

CCITT Draft Recommendation T.4

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TITLE: DRAFT RECOMMENDATION T.4 - STANDARDIZATION OF GROUP 3
FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION (as
amended and agreed by Working Party XIV/2)

Draft Recommendation T.4

STANDARDIZATION OF GROUP 3 FACSIMILE APPARATUS FOR DOCUMENT
TRANSMISSION

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 and international leased circuits 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 scanning direction should be from left to right and subsequent scans should be adjacent and below the previous scan.

2. Dimensions of apparatus

The following dimensions should be used:

- a. A normal definition standard and an optional higher definition standard of 3.85 and 7.7 line/mm respectively in vertical direction;
- b. 1728 black and white picture elements along the scanned line;
- c. A scanning line length of 215 mm. Other scanning line lengths may be employed in which case the scanning density should be changed to maintain the correct picture proportions;
- d. Input documents up to a minimum of ISO A4 size should be accepted.

3. Transmission time per scanning line

A total scanning line is defined as the sum of DATA bits plus any required FILL bits plus the EOL bits. The minimum transmission times of the total scanning line should conform to the following:

- a. 20 milliseconds recommended standard with an optional fall-back to the 40 milliseconds option;
- 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. 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 the T.30 control procedure. The maximum transmission time of any total scanning line should be less than 5 seconds.

4. Coding scheme

The one-dimensional run length encoding scheme recommended for Group 3 apparatus is as follows:

- a. 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 scanning line of the document of standard A4 size. In order to insure that the receiver maintains color synchronization, all DATA lines will begin with a white run length code word. If the actual scanning 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 scanning line

(1728 picture elements or pels) are defined by the code words in Tables 1 and 2. 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.

b. 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

c. 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 insure that each line of DATA, FILL, and EOL exceeds the minimum transmission time of a total scanning line established in the premessage control procedure. The maximum length for a single line of FILL is 5 seconds, after which the receiver may disconnect.

Format: variable length string of 0's.

d. RETURN TO CONTROL (RTC)

The end of a document transmission is indicated by sending six consecutive EOL's. Following the RTC signal, the transmitter will send the post message commands in the standard T.30 blocked format at the data rate.

Format: 0000000000001 0000000000001
(total of 6 times)

Table 1a. Terminating White Codes

Code	Lng	Run
00110101	8	0
000111	6	1
0111	4	2
1000	4	3
1011	4	4
1100	4	5
1110	4	6
1111	4	7
10011	5	8
10100	5	9
00111	5	10
01000	5	11
001000	6	12
000011	6	13
110100	6	14
110101	6	15
101010	6	16
101011	6	17
0100111	7	18
0001100	7	19
0001000	7	20
0010111	7	21
0000011	7	22
0000100	7	23
0101000	7	24
0101011	7	25
0010011	7	26
0100100	7	27
0011000	7	28
00000010	8	29
00000011	8	30
00011010	8	31
00011011	8	32
00010010	8	33
00010011	8	34
00010100	8	35
00010101	8	36
00010110	8	37
00010111	8	38
00101000	8	39
00101001	8	40
00101010	8	41
00101011	8	42
00101100	8	43
00101101	8	44
00000100	8	45
00000101	8	46
00001010	8	47
00001011	8	48
01010010	8	49

01010011	8	50
01010100	8	51
01010101	8	52
00100100	8	53
00100101	8	54
01011000	8	55
01011001	8	56
01011010	8	57
01011011	8	58
01001010	8	59
01001011	8	60
00110010	8	61
00110011	8	62
00110100	8	63

Code	Make Up Lng	White Codes Run
11011	5	64
10010	5	128
010111	6	192
0110111	7	256
00110110	8	320
00110111	8	384
01100100	8	448
01100101	8	512
01101000	8	576
01100111	8	640
011001100	9	704
011001101	9	768
011010010	9	832
011010011	9	896
011010100	9	960
011010101	9	1024
011010110	9	1088
011010111	9	1152
011011000	9	1216
011011001	9	1280
011011010	9	1344
011011011	9	1408
010011000	9	1472
010011001	9	1536
010011010	9	1600
011000	6	1664
010011011	9	1728

Table 2a. Terminating Black Codes

Code	Lng	Run
0000110111	10	0
010	3	1
11	2	2
10	2	3
011	3	4
0011	4	5
0010	4	6
00011	5	7
000101	6	8
000100	6	9
0000100	7	10
0000101	7	11
0000111	7	12
00000100	8	13
00000111	8	14
000011000	9	15
0000010111	10	16
0000011000	10	17
0000001000	10	18
00001100111	11	19
00001101000	11	20
00001101100	11	21
00000110111	11	22
00000101000	11	23
00000010111	11	24
00000011000	11	25
000011001010	12	26
000011001011	12	27
000011001100	12	28
000011001101	12	29
000001101000	12	30
000001101001	12	31
000001101010	12	32
000001101011	12	33
000011010010	12	34
000011010011	12	35
000011010100	12	36
000011010101	12	37
000011010110	12	38
000011010111	12	39
000001101100	12	40
000001101101	12	41
000011011010	12	42
000011011011	12	43
000001010100	12	44
000001010101	12	45
000001010110	12	46
000001010111	12	47
000001100100	12	48
000001100101	12	49

000001010010	12	50
000001010011	12	51
000000100100	12	52
000000110111	12	53
000000111000	12	54
000000100111	12	55
000000101000	12	56
000001011000	12	57
000001011001	12	58
000000101011	12	59
000000101100	12	60
000001011010	12	61
000001100110	12	62
000001100111	12	63

Table 2b. Make Up Black Codes
Code Lng Run

0000001111	10	64
000011001000	12	128
000011001001	12	192
000001011011	12	256
000000110011	12	320
000000110100	12	384
000000110101	12	448
0000001101100	13	512
0000001101101	13	576
0000001001010	13	640
0000001001011	13	704
0000001001100	13	768
0000001001101	13	832
0000001110010	13	896
0000001110011	13	960
0000001110100	13	1024
0000001110101	13	1088
0000001110110	13	1152
0000001110111	13	1216
0000001010010	13	1280
0000001010011	13	1344
0000001010100	13	1408
0000001010101	13	1472
0000001011010	13	1536
0000001011011	13	1600
0000001100100	13	1664
0000001100101	13	1728

Note: It is recognized that machines exist which accommodate larger paper widths whilst maintaining the standard horizontal resolution. This option has been provided for by the addition of the Make Up Code Set defined as follows:

Table 3. Extended Make Up Codes (Black and White)

Code	Lng	Run
-----	-----	-----
000000001000	11	1792
000000001100	11	1856
000000001101	11	1920
0000000010010	12	1984
0000000010011	12	2048
0000000010100	12	2112
0000000010101	12	2176
0000000010110	12	2240
0000000010111	12	2304
0000000011100	12	2368
0000000011101	12	2432
0000000011110	12	2496
0000000011111	12	2560

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 the T.30 control procedures.

4.2 Two dimensional coding scheme

The one-dimensional coding scheme defined in 4.1 may be extended as an option to a two-dimensional scheme. This is the subject of further study.

5. Modulation and demodulation method

It is provisionally agreed that Group 3 apparatus operating on the general switched telephone network shall utilize the modulation scrambler, equalization and timing signals defined in Recommendation V.27ter, specifically in the preamble and 2, 3, 6, 7, 9 and 10.

The data signalling rates to be used are those recommended in Recommendation V.27ter, i.e. 4800 and 2400 bit/s.

Note 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.

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

arrangement of interworking between equipment conforming to Recommendation T.4 and these existing equipments is subject to further study.

Note 3: For higher speed operation, such as may be possible on leased circuits, it is provisionally agreed that Group 3 apparatus may utilize the signals specifically defined in 1, 2, 3, 4, 7, 8, 9, 11, and 12 of Recommendation V.29.