

CCITT Draft Recommendation T.4

As Defined In: CCITT STUDY GROUP XIV, CONTRIBUTION No.25-E

SOURCE: DRAFTING GROUP ON DRAFT RECOMMENDATION T.4

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: 000000000001 000000000001
(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 |

Table 1b. Make Up White Codes
Code Lng 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 |
|--------------|-------|-------|
| ----- | ----- | ----- |
| 00000001000 | 11 | 1792 |
| 00000001100 | 11 | 1856 |
| 00000001101 | 11 | 1920 |
| 000000010010 | 12 | 1984 |
| 000000010011 | 12 | 2048 |
| 000000010100 | 12 | 2112 |
| 000000010101 | 12 | 2176 |
| 000000010110 | 12 | 2240 |
| 000000010111 | 12 | 2304 |
| 000000011100 | 12 | 2368 |
| 000000011101 | 12 | 2432 |
| 000000011110 | 12 | 2496 |
| 000000011111 | 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.

