	0010111101	81	00000011110101
82	0010111100	82	00000011110100
83	0010111011	83	00000011101111
84	0010111010	84	00000011101110
85	0010110111	85	00000011101101
86	0010110110	86	00000011101100
87	0010110101	87	00000011101011
88	0010110100	88	00000011101010
89	0010101111	89	00000011011111
90	0010101110	90	00000011011110
91	0010101101	91	00000011011101
92	0010101100	92	00000011011100
93	0011101111	93	00000011011011
94	0011101110	94	00000011011010
95	0011101101	95	00000011010111
96	0011101100	96	00000011010110
97	0011101011	97	00000011010101
98	0011101010	98	00000011010100
99	0011011111	99	00000010111111
100	0011011110	100	00000010111110
101	0011011101	101	00000010111101
102	0011011100	102	00000010111100
103	0001011100	103	00000010111011
104	0001010100	104	00000010111010
105	0001010101	105	00000010101111
106	0001010110	106	00000010101110
107	00010101111	107	00000010101101
108	00010101110	108	00000010101100
109	00010110101	109	00000010101011
110	00010110100	110	00000010101010
111	00010110111	111	00000010110111
112	00010110110	112	00000010110110
113	00010111011	113	00000010110101
114	00010111010	114	00000010110100
115	00010111101	115	00000010011111
116	00010111100	116	00000010011110
117	00010111111	117	00000010011101
118	00010111110	118	00000010011100
119	00001010101	119	00000010011011
120	00001010100	120	00000010011010
121	00001010111	121	00000010011001
122	00001010110	122	00000010011000
123	00001011011	123	00000010010111
124	00001011010	124	00000010010110
125	00001011101	125	00000010010101
126	00001011100	126	00000010010100
127	00001011111	127	00000011001111
128	00001011110	128	00000011001110
129	00001101011	129	00000011001101
130	00001101010	130	00000011001100
131	00001101101	131	00000011001011

TABLE B.2/T.4 *(cont.)*

White run lengths	Code	Black run lengths	Code
132	00001101100	132	00000011001010
133	00001101111	133	00000011001001
134	00001101110	134	00000011001000
135	00001110101	135	00000011100111
136	00001110100	136	00000011100110
137	00001110111	137	00000011100101
138	00001110110	138	00000011100100
139	00001111011	139	00000010100111
140	00001111010	140	00000010100110
141	00001111101	141	00000010100101
142	00001111100	142	00000010100100
143	00001111111	143	00000010010011
144	00001111110	144	00000010010010

Annex C

Optional file transfer for group 3

(This annex forms an integral part of this Recommendation)

C.1 Introduction

This annex specifies the technical features of the file transfer for group 3.

File transfer is an optional feature of group 3 which permits to transmit any data file with or without additional information concerning the file to be transmitted.

The content of the data file itself may be of any kind of coding.

The file transfer applied to group 3 equipments is based on Recommendation T.30 and on Annex A (Error correction mode).

Because files must be reliably transferred, using error correction mode described in Annex A and in Annex A/T.30 is mandatory in the context of Annex C.

From the point of view of service, file transfer is defined in Recommendation F.551 where alignment between different telematic applications (group 3, group 4, teletex) is achieved.

C.2 Definitions

The definitions contained in this Recommendation and in Recommendation T.30 apply unless explicitly amended.

C.3 Normative references

In addition to this Recommendation and Recommendation T.30, the present annex contains references to other CCITT and ISO Standards:

[1] CCITT Recommendation T.50 — International Alphabet No. 5

[2] CCITT Recommendation X.209 — Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)

[3] CCITT Recommendation T.434 — Binary file transfer protocol for the telematic services

[4] ISO/IEC 9735 — Electronic data interchange for administration commerce and transport (EDIFACT) – Application level syntax rules

[5] CCITT Recommendation F.551 Service Recommendation for telematic file transfer within telefax 3, telefax 4, teletex services and message handling services.

[6] CCITT Recommendation T.51 Coded characters sets for telematic services

[7] ISO 8859-1 Information processing – 8 bit single byte coded graphic character sets – Part 1: Latin Alphabet No. 5

C.4 Definition of the different file transfer modes

At the time being, four file transfer modes exist:

- basic transfer mode: (BTM),
- document transfer mode: (DTM),
- binary file transfer: (BFT),
- EDIFACT transfer: (EDI).

For a comprehensive explanation, from the point of view of service, of the use of these four different file transfer modes, see Recommendation F.551 [5].

Additional file transfer modes besides these four modes may be issued in further versions of this Recommendation and Recommendatoin T.30.

C.4.1 Basic transfer mode (BTM)

Basic transfer mode provides the user of a group 3 equipment with a means to exchange files of any kind (binary files, wordprocessor native format documents, bitmaps, etc.) without any additional information.

C.4.2 Document transfer mode (DTM)

Document transfer mode provides the user of a group 3 equipment with a means to exchange files of any kind with additional information readable by the user and included in a file description.

The file description is a structured information regarding the file (e.g. file name, file type, file coding, etc.). On the receiving side, it can either be handled by automatic processing or read by the user.

The file description is transmitted ahead of the data file itself and concatenated with this latter.

C.4.3 Binary file transfer (BFT)

Binary file transfer provides the user of a group 3 equipment with a means to exchange files of any kind with additional information included in a file description and automatically processed at the receiving side.

The file description is a structured document which contains information regarding the file (e.g. file name, contents types, etc.). It is mainly aimed to be automatically processed at the receiving side.

The coding rules which apply for the coding of the file description are technically aligned on those of FTAM (coding according to Recommendation X.209 [2]).

The file description is transmitted ahead of the data file itself and concatenated with this latter.

For technical description of the binary file transfer, see Recommendation T.434 [3] and Annex B/Appendix VI/T.30.

C.4.4 EDIFACT transfer

EDIFACT transfer provides the user of a group 3 equipment with a means to exchange EDIFACT files coded according to ISO/IEC 9735 [4] rules.

C.5 Coding of the file description

C.5.1 Basic transfer mode (BTM)

BTM mode does not require to transmit any additional information. Then, no file description exists. Only the file itself is sent.

C.5.2 Document transfer mode (DTM)

The character set which shall be used to code the file description is the primary set of graphic characters of Recommendation T.51 [6] plus character "SPACE" (this later in position 2/0 of the table).

NOTE – This set is exactly the same one as that of International Alphabet No. 5 (Recommendation T.50 [1]) and that of the left part of characters set ISO 8859-1 (7).

Coding of the file description sent by a group 3 equipment

For details of the utility of the different fields of the file description listed below, see Recommendation F.551 [5].

CR FF	6.1	: ADDITIONAL INFORMATION :		
CR LF	1	: FILE NAME :		
CR.LF			[file name]	(72 characters maximum)
CR LF	2	: APPLICATION REFERENCE :		
CR LF			[application reference]	(72 characters maximum)
CR LF	3	: TYPE :		
CR LF			[coding]	(72 characters maximum)
CR LF	4	: ENVIRONMENT :		
CR LF	4.1	: MACHINE :		
CR LF			[machine]	(72 characters maximum)
CR LF	4.2	: OPERATING SYSTEM :		
CR LF			[operating system]	(72 characters maximum)
CR LF	4.3	: PROGRAM :		
CR-LF			[program]	(72 characters maximum)
CR.-LF	4.4	: CHARACTER SET :		
CR LF			[machine character set]	(72 characters maximum)
CR LF	5	: LAST REVISION :		
CR LF			[last revision]	(72 characters maximum)
CR LF	6	: LENGTH :		
CR LF			[file length]	(72 characters maximum)
CR LF	7	: PATH :		
CR LF			[path name]	(72 characters maximum)
CR LF	8	: RESERVED :		

CR LF			[reserved]	(72 characters maximum)
CR LF	9	: AUTHOR'S NAME :		
CR LF			[author 's name]	(72 characters maximum)
CR LF	10	: USER VISIBLE STRING :		
CR LF			[[user 's comments]]	(8 lines, 72 characters maximum per line)
CR LF	11	: FUTUR FILE LENGTH :		
CR LF			[futur file length]	(72 characters maximum)
CR LF	12	: STRUCTURE :		
CR LF			[structure]	(72 characters maximum)
CR LF	13	: PERMITTED ACTIONS :		
CR LF			[permitted actions]	(72 characters maximum)
CR LF	14	: LEGAL QUALIFICATIONS :		
CR LF			[legal qualification]	(72 characters maximum)
CR LF	15	: CREATION :		
CR LF			[date and time of creation]	(72 characters maximum)
CR LF	16	: LAST READ ACCESS :		
CR-LF			[last read access]	(72 characters maximum)
CR LF	17	: IDENTITY OF THE LAST MODIFIER :		
CR LF			[identity of the last modifier]	(72 characters maximum)
CR LF	18	: IDENTITY OF THE LAST READER :		
CR LF			[identity of the last reader]	(72 characters maximum)
CR LF	19	: RECIPIENT :		
CR LF			[recipient]	(72 characters maximum)
CR LF	20	: TFT VERSION :		
CR LF			[TFT version]	(72 characters maximum)
CR LF	21	: COMPRESSED :		
CR LF			[compression]	(72 characters maximum)
CR LF				

NOTES

1 When only one [ ] is used, this element is included in one line. When [[]] is used, this element can be included in several lines.

2 Further additional information fields may be added in next versions of Annex C. An equipment shall not be disturbed by unknown fields.

3 The file description must contain at least the following information:

CR LF 6.1 : ADDITIONAL INFORMATION :

CR LF 1 : FILE NAME :

CR LF [file name] (72 characters maximum)

CR LF

CR LF

C.5.3 Binary file transfer (BFT)

The structure of the additional information to be transmitted is described in Recommendation T.434 [3].

C.5.4 EDIFACT transfer

To transfer EDIFACT files there is no need for a file description.

The structure of the information to be transmitted is described in the ISO/IEC 9735 specification [4].

C.6 Message format – Blocks structure

The structure of the data block sent by means of error correction mode is the same structure as when T.4 facsimile coded data is sent (see description in Annex A), except for the last block (see further).

The sequence of octets is transmitted beginning with the least significant bit of the first octet.

As normally, the sending equipment indicates the frame size by the DCS frame content (see Table 2/T.30). The values of frame size applicable are 256 or 64 octets.

At the end of the transmission of a file, the sending equipment may send a block the size of which is less than 256 frames. This block is called a short block.

This short block may have its last frame less than 256 or 64 octets.

Within the T.4 code exists an “end of page” (codeword RTC) which permits to delineate the pads bits which are usually inserted at the end of the last frame of the last block to match, either an octet boundary or the frame limit (see A.3.6.2).

As for file transfer such a general “end of page” codeword cannot exist because files may be of different kinds, the last frame of the short block shall contain no pad bit.

Hence, a sender must be able to send the last frame containing less than 256 or 64 data octets.

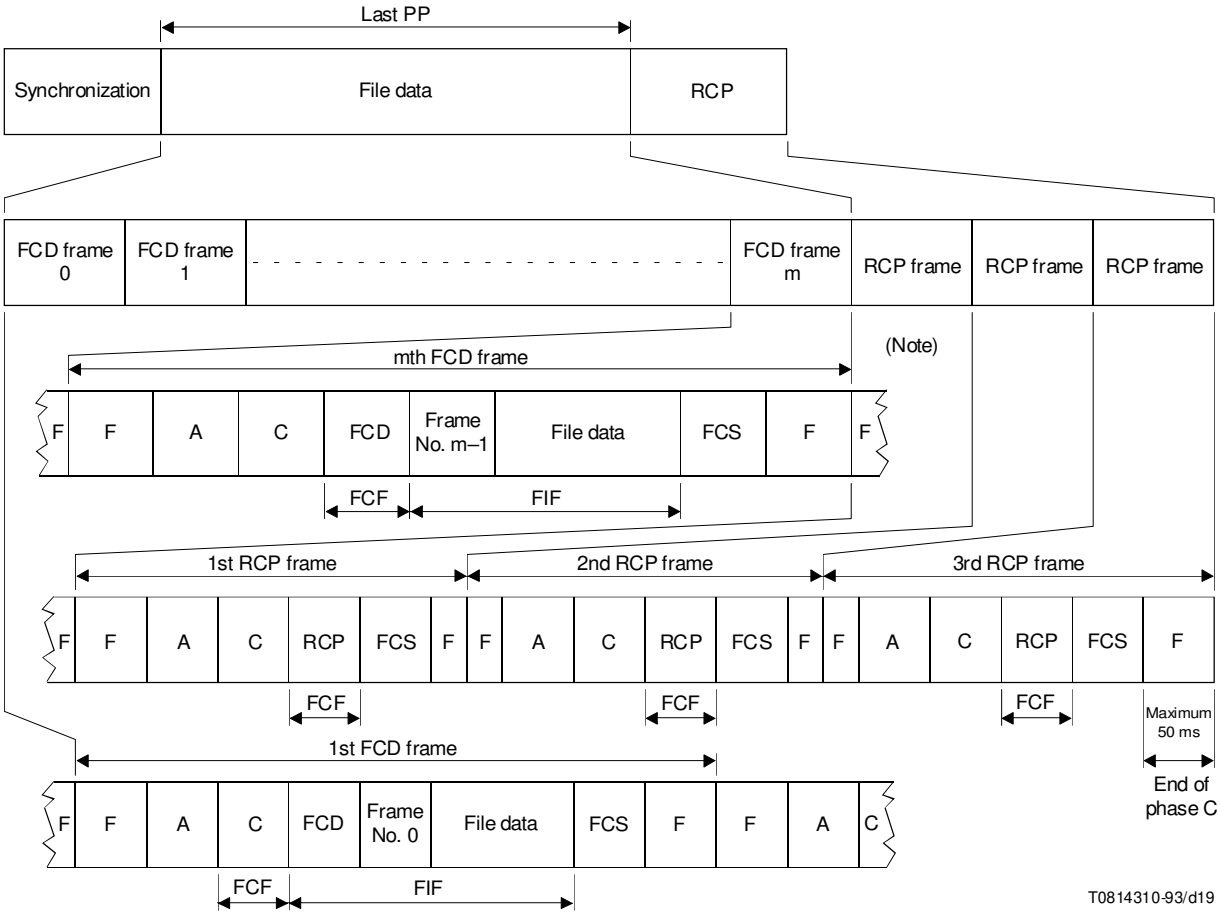
Figure C.1 represents the structure of the short block.

C.7 Protocol aspects

C.7.1 Abbreviations

The abbreviations contained in Recommendation T.30 and used in this annex are:

DCS	Digital command signal
DIS	Digital identification signal
DTC	Digital transmit command
PPS-EOM	Partial page signal – End of message
PPS-EOP	Partial page signal – End of procedure
PPS-MPS	Partial page signal – Multi page signal
PPS-NULL	Partial page boundary signal



NOTE – See A.3.2.

FIGURE C.1/T.4

Last block frame structure

C.7.2 Phase B of T.30 (Pre-message procedure)

Group 3 equipment negotiates a file transfer mode among the above mentioned modes (BTM, DTM, BFT, EDIFACT) by using the usual DIS/DTC/DCS frames of T.30 protocol.

The facsimile information field of the frames DIS/DTC/DCS contains specific bits for the file transfer modes, see bits allocation in Table 2/T.30.

NOTE – The use of facsimile service info file (FSI) is for further study.

C.7.3 Specific application rules of T.30 protocol

This subclause is not applicable to binary file transfer. For precisions about specific application rules of T.30 protocol to BFT, see Annex B/Appendix VI/T.30.

Specific application rules of T.30 protocol concerning T.30 post-message commands exist for file transfer:

- Procedure interrupt post-message commands (PPS-PRI-Q) shall not be used.
- As files must be entirely transmitted, EOR-Q signals are not allowed. When the transmitter receives PPR four times, the modem speed must fall back (by use of CTC command) or the group 3 equipment has to switch to phase E (emission of DCN and call release). In case of failure, the file must be retransmitted as a whole.

Other post-message commands have largely their usual purpose as described in Annex A/T.30 (error correction mode):

- PPS-NULL commands are used normally to separate intermediate error correction mode blocks.
- Page boundary indications PPS-MPS commands are used in place of PPS-NULL commands at the end of intermediate files if several files are to be transmitted in the same communication.
- PPS-EOP command is sent at the end of the last block of the last file to be transmitted.
- PPS-EOM commands are sent at the end of intermediate files if several files are to be transmitted in the same communication and a change in the mode of the communication is desired.

Annex D

Optional character mode of group 3

(This annex forms an integral part of this Recommenation)

D.1 Introduction

This annex specifies the technical features of the character mode of group 3.

Character mode is an optional feature of group 3 which permits to transmit character coded documents by the means of T.30 protocol.

Character mode is based on Recommendation T.30 and on Annex A (Error correction mode).

Because character coded documents must be reliably transferred, using error correction mode described in Annex A and in Annex A/T.30 is mandatory in the context of this annex.

D.2 Definitions

The definitions contained in this Recommendation and in Recommendation T.30 apply, unless explicitly amended.

D.3 Normative references

In addition to this Recommendation and Recommendation T.30, this annex contains references to other CCITT and ISO Standards:

- CCITT Recommendation T.51 *Coded characters sets for telematic services*
- CCITT Recommendation T.61 *Character repertoire and coded character sets for the international Teletex service*
- ISO 8859-1 *Information processing – 8 bit single byte coded graphic character sets – Part 1 : Latin Alphabet No. 5*

D.4 Graphic character set – Repertoire and coding

D.4.1 Repertoire of graphic characters

The character repertoire which represents and describes the graphic characters allowed for character mode is that of ISO 8859-1 in addition with the box-drawing character repertoire which is a subset of registered CCITT set ISO 72.

From the character mode of group 3 apparatus, the following character positions are excluded: 4/4...4/11, 4/13...4/15, 5/11...5/14, 6/0...6/13, 7/0...7/15.

A group 3 equipment providing character mode shall not send any graphic character which is neither contained in repertoire ISO 8859-1 nor the box-drawing character repertoire.

Taking into account other graphic characters (e.g. national graphic characters) is for further study.

D.4.2 Coding of graphic characters

The coding of the graphic characters is not that of the code table given in ISO 8859-1; it shall follow the coding rules of Recommendation T.51.

The graphic characters are coded by bytes (8-bits environment of Recommendation T.51).

The left part of the table (bytes "0/0" to "7/15") is fixed as the primary set of Recommendation T.51 (see Figure 1/T.51). That is fixed **by default**, then designation and invocation sequences as defined in Recommendation T.51 shall not be used prior to the transmission of these characters.

The "SPACE" character is coded "2/0".

The right part of the table (bytes "8/0" to "15/15") is fixed as the supplementary set of Recommendation T.51 (see Figure 2/T.51). That is fixed **by default**, then designation and invocation sequences as defined in Recommendation T.51 shall not be used prior to the transmission of these characters.

To be coded, some graphic characters represented in ISO 8859-1 need two bytes of the 8-bits code table specified above. For example, diacritical characters require two bytes : the diacritical mark followed by the basic character.

For using a box-drawing character, a single shift function SS2 is necessary prior to the 8 bits-code of the character itself. Then, each box-drawing character needs two octets for the transmission : SS2 followed by the character code.

SS2 is the "single shift two function" as described in Recommendation T.51. It is coded : "1/9".

Then, following the T.51 rules, box-drawing character repertoire is the graphic character set "G2".

This repertoire is fixed as G2 **by default**, then the designation sequence as defined in Recommendation T.51 shall not be used.

D.4.3 Fall-back in case of a graphic character of repertoire ISO 8859-1 not supported

When a character from repertoire ISO 8859-1 or from the box-drawing character repertoire is received by a group 3 equipment which does not support it, a fall-back behaviour is required in order that the reception of the document can go on.

The fall-back behaviour may be the following:

- upon reception of a diacritical character not supported, the receiver considers it as a basic character and discards the diacritical mark;
- upon reception of a basic character not supported, the receiver considers it as another basic character.

D.5 Page format

The character coded pages have their format fixed:

- Vertical basic format with **55 lines of 77 characters**.

NOTES

1 55 lines per page permit to print the text received at 6 LPI (lines per inch).

2 55 lines are the maximum length of a page. Shorter pages are permitted.

3 Different page formats are for further study.

D.6 Control functions

Control functions act on the formatting of the document (go to next line, etc.) and permit to switch on or to switch off character attributes.

Some control functions are represented with a unique byte; some others (with parameters) are represented by a sequence beginning by CSI ("9/11").

If the receiving equipment receives a control function it cannot handle, it must simply ignore it and proceed normally.

If the receiving equipment receives a control function it can handle but the parameters which are unknown to it, it must also simply ignore the request.

NOTE – It is the responsibility of the sender to provide for correct sending format. If the sending equipment is providing an incorrect format, that will not necessarily be rejected by the receiving equipment, but the results of that cannot be predicted.

D.6.1 Single byte control functions applicable to character mode

The single byte control functions (coded by a single byte) applicable to character mode are:

LF : Line feed :	0/10
FF : Form feed :	0/12
CR : Carriage Return :	0/13
HT : Horizontal Tabulation :	0/9
SS2 : Single Shift two :	1/9
CSI : Control Sequence Introduce :	9/11

Escape sequences (beginning by the control character "ESC") shall not be emitted by a group 3 equipment.

NOTES

1 Other single byte control functions are for further study.

2 Coding values of LF, FF, CR, SS2 and CSI are in line with Recommendation T.61.

D.6.2 Control functions with parameters applicable to character mode

The character mode implements some control functions with parameters which are described further in this annex.

Control functions with parameters consist of control sequences beginning by control sequence introducer (CSI) and followed by one or several bytes.

NOTE – The rules of coding of control functions within this annex are in line with Annex D/T.61.

D.6.3 Control functions for format effectors

D.6.3.1 Page initiator

The "page initiator" shall be used at the beginning of each page.

Coding: CR FF (0/13 0/12)

D.6.3.2 End of line

The "end of line" shall be used at the end of each line, except for the last line of the last character coded page.

Coding : CR LF (0/13 0/10)

NOTE – "End of line" permits to send lines which contain less than 77 characters.

D.6.3.3 End of the last character coded page

The “end of the last character coded page” shall be used at the end of the last character coded page.

Coding : CR FF (0/13 0/12)

D.6.3.4 Horizontal tabulation

Horizontal tabulation moves the active position to the next horizontal tabulation stop. The horizontal tabulation stops are defined in fixed steps of 5 characters, the first one being at the fifth character of the line.

D.6.4 Control functions for characters attributes

Characters attributes permit to modify the rendition of the characters.

The graphic rendition is selected by the control function SGR.

Coding : CSI 3/X 6/13 (9/11 3/X 6/13),

X depends on the attribute, (see Table D.1).

The effect follows immediately the function and is cancelled by a new SGR function or by a page initiator.

The character attributes are not negotiated. If they are not supported at the receiving side, a fall-back behaviour is required (attribute ignored).

TABLE D.1/T.4

Character attribute	Coding	Availability
Default rendition	CSI 3/0 6/13	Optional
Bold intensity	CSI 3/1 6/13	Optional
Italicized	CSI 3/3 6/13	Optional
Singly underlined character	CSI 3/4 6/13	Optional

D.7 Message format – Blocks structure

The structure of the block of data sent by means of error correction mode is the same structure as when T.4 facsimile data is sent (see description in Annex A), except for the last block (see further).

A sequence of octets is transmitted beginning with the least significant bit of the first octet.

As normally, the sending equipment indicates the frame size by the DCS frame content (see Table 2/T.30). The values of frame size applicable are 256 or 64.

At the end of the transmission of a page, the sending equipment may send a block the size of which is less than 256 frames. This block is called a short block.

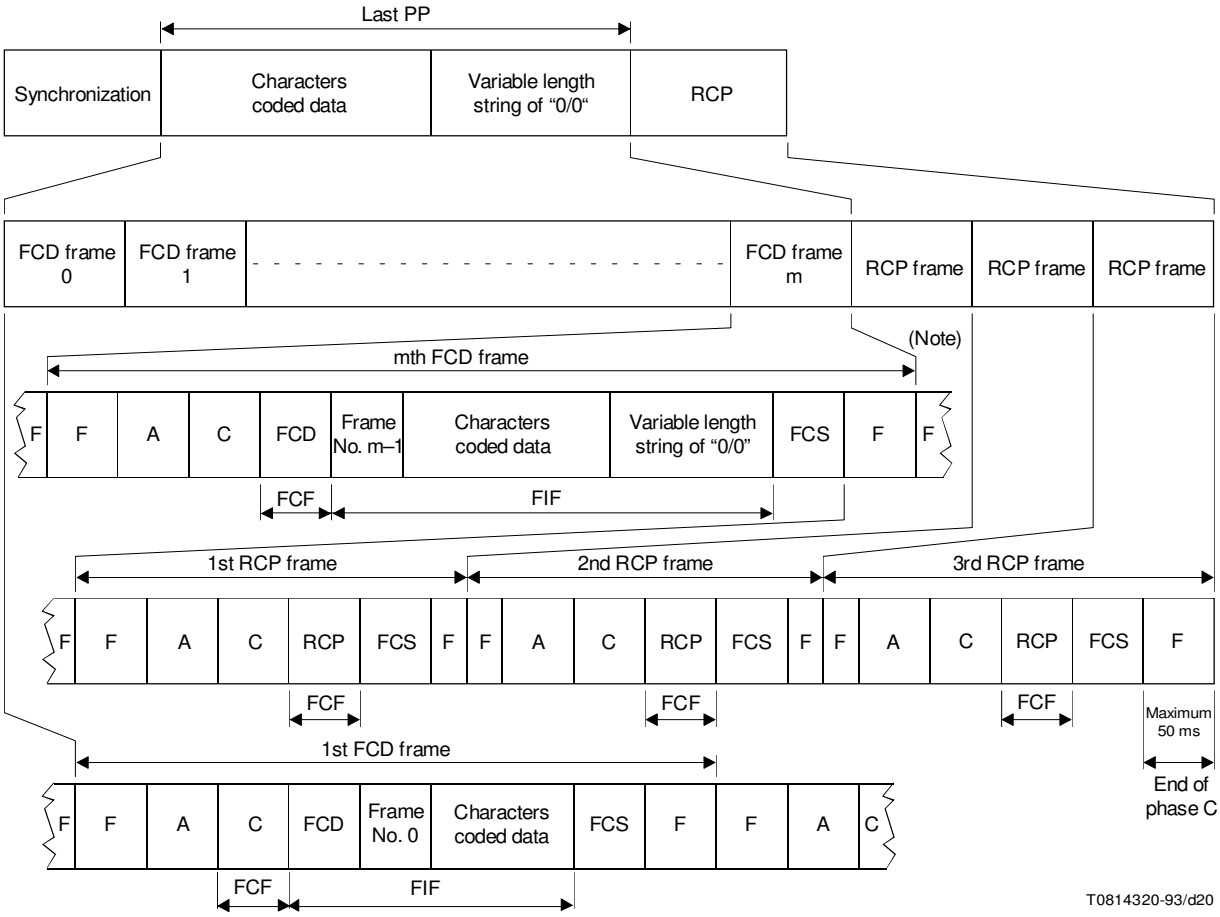
This short block may have its last frame less than 256 (or 64 octets). Within this last frame, pad bytes may be used to align frame boundary.

The format is a variable sequence of octets “0/0”.

These pad bytes are inserted between the last “end of line” of the document and the end of the frame (same principle as for T.4 data where pad bits may be inserted after RTC code).

The receiver must be able to receive pad bytes and to discard them.

Figure D.1 represents the structure of the short block.



NOTE – See A.3.2.

FIGURE D.1/T.4

Last block frame structure

D.8 Protocol aspects

D.8.1 Abbreviations

The abbreviations contained in Recommendation T.30 and used in this annex are:

DCS	Digital command signal
DIS	Digital identification signal
DTC	Digital transmit command
PPS-EOM	Partial page signal – end of message
PPS-EOP	Partial page signal – end of procedure
PPS-MPS	Partial page signal – multi page signal
PPS-NULL	Partial page boundary signal
EOR	End of retransmission

D.8.2 Phase B of Recommendation T.30 (Pre-message procedure)

Group 3 equipment negotiates the character mode by using the usual DIS/DTC/DCS frames of T.30 protocol.

The facsimile information field of the frames DIS/DTC/DCS contains specific bits for the character mode. See bits allocation in Table 2/T.30.

NOTES

1 The use of control document to access facsimile enhanced service is for further study.

2 Future negotiation mechanism is for further study.

D.8.3 End of document, beginning of page, end of block

Post message commands have their usual purpose as described in Annex A/T.30 (error correction mode):

- PPS-NULL command is used normally to separate intermediate error correction modes blocks.
- PPS-MPS command is sent at the end of each page.
- In addition, the "page initiator" (see D.6.3.1) is present at the beginning of each page.
- PPS-EOP command is sent at the end of the last block of the characters coded document if no further document is to be transmitted.
- PPS-EOM command is sent at the end of intermediate characters coded document if several are to be transmitted in the same communication.

The use of end of retransmission (EOR) command defined in A.4.3/T.30, is not permitted with the character mode. If all frames have not been correctly received after the third transmission of the error frames, then the transmitter shall use the continue to correct (CTC) command (A.4.1/T.30).

D.9 Imaging process

The displaying of the coded characters is assumed to be from left to right.

The position of the first character line on the facsimile page is the 105th pel on the 131st scanning line. (at 3.85 lines/mm).

The size of the character box are 20 pels wide by 16 lines / mm high and concatenated across the page. Since no gap is provided between the boxes, implementations should ensure that when the characters are displayed, there is a separation between the characters.

Annex E

Optional mixed mode for group 3

(This annex forms an integral part of this Recommendation)

E.1 Introduction

This annex specifies the technical features of the optional mixed mode (MM) for group 3 facsimile apparatus.

MM allows pages containing both character coded and facsimile coded information to be transferred between compatible apparatus. The use of the standardized error correction mode defined in Annex A of this Recommendation and Annex A/T.30 is mandatory with MM.

With MM, the page is divided into slices horizontally across the page, each slice contains either facsimile or character coded information but not both.

The content of the information field is identified by means of the facsimile control field (see E.3). The first slice is either facsimile or character coded. Subsequent slices are alternatively character of facsimile coded.

E.2 Definitions

The definitions contained in this Recommendation and Recommendation T.30 apply unless explicitly amended by this annex.

E.3 Facsimile control field (FCF)

In order to distinguish between the facsimile coded data (FCD), the return to control for partial-page (RCP), and the character coded data (CCD) frames, the FCF for the in-message procedure is defined as follows:

1) FCF for the FCD frame

   0110 0000

2) FCF for the RCP frame

   0110 0001

3) FCF for the CCD frame

   0110 0010

NOTE – The FCF code 0110 0100 is reserved for future use.

E.4 Frame numbering

The frames in each partial page are numbered sequentially from 0 to the maximum of 255 irrespective of whether the partial page consists of FCD and/or CCD frames.

Figure E.1 shows one example of FCD and CCD frames in a partial page.

At the end of each slice, facsimile coded data field length or character coded data field length may be less than 256 or 64 octets.

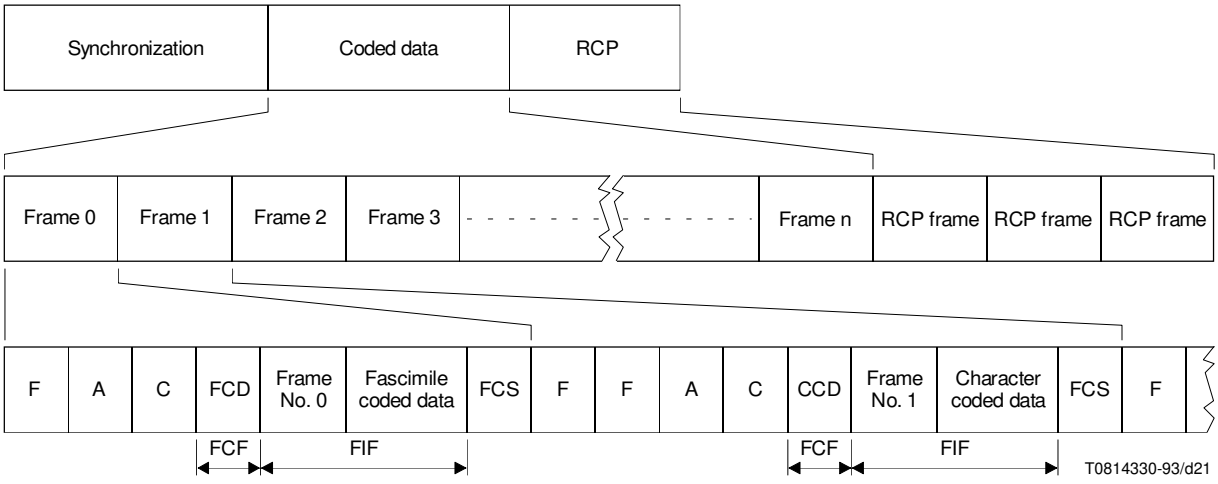


FIGURE E.1/T.4

Initial partial page frame structure

E.5 Facsimile data field

A.3.6.2 requirements apply.

"Facsimile slice terminator code" (FSTC) is defined as six times "EOL + 1". FSTC is used at the end of each facsimile slice.

In case of T.6 coding, EOFB shall precede FSTC. Pad bits can be inserted after FSTC. Although this bit pattern is the same as that of RTC, this bit pattern shall be recognized as FSTC in case of MM.

E.6 Character coded data field

The character coded data field may be up to 256 octets.

D.7 requirements apply. "End of line (CR LF)" is used at the end of each character slice.

E.7 Graphic character set

The graphic character set used with MM is defined in D.4.

E.8 Page format

E.8.1 Facsimile coded slices

Facsimile coded slices must be transmitted as integral multiple of 16 scanning lines.

E.8.2 Character coded slices

Each character coded line is equivalent to 16 scanning lines (at standard resolution).

The width of each coded character is equivalent to 20 picture elements (at standard resolution).

To ensure printing on an A4 page, a maximum of 77 characters per line should be transmitted.

If the first slice on a page is character coded, the first six character lines may not be reproduced; therefore, it is recommended that the transmitter sends 6 combinations of CR-LF before the start of the information.

E.8.3 Page length

To ensure that the text can be reproduced on an A4 page, the total length of each page should not exceed 1024 scanning lines (at standard resolution). This means that the maximum length of a coded character slice is 64 character lines.

E.9 Control functions

The control functions used in MM are defined in D.6.

The "page initiator" is used only if the first slice of the page is character coded.

E.10 End of retransmission (EOR)

The use of the end of retransmission (EOR) command defined in A.4.3/T.30 is not permitted with MM. If all the frames have not been correctly received after the third transmission of the error frames, then the transmitter shall use the continue to correct (CTC) command (see A.4.1/T.30).

Annex F

64 kbit/s option of facsimile group 3 [G3 (UDI)]

(This annex forms an integral part of this Recommendation)

F.1 Introduction

This annex describes the terminal characteristics, protocol set and document application profile (DAP) used by 64kbit/s option of facsimile group 3 [G3 (UDI)] when operating over the integrated services digital network (ISDN).

F.2 Terminal characteristics for G3 (UDI)

F.2.1 Definitions

The clauses and annexes listed below shall not be applied.

Clause 3	Transmission time per total coded scan line
Clause 5	Modulation and demodulation
Clause 6	Power at the transmitter
Clause 7	Power at the receiver input
Annex A	Optional error correction mode
Annex B	Optional error limiting mode
Annex C	Interworking between equipments with A5/A6 and A4 facilities and between equipments with combinations of these facilities.

F.2.2 Basic characteristics

Basic characteristics of G3 (UDI) are given in Table F.1.

Printing capability of the call identification line (CIL) is mandatory. Details of the CIL are covered in Recommendation T.563.

TABLE F.1/T.4

	Values
Coding scheme	T.4 one-dimensional coding and T.6 coding
Paper size	ISO A4
Pels / scan line length	1728 pels/ 215 mm ± 1% and/or 1728 pels/ 219.46 mm ± 1%
Resolution in vertical direction	3.85 line/mm ± 1% and 200 pels/ 25.4 mm ± 1%
NOTE – T.6 coding scheme, ISO A4 paper size, 1728 pels along a scale line length of 219.46 mm ± 1% and the resolution of 200 pels 25.4 mm ± 1% in vertical direction in this Table are basic characteristics of group 5 facsimile class 1. G3 (UDI) should be designed and operated as the terminal supporting the dual characteristics of group 3 facsimile and group 4 facsimile class 1.	

F.2.3 Optional characteristics

Optional characteristics of G3 (UDI) are given in Table F.2.

F.3 Protocol set

The protocol set applied to the group 3 facsimile 64 kbit/s option is described in this clause.

TABLE F.2/T.4

	Values
Coding scheme	T.4 two-dimensional coding
Paper size	ISO B4 ISO A3
Pels/scan line length	3456 pels/215 mm ± 1% 2048 pels/255 mm ± 1% 4096 pels/255 mm ± 1% 2432 pels/303 mm ± 1% 4864 pels/303 mm ± 1% 2592 pels/219,46 mm ± 1% 3456 pels/219,46 mm ± 1% 2048 pels/260,10 mm ± 1% 3072 pels/260,10 mm ± 1% 4096 pels/260,10 mm ± 1% 2432 pels/308,86 mm ± 1% 3648 pels/308,86 mm ± 1% 4864 pels/308,86 mm ± 1%
Resolution in vertical direction	7.7 line/mm ± 1% 15.4 line/mm ± 1% 300 pels/25.4 mm ± 1% 400 pels/25.4 mm ± 1%
NOTE – The resolutions of 200 × 200 pels/25.4 mm et R8 × 7.7 lines/mm can be considered as being equivalent. Similarly, the resolutions of 400 × 400 pels/25.4 mm and R16 × 154 lines/mm can be considered also as being equivalent. Consequently, conversion between mm based terminals and inch based terminals is not required for the communications in these cases. However, communication between these resolutions will cause the distortion and the reduction of reproducible area.	

F.3.1 Application rules of low layer protocols

F.3.1.1 General

The group 3 facsimile apparatus with 64 kbit/s option shall be designed and operated according to Recommendation T.90 (1992) with the following application and implementation rules.

F.3.1.2 High layer compatibility (HLC)

HLC IE (information element), when encoded, shall be set to "group 4 facsimile class 1". For further information, see 2.2.4./T.90.

Receipt of HLC IE set to "group 4 facsimile class 1" shall not cause the rejection of incoming call.

Interworking between group 3 facsimile 64 kbit/s option and group 4 facsimile class 1 is described in F 5.

The interoperability between facsimile terminals on the ISDN is for further study.

F.3.1.3 Clauses not to be referred in Recommendation T.90 (1992)

Recommendation T.90 (1992) clauses 7, 8 and 10 are not referred and out of the scope of this annex.

F.3.2 Application rules of high layer protocols

F.3.2.1 General

The group 3 facsimile apparatus with 64 kbit/s option shall be designed and operated according to the following CCITT Recommendations.

F.3.2.2 Transport layer

The transport end-to-end control procedure of group 3 facsimile 64 kbit/s option shall be in accordance with Recommendation T.70;

– Recommendation T.70 (1984) *Network-independent basic transport service for the telematic services*

F.3.2.3 Session layer

Session layer control procedure of group 3 facsimile 64 kbit/s option shall be in accordance with Recommendation T.62;

– Recommendation T.62 (1984) *Control procedures for teletex and group 4 facsimile services*

F.3.2.4 Communication application profile

Communication application profile of group 3 facsimile 64 kbit/s option shall be in accordance with Recommendation T.521;

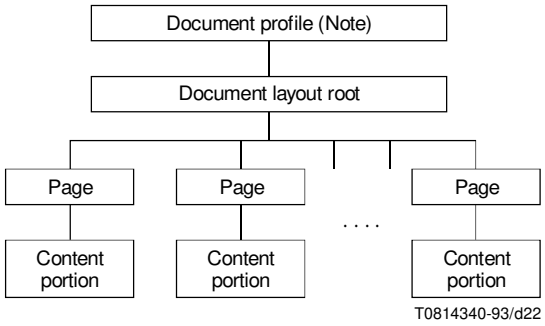
– Recommendation T.521 (1992) *Communication application profile BTO for document bulk transfer based on the session service (according to the rules defined in T.62 bis)*

F.4 Basic procedure for the interchange of G3-64 kbit/s option facsimile document

This clause defines a document application profile that is in conformance with G3-64 kbit/s option facsimile.

F.4.1 Document architecture

The hierarchical structure of the document for G3-64 kbit/s option facsimile is illustrated in the figure below.



NOTE – Document profile is not transmitted. The responding terminal may re-generate the document profile descriptor based on the user data conveyed by SUD in CDS.

F.4.2 ASN.1 definition of user data conveyed by session PDU

Abstract syntax definition of APDUs conveyed by session PDU applicable to G3-64 kbit/s option facsimile and encoding examples are described in this subclause.

F.4.2.1 D-INITIATE request/response APDUs conveyed by SUD in CSS/RSSP

```
D-INITIATE-REQ/RESP             ::=     CHOICE {
                                        [4]  IMPLICIT ApplicationCapabilities }

ApplicationCapabilities  ::=    SET {
        documentApplicationProfileT73   [0]  IMPLICIT OCTET STRING,
                                -- '02'H document application profile T.503
                                -- '0204'H document application profile T.503 and G3-64k (see Note)
        documentArchitectureClass       [1]  IMPLICIT OCTET STRING,
                                -- '00'H   FDA      }
        NOTE – G3-64k shall set this value

        Example (CSS) ----------------------------------------------------------------
            A4  07   ApplicationCapabilities
                80 02 0204      documentApplicationProfileT73 = T.503 and G3-64k
                81 01 00        documentArchitectureClass  =  FDA
        ---------------------------------------------------------------------------------
        Example (RSSP) ---------------------------------------------------------------
            A4  07   ApplicationCapabilities
                80 02 0204      documentApplicationProfileT73 = T.503 and G3-64k
                81 01 00        documentArchitectureClass  =  FDA
        ---------------------------------------------------------------------------------
```

F.4.2.2 D-CAPABILITY request/response APDUs conveyed by SUD in CDCL/RDCLP

```
D-CAPABILITY-REQ/RESP                   ::=     CHOICE {
                                                [4]  IMPLICIT ApplicationCapabilities }
ApplicationCapabilities  ::=    SET {
        documentApplicationProfileT73   [0]  IMPLICIT OCTET STRING,
                                -- '04'H document application profile G3-64k
        documentArchitectureClass       [1]  IMPLICIT OCTET STRING,
                                -- '00'H FDA
        nonBasicDocCharacteristics      [2]  IMPLICIT NonBasicDocCharacteristics OPTIONAL }

NonBasicDocCharacteristics      ::=     SET {
        page-dimensions                 [2]  IMPLICIT SET OF Dimension-pair OPTIONAL,
        ra-gr-coding-attributes         [3]  IMPLICIT SET OF Ra-Gr-Coding-Attribute OPTIONAL,
        ra-gr-presentation-features     [4]  IMPLICIT SET OF Ra-Gr-Presentation-Feature OPTIONAL,
        types-of-coding                 [29] IMPLICIT SET OF Type-of-Coding OPTIONAL }

Dimension-pair                  ::=     SEQUENCE {
        horizontal                      [0]  IMPLICIT INTEGER,
        vertical                        CHOICE {
            fixed                       [0]  IMPLICIT INTEGER,
            variable                    [1]  IMPLICIT INTEGER }}
                                                -- ISO B4     = (11811, 16677 fixed or variable)
                                                -- ISO A3     = (14030, 19840 fixed or variable)
                                                -- ISO A4     = ( 9920, 14030 fixed or variable)
                                -- default value is ISO A4     = ( 9920, 14030 fixed)
                        -       -- basic default value is ISO A4 = ( 9920, 14030 fixed or variable)
```

```
Ra-Gr-Coding-Attribute    ::=    CHOICE {
        compression                    [0]  IMPLICIT Compression }

Compression                      ::=    INTEGER { uncompressed  (0) ,
                                                  compressed    (1) }
                                 -- default and basic value is compressed (1)

Ra-Gr-Presentation-Feature       ::=    CHOICE {
        pel-transmission-density [11]  IMPLICIT Pel-Transmission-Density }

Pel-Transmission-Density ::=    INTEGER { p6              (1), -- 6 BMU (200pels / 25.4 mm)
                                          p4              (3), -- 4 BMU (300pels / 25.4 mm)
                                          p3              (4), -- 3 BMU (400pels / 25.4 mm)
                                          R8 × 3.85       (5),
                                          R8 × 7.7        (6),
                                          R8 × 15.4       (7),
                                          R16 × 15.4      (8) }
                                 -- default and basic value is R8 × 3 .85 (5)

Type-of-Coding                   ::=    CHOICE {
                                        [0]  IMPLICIT INTEGER {  T.6 coding (1),
                                                                 T.4 one dimensional coding (2),
                                                                 T.4 two dimensional coding (3) }
                        -- default and basic value is T.4 one dimensional coding (2) }

        Example ----------------------------------------------------------------------------------------
            A4  31   ApplicationCapabilities
                80 01 04          documentApplicationProfileT73  =  G3-64k
                81 01 00          documentArchitectureClass  =  FDA
                A2  29            nonBasicDocCharacteristics
                A2  14                    page-dimensions
                30  08                    SEQUENCE
                    80 02 36CE            horizontal  =  14030 BMU
                    81 02 4D80            vertical  =  variable 19840 BMU (ISO A3 variable)
                30  08                    SEQUENCE
                    80 02 2E23            horizontal  =  11811 BMU
                    81 02 4125 vertical  =  variable 16677 BMU (ISO B4 variable)
            A4  09     ra-gr-presentation-features
                8B 01 01                  pel-transmission-density  =  1 (6 BMU)
                8B 01 03                  pel-transmission-density  =  3 (4 BMU)
                8B 01 06                  pel-transmission-density  =  6 (R8 × 7.7)
            BD  06   types-of-coding
                80 01 01          Type-of-coding  =  1 (T.6 coding)
                80 01 03          Type-of-coding  =  3 (T.4 two dimensional coding)


        ----------------------------------------------------------------------------------------------------
```

F.4.2.3 User data conveyed by SUD in CDS

```
S-ACTIVITY-START-user-data       ::=    CHOICE {
                                        [4]  IMPLICIT DocumentCharacterisitcs }

DocumentCharacteristics ::=     SET {
        documentApplicationProfile      [0]  IMPLICIT OCTET STRING,
                                -- '04'H document application profile G3-64k
        documentArchitectureClass       [1]  IMPLICIT OCTET STRING
                                -- '00'H FDA
        nonBasicDocCharacteristics      [2]  IMPLICIT NonBasicDocCharacteristics OPTIONAL
                                -- see F.4.2.2 }
```

```
Example ----------------------------------------------------------------
A4  2B  DocumentCharacteristics
    80 01 04        documentApplicationProfile  =  G3-64k
    81 01 00        documentArchitectureClass  =  FDA
A2  23  nonBasicDocCharacteristics
    A2  14                  page-dimensions
    30  08                  SEQUENCE
        80 02 2E23          horizontal  =  11811 BMU
        81 02 4125 vertical  =  variable 16677 BMU (ISO B4  variable)
    30  08                  SEQUENCE
        80 02 36CE          horizontal  =  14030 BMU
        81 02 4D80          vertical  =  variable 19840 BMU (ISO A3 variable)
A4  06      ra-gr-presentation-features
    8B 01 06                pel-transmission-density = 6 (R8 × 7.7)
    8B 01 07                pel-transmission-density = 7 (R8 × 15.4)
BD  03      types-of-coding
    80 01 03        Type-of-coding = 3 (T.4 two dimensional coding)
```

F.4.2.4 Layout object descriptor (document layout root) conveyed by CSUI/CDUI

```
Interchange-Data-Element        ::=     CHOICE {
        layout-object                   [2]  IMPLICIT Layout-Object-Descriptor }

Layout-Object-Descriptor ::=    SEQUENCE {
        object-type                     Layout-Object-Type,
        descriptor-body         Layout-Object-Descriptor-Body OPTIONAL }

Layout-Object-Type              ::=     INTEGER { document-layout-root  (0) }

Layout-Object-Descriptor-Body   ::=     SET {
        object-identifier               Object-or-Class-Identifier OPTIONAL,
        subordinates                    [0]  IMPLICIT SEQUENCE OF NumericString OPTIONAL,
        default-value-lists             [7]  IMPLICIT Default-Value-Lists-Layout OPTIONAL }

Object-or-Class-Identifier ::=  [APPLICATION 1] IMPLICIT PrintableString
                                -- only digits and space are used in the present version
                                -- of the standard; other characters are reserved for extensions:
                                -- a "null" value is represented by an empty string.

Default-Value-Lists-Layout      ::=     SET {
        page-attributes                 [2]  IMPLICIT Page-Attributes OPTIONAL }

Page-Attributes                 ::=     SET {
        dimensions                      < Attribute OPTIONAL,
        presentation-attributes         < Attribute OPTIONAL }

Attributes                      ::=     CHOICE {
        dimensions                      [1]  IMPLICIT Dimension-Pair,
                                        -- see section 4.2.2
        presentation-attributes         [3]  IMPLICIT Presentation-Attributes
                                        -- see F.4.2.5 }
        Example ----------------------------------------------------------------

        A2  03          Layout-Object-Descriptor
            02 01 00    INTEGER  =  document-layout-root
        ---------------------------------------------------------------------------
```

F.4.2.5 Layout object descriptor (page) conveyed by CSUI/CDUI

```
Interchange-Data-Element        ::=     CHOICE {
        layout-object                   [2]  IMPLICIT Layout-Object-Descriptor }

Layout-Object-Descriptor ::=    SEQUENCE {
        object-type                     Layout-Object-Type,
        descriptor-body         Layout-Object-Descriptor-Body OPTIONAL }

Layout-Object-Type              ::=     INTEGER { page (2) }

Layout-Object-Descriptor-Body   ::=     SET {
        object-identifier               Object-or-Class-Identifier OPTIONAL,
        content-portions                [1]  IMPLICIT SEQUENCE OF NumericString OPTIONAL,
        dimensions                      [4]  IMPLICIT Dimension-Pair OPTIONAL,
                                -- see F.4.2.2
        presentation-attributes         [6]  IMPLICIT Presentation-Attributes OPTIONAL }

Object-or-Class-Identifier ::=  [APPLICATION 1] IMPLICIT PrintableString
                                -- see F.4.2.4
Presentation-Attributes         ::=     SET {
        content-type                    Content-Type    OPTIONAL,
        raster-graphics-attributes      [1]  IMPLICIT Raster-Graphics-Attributes   OPTIONAL }

Content-Type                    ::=     [APPLICATION 2] IMPLICIT INTEGER
                                                { formatted-raster-graphics (1) }

Raster-Graphics-Attributes      ::=     SET {
        pel-path                        [0]  IMPLICIT One-of-Four-Angles OPTIONAL,
        line-progression                [1]  IMPLICIT One-of-Two-Angles OPTIONAL,
        pel-transmission-density[2]  IMPLICIT Pel-Transmission-Density OPTIONAL
                                -- see F.4.2.2 (See Note) }
```

NOTE – The transmitter shall correctly indicate the resolution of the transmitted document. Consequently, the transmitter may use the resolution of 6BMU when the receiver indicates the resolution of R8 × 7.7 or vice versa. Similarly, the transitter may use the resolution of 3BMU when the receiver indicates the resolution of R16 × 15.4 or vice versa.

```
One-of-Four-Angles              ::=     INTEGER  {  d0     (0)  -- 0 }
                                -- default and basic value is d0 (0)


One-of-Two-Angles               ::=     INTEGER  {  d270  (3)  -- 270 }
                                -- default and basic value is d270  (3)
```

Example 1 ----------

```
A2   03          Layout-Object-Descriptor
     02 01 02      INTEGER  =  page
                        -- This means ISOA4 fixed and R8 × 3.85
```

Example 2 ----------

```
A2   16          Layout-Object-Descriptor
     02 01 02      INTEGER  =  page
     31 11         SET
          A4 08              dimensions
               80 02 26C0         horizontal  =  9920  BMU
               81 02 36CE         vertical     =  14030  BMU (ISO A4 variable)
          A6   05            presentation-attributes
               A1 03              raster-graphics-attributes
                 82 01 06         pel-transmission-density  =  R8 × 7.7
```

F.4.2.6 Content portion conveyed by CSUI/CDUI

```
Interchange-Data-Element        ::=     CHOICE {
        content-portion                 [3]  IMPLICIT Text-Unit }

Text-Unit                       ::=     SEQUENCE {
        content-portion-attributes      Content-Portion-Attributes OPTIONAL,
        content-information              Content-Information  }

Content-Portion-Attributes      ::=     SET {
        content-identifier-layout       Content-Portion-Identifier OPTIONAL,
        type-of-coding                  Type-of-Coding          OPTIONAL,
                                --      see F.4.2.2

        coding-attributes               CHOICE {
        raster-gr-coding-attributes     [2]  IMPLICIT Raster-Gr-Coding-Attributes } OPTIONAL }

Content-Portion-Identifier ::=  [APPLICATION 0] IMPLICIT PrintableString
                                --      only digits and space are used in the present version
                                --      of the standard; other characters are reserved for extensions.

Raster-Gr-Coding-Attributes     ::=     SET {
        number-of-pels-per-line         [0]  IMPLICIT INTEGER   OPTIONAL,
                                --ISO A4 R8                     = 1728
                                --      R16                     = 3456
                                --      200 pels/25.4 mm        = 1728
                                --      300 pels/25.4 mm        = 2592
                                --      400 pels/25.4 mm        = 3456
                                --ISO B4 R8                     = 2048
                                --      R16                     = 4096
                                --      200 pels/25.4 mm        = 2048
                                --      300 pels/25.4 mm        = 3072
                                --      400 pels/25.4 mm        = 4096
                                --ISO A3 R8                     = 2432
                                --      R16                     = 4864
                                --      200 pels/25.4 mm        = 2432
                                --      300 pels/25.4 mm        = 3648
                                --      400 pels/25.4 mm        = 4864
                                -- default and basic value is 1728 (ISO A4 R8)

        compression                     [2]  IMPLICIT Compression       OPTIONAL,
                                -- see F.4.2.2

Content-Information                     ::=     OCTET STRING
                                        -- basic value is T.4 one dimensional coding string

Example 1 ------------------------------------------------------------------------------------------------------
        A3   LI        Text-Unit
             04 LI XXXXX (T.4 one dimensional coding string) XXXXX      OCTET STRING (primitive)
-------------------------------------------------------------------------------------------------------------------

Example 2 ------------------------------------------------------------------------------------------------------
        A3   80        Text Unit
        31   09   content-portion-attributes
             80   01   01        Type-of-coding = 1 (T.6 coding)
             A2   04   coding-attributes
             80   02   0800      number-of-pels-per-line = 2048
        24 80     OCTET STRING (constructed)
             04 LI XXXXXXXXX (T.6 coding string) XXXXXXXXXX    OCTET STRING (primitive)
             04.LI XXXXXXXXX (T.6 coding string) XXXXXXXXXX    OCTET STRING (primitive)
             0000EOC
             0000EOC
-------------------------------------------------------------------------------------------------------------------
```

F.4.3 Communication concepts

F.4.3.1 General

A G3-64 kbit/s facsimile may negotiate the capability to use the document application profile and the document architecture class within an association. This negotiation is accomplished with the DINQ/DINR APDUs (user data of CSS/RSSP) and DCPQ/DCPR APDUs (user data of CDCL/RDCLP) exchanges during the association establishment phase. However, only one type of document may be invoked at any given time during the document transfer phase. The negotiation and invocation are described below.

F.4.3.2 Negotiation

The application capabilities are negotiated as follows:

- For DINQ/DINR, the application capabilities indicated within the session user data (SUD) parameter CSS/RSSP shall only indicate which document application profile(s) and document architecture class(es) are available as receiving capabilities of the sender of the command/response.

- For DCPQ, the application capabilities indicated within the SUD of CDCL should include a list of non-basic document characteristics that may be needed at the receiver by the sender of this command.

- For DCPR, the non-basic document characteristics available should be indicated and are conveyed in the SUD of RDCLP.

F.4.3.3 Invocation

The document characteristics indicated within the SUD of CDS/CDC should include the non-basic document characteristics which are required for the document. The non-basic document characteristics are conveyed in the SUD, using the document characteristics protocol element. The document sender only sends documents which the sink has indicated it is capable of handling.

F.4.3.4 Data transfer

The layout object descriptors and the text units are carried inside the session service data units (CSUI-CDUI T.62 commands). Within the data stream, the interchange data elements are ordered in accordance with “interchange format class B”, as defined in Recommendation T.415. Every text unit follows immediately the descriptor of the associated lowest-level object. When a document is transmitted, a synchronization point is set at each page boundary of the specific structure.

F.5 Interworking

The sequence diagrams of session establishment phase between group 3 facsimile 64 kbit/s option and group 4 class 1 facsimile are shown as follows.

F.5.1 In case of group 3-64 kbit/s option calling

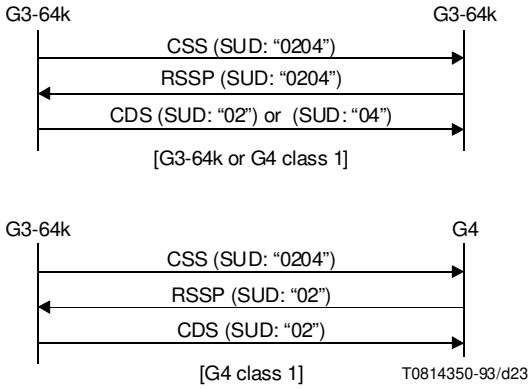


FIGURE F.1/T.4

F.5.2 In case of group 4 class 1 facsimile calling

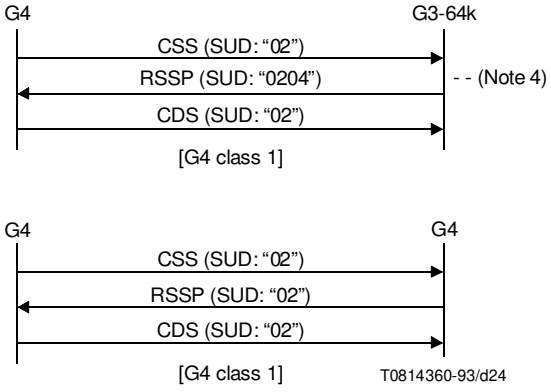


FIGURE F.2/T.4

NOTES

1 The document application profile in the session user data (SUD) of CSS indicates "0204" for T.503 and group 3-64 kbit/s as described in F.4.2. The document application profile contained in the SUD of RSSP indicates the capability of the called side by using "0204" for T.503 and group 3-64 kbit/s option F. CDS shall indicate one of the document application profiles T.503 ("02") and group 3-64 kbit/s ("04") in the SUD.

2 When the calling side intends to use NonBasicCharacteristics, it shall emit CDCL command prior to CDS command and negotiates the capability of the called side according to T.62 procedures. The document application profile contained in the SUD of CDCL shall be either T.503 ("02") or group 3-64 kbit/s ("04").

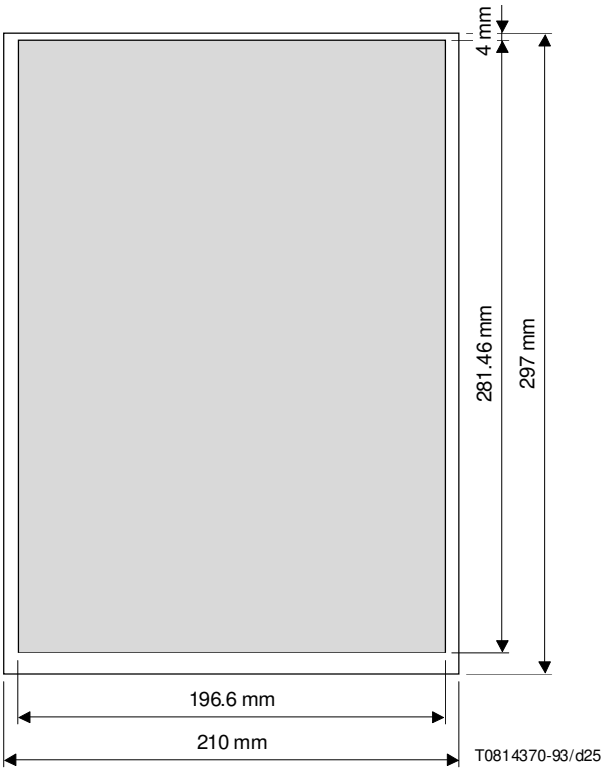
3 When both document application profiles are available at both ends, the document transmitting side shall select one of the two profiles by CDCL and/or CDS commands.

4 In this case, called side may transmit only T.503 ("02") in the SUD.

Appendix I

Guaranteed reproducible area for group 3 apparatus conforming to Recommendation T.4

(This appendix does not form an integral part of this Recommendation)



NOTES

1 Paper characteristics (i.e. weight) are important parameters. Lightweight paper may cause additional paper handling errors and result in a reduced guaranteed reproducible area.

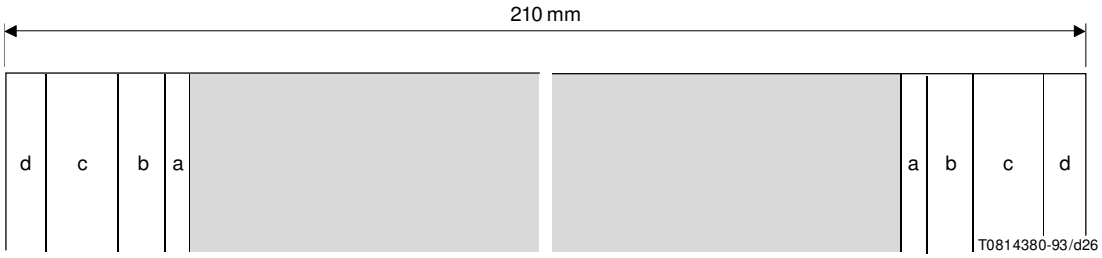
2 Sheet feed mechanism may reduce the guaranteed reproducible area.

3 All calculations were done using worst values. Using nominal values increases the reproducible area.

4 The exact horizontal position of this area within the ISO A4 paper size as well as sizes larger than the above are subject to national recommendations and/or definitions.

FIGURE I.1/T.4

Guaranteed reproducible area for Group 3 machines for use on facsimile services referring to ISO A4 paper size



a Printer/scanner tolerances
b Loss caused by the enlarging effect due to TLL tolerance
c Loss caused by skew
d Record medium positioning errors

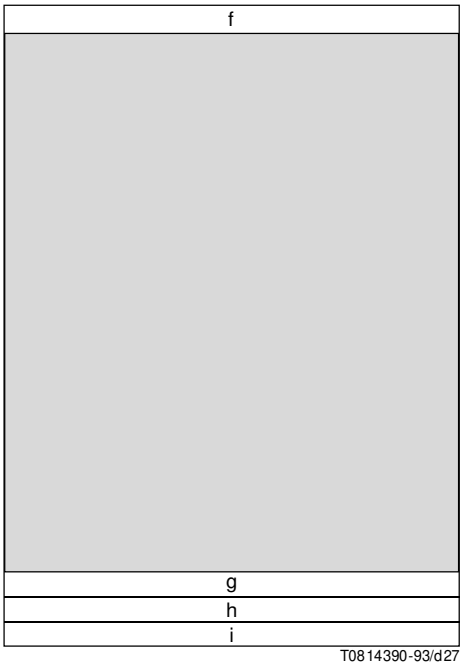
FIGURE I.2/T.4

Horizontal loss

TABLE I.1/T.4

Horizontal losses

Printer/scanner	a	± 0.5 mm
Enlarging	b	± 2.1 mm
Skew	c	± 2.6 mm
Positioning errors	d	± 1.5 mm



f Paper insertion loss
g Loss caused by skew
h Scanning density tolerance
i Gripping loss

FIGURE I.3/T.4

Vertical loss (ISO A4 format)

TABLE I.2/T.4

Vertical losses

Paper insertion	f	4.0 mm
Skew	g	±1.8 mm
Scanning density tolerance	h	± 2.97 mm
Gripping loss	i	2.0 mm
NOTE – Scanning density tolerance will reduce to 0 mm on roll-fed machines.		

Appendix II

Repertoire of box-drawing characters for character mode of group 3 apparatus

(This appendix does not form an integral part of this Recommendation)

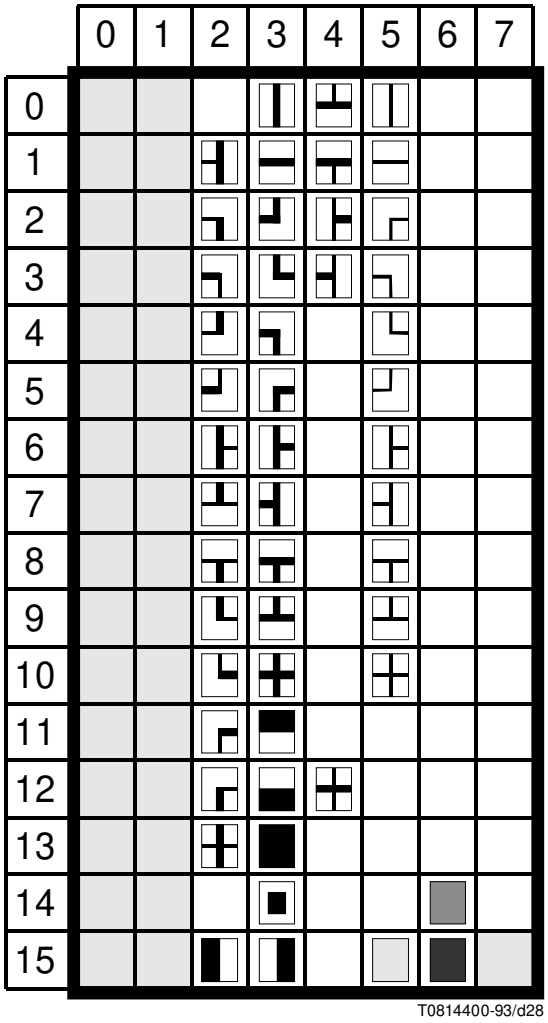


FIGURE II.1/T.4

Repertoire of box-drawing characters