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TRANSMISSION, SIGNALLING AND SWITCHING

DECENTRALIZED TERMINAL AND TRANSIT CONTROL SIGNALLING SYSTEM ON INTERNATIONAL CIRCUITS BETWEEN SYNCRHONOUS DATA NETWORKS

ITU-T Recommendation X.71

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation X.71 was published in Fascicle VIII.3 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation X.71

DECENTRALIZED TERMINAL AND TRANSIT CONTROL SIGNALLING SYSTEM ON INTERNATIONAL CIRCUITS BETWEEN SYNCHRONOUS DATA NETWORKS

(Geneva, 1976, amended at Geneva, 1980;
Malaga-Torremolinos, 1984, and Melbourne, 1988)

With the appearance of public data networks in various countries it becomes necessary to establish the appropriate international control signalling schemes for interworking in order to facilitate the introduction of such networks as much as possible. The main objective of public data networks is to offer to the user a great range of data signalling rates with a minimum of restrictions, very short call set-up and clear-down times and a variety of new service facilities. These requirements can be fulfilled only by specially conceived signalling systems which cater for all foreseeable needs and which are flexible enough to provide also for new, not yet defined, services.

For these reasons, the CCITT

unanimously recommends

for interworking between synchronous data networks utilizing decentralized control signalling techniques the scheme given below should be used on international circuits.

Note 1 - The synchronous user classes of service are as specified in Recommendation X.1.

Note 2 - The signalling on links between synchronous and anisochronous networks is the subject of further study.

Note 3 - The interworking between common channel and decentralized signalling is the subject of Recommendation X.80.

Scope

This Recommendation defines a decentralized control signalling system for use in setting up terminal and transit calls on international circuits between synchronous data networks.

1 General switching and signalling principles

1.1 Signalling will be at bearer rates appropriate to the synchronous user classes of data only. It is expected that start-stop user classes of data, telex, etc., will be assembled and transmitted in accordance with Recommendation X.52.

1.2 The control signalling should employ bits transmitted at the maximum data signalling rate of the links provided.

1.3 Decentralized signalling will apply, the same channel being used for control signalling and data transmission.

1.4 Both terminal and transit operation will be required. Due to the inclusion of transit operation, link-by-link signalling control of calls will be adopted.

The data network identification code (DNIC) (see Recommendation X.121), and *network* or *service identification* signals will be transmitted on both transit and terminal calls. However, the data country code (DCC) portion of the DNIC may be suppressed and only the network or service digit forwarded on terminal calls if requested by the incoming network.

Onward selection from transit and incoming terminal centres should be arranged in order to commence as soon as possible.

Selection signals will be transmitted by the originating or transit country, or network, in a single block.

1.5 The numbering scheme that will be applied to networks accessed by this signalling system is defined in Recommendation X.121.

1.6 Alternative routing will be permitted. The principle of high-usage circuits will be adopted, with overflow onto adequately provided routes between centres.

Overflow onto higher speed circuits will not be permitted.

In order to prevent repeated alternative routing causing traffic to circulate back to the originating point, alternative routing will be restricted to once per call.

1.7 Both-way operation will be assumed and inverse order of testing of circuits on both-way routes or a close approximation to it by testing the route in small groups in fixed order always starting the search from the same position, will be specified in order to minimize head-on collisions.

1.8 It is assumed that the gathering of information required for charging and accounting should normally be the responsibility of the calling Administration (see Recommendation D.10). Other arrangements for gathering information are for further study.

1.9 The grade of service to apply for the provision of circuits for links between public data networks of the synchronous type which carry traffic overflowing from other routes, or from which overflow was not permitted, would not be worse than one call lost in 50.

For high-usage direct links circuits would be provided at a grade of service of not worse than one lost call in 10.

1.10 Sufficient switching equipment will be provided to ensure that congestion will not be signalled by return of a *reception-congestion* signal or absence of a *proceed-to-select* signal on more than 0.4% of calls in the busy hour and, in the first case, only then when congestion has been positively identified.

1.11 The target setting-up time for the user classes of service applicable to these types of data networks is for further study.

2 Specific signalling characteristics

Notes applicable to § 2.

Note 1 - X denotes the international centre which originates the call under consideration on the international link concerned. Y denotes the international centre which receives the call under consideration on the international link.

Note 2 - Timings shown are within the centre concerned, excluding propagation and other transmission delays.

Note 3 - The signalling plan will employ 8-bit signalling characters and continuous 0s[1)] and 1s.

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1) The impact of the all zeros pattern is left for further study.

During the control signalling stage, the status bits are 0s. Upon the final through-connection in the originating exchange, the status bits on both signalling paths are 1s.

For the case of signalling characters, the parity of the characters will be odd, and hence will be consistent with Recommendation X.4 for links and connections using end-to-end synchronous operation, and with Recommendation X.21. For the case of signals being continuous 0s, or continuous 1s, parity is undefined inasmuch as no characters are employed. Moreover, character synchronization is not maintained over a period of continuous 0s or 1s, but must be re-established when further signalling characters are sent.

All groups of contiguous characters will be preceded by at least two repetitions of International Alphabet No. 5 (IA5) character 1/6 (SYN). The term "at least" means two SYN characters for the 600 bit/s user class. For the higher speed user classes, the number of SYN characters could be two or more but the total number of SYN characters should not unnecessarily prolong the setting-up time. If two signalling groups are combined to form one group of contiguous characters, the SYN characters may be omitted from within this group.

The end-of-selection signal will be the IA5 character 2/11 (+). The *call confirmation* and *proceed-to-select* signals will use IA5 character 2/10 (*).

Apart from the above mentioned signals (namely, continuous 0s, continuous 1s, 1/6, 2/10 and 2/11), all signals will be characters chosen from column 3 of IA5 (see Table 1/X.71). This choice helps ensure that the synchronization and other characters specified above are uniquely separable from the IA5 column 3 signalling characters.

An example of three successive signalling characters within five octets of one channel of the Recommendation X.50 multiplex structure is shown in Appendix V. In the Recommendation X.51 multiplex structure, the signalling characters will be aligned with the 8 + 2 envelope.

2.1 The signals between two data networks of synchronous type are described in Table 1/X.71. There are two protocols, the Call Confirmation Protocol (CCP) and the Proceed-To-Select Protocol (PTSP). The CCP is the basic method of this Recommendation and the PTSP is an option for an interim period at the discretion of the incoming network.

2.2 The incoming equipment may release the connection as follows:

2.2.1 *Call Confirmation Protocol*

If the *calling* signal exceeds the specified maximum period, but not before at least one call confirmation character has been transmitted.

2.2.2 *Proceed-to-select Protocol*

If the first selection signal is not received within 2 seconds after having sent the *proceed-to-select signal.*

2.3 A head-on collision is detected by the fact that exchange X receives *calling* signal (repetitions of 1s) followed by SYN characters, instead of *call confirmation* or *proceed-to-select* signal (SYN characters followed by repetitions of 2/10) or *reception-congestion* signal (repetitions of 1s followed by *clearing* signal).

When a head-on collision is detected, the switching equipment at each end of the circuit should make another attempt to select a free circuit, either on the same group of circuits or on a group of overflow circuits, if facilities for alternative routing exist and there are no free circuits on the primary route. In the event of a further head-on collision on the second attempt, no further attempt will be made and the call will be cleared down. In the case of a transit centre, the *call progress* signal No. 20 is returned to the preceding centre within a sequence of signals ordered as follows: *call confirmation* or *proceed-to-select*, *network* or *service identification*, the *call progress* signal and *clearing.*

2.4 Failure to receive *reception-congestion, call confirmation* or *proceed-to-select* signal within 4 seconds from the start of the *calling* signal, the reception of a spurious signal as indicated by a signal other than *reception-congestion, call confirmation* or *proceed-to-select* signal, or by a head-on collision, can initiate the automatic *retest* signal on the circuit concerned.

The need for an automatic *retest* signal may not be so great in a digital environment, its purpose being met by alternative methods. If an automatic *retest* signal is used, however, it will conform to § 2.16.

In the case of failure to receive *reception-congestion, call confirmation* or *proceed-to-select* signal, an attempt to select another circuit should be made (once only). In the case of transit calls, if the second attempt is unsuccessful, the *call progress* signal No. 20 is returned to the preceding centre within a sequence of signals ordered as follows: *call confirmation* or *proceed-to-select, network* or *service identification, the call progress signal* and *clearing.*

TABLE 1/X.71

Decentralized signalling between synchronous data networks

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Free line	S = 0, continuous repetitions of 0s	S = 0, continuous repetitions of 0s	
Calling signal	S = 0, continuous repetitions of 1s - - - - - - - - - - - - - - - - - For CC protocol, this signal is continuous for a minimum period of 10 ms or 16 information bits, whichever is the greater in time, and for a maximum period of 15 ms or 24 information bits, whichever is the greater in time [a)] - - - - - - - - - - - - - - - - - For PTS protocol, this signal is continuous until the *proceed-to-select* signal is received	- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	- The equipment at exchange Y should be ready to receive *selection* signals within a period of 10 ms or 16 information bits, whichever is the greater in time, from the start of the received *calling* signal. - The *proceed-to-select* signal should be returned when the equipment is ready to receive *selection* signals.
Call confirmation signal (CC protocol)		S = 0, continuous repetitions of IA5 character 2/10 maintained until the first call-of-traffic character is recognized and always preceded by at least 2 SYN characters (1/6).	Returned within 10 ms or 16 information bits of receipt of the *calling* signal, whichever is the greater in time. The *call confirmation* signal shall be followed by the *network* or *service identification* signal within 50 ms of receipt of the first class-of-traffic character, followed by the *waiting* signal if no other characters follow contiguously. The *call confirmation* signal will have to be absorbed at centre X and should not be able to go through the equipment to arrive at the preceding centre.
Proceed-to-select signal (PTS protocol)		S = 0, continuous repetitions of IA5 character 2/10 maintained until the first class-of-traffic character is recognized and always preceded by at least 2 SYN characters (1/6).	Returned within 3 seconds from the start of the received *calling* signal. The *proceed-to-select* signal shall be followed by the *network or service* identification signal within 50 ms of receipt of the first class-of-traffic character, followed by the *waiting* signal if no other signalling characters follow contiguously. The *proceed-to-select* signal will have to be absorbed at centre X and should not be able to go through the equipment to arrive at the preceding centre.

TABLE 1/X.71 *(continued)*

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Selection signals	S = 0, at least one (first class-of-traffic character only) and possibly several network *selection* signals depending on the network requirement (see Appendix I), the digits of the DNIC of the called network, the digits of the called terminal number, and as end-of-selection character (2/11) and then followed by the *waiting* signal		The *selection* signals are transmitted at the maximum data signalling rate of the links provided. The data country code (DCC) may be omitted on terminal calls at the request of the incoming country. For CC protocol, these signals, preceded by at least two SYN characters, are transmitted immediately after the *calling* signal without awaiting the reception at X of the *call-confirmation* signal. For PTS protocol, these signals, preceded by at least two SYN characters, are transmitted immediately after reception at X of *the proceed-to-select* signal.
Network or service identification signals		S = 0, IA5 character 3/11 followed by the DNIC of the network followed by the *waiting* signal if no other signalling characters follow contiguously	The characters 3/11 and DNIC follows the *call confirmation* of *PTS* signal. These signals, preceded by at least two two SYN characters (1/6) when they follow a *waiting* signal; must go through centre X and arrive at the originating network.
Waiting signal	S = 0, repetitions of 1s for a period of at least 15 information bits		This signal must be sent if two groups of signalling characters cannot be combined to form one group of contiguous characters.
Reception congestion signal		S = 0, repetitions of 1 s for a minimum period of 10 ms or 16 information bits, whichever is the greater in time, and for a maximum period of 24 information bits or 15 ms, whichever is the greater in time, followed by the *clearing* signal	It may be possible that this signal will be preceded by the call confirmation signal or a part of it. This signal is returned as soon as possible and the target time will be within 15 ms or 24 information bits of the start of the calling signal, which-ever is the greater in time, when the selection signals cannot be received. This signal should be absorbed by X and not allowed to be received by a preceding centre. This signal should be provided in networks using the CC protocol and may be provided in networks using the PTS protocol.
Call progress signal without clearing (if required)		S = 0, one IA5 character 3/10 and then 2 characters according to Table 7d/X.71, followed by the *waiting* signal id no other signalling characters follow contiguously	These signals are preceded by at least two SYN characters (1/6) when they follow a *waiting* signal. Examples would be redirected-call or *terminal-called call progress* signals, which are followed by a return to the waiting signal.

TABLE 1/X.71 *(continued)*

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Call connected signal		S = 0, one IA5 characters, 3/12-15, according to Table 7/X.71, followed by the *waiting* signal if no other signalling characters follow contiguously	See § 2.13 of the text and Appendix III. This signal is preceded by at least two SYN characters (1/6) if it follows a *waiting* signal.
Start-of-transit through-connect signal (STTC)		S = 0, one IA5 character 3/14 according to Table 7/X.71	This signal always preceded the transit through-connect signal.
Transit through-connect signal (TTC)		S = 0, one IA5 character, 3/12-3/15, according to Table 7b/X.71, followed by the waiting signal if no other signalling characters follow contiguously	This signal will always be prefaced by the *start-of-transit through-connect* signal and will be returned preceding a *call progress* signal without clearing when this has to be sent. It will also be transmitted when the calling and /or called line identification is required (for further details see Appendix III). The signal is returned at the same time as the subscriber call set-up procedure is initiated following a positive subscribers state check, e.g. not busy, no loss of synchronization, or when the subscriber is busy and connect when free facility is provided (see Appendix III(B) for example).
Transit centres through-connected signal (TTD)	S = 0, one IA5 character, 3/10 according to Table 6/X.71		This signal is returned by the originating exchange 30-50 ms following receipt of the *transit through-connect* signal. The signal is omitted and replaced by the calling line identity if it is requested.
Called line identification signal (if applicable)		S = 0, *called line identification* signal transmitted between 0 and 30 ms after the transit *centres through-connected* signal or the first character of the calling line identification is received	The *called line identification* signal consists of the DNIC followed by the digits of the network terminal number and then the end-of-identification character (3/11) (see § 2.12 of the text and Appendix III). If the called line identification is requested and is not available within the network receiving the request, a dummy identification consisting of the end-identification character (3/11) only is transmitted. This signal is preceded by at least two SYN characters (1/6) when it follows a *waiting* signal.

TABLE 1/X.71 *(continued)*

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Calling line identification signal (if applicable)	S = 0, *calling line identification* signal transmitted between 30 and 50 ms after the *transit through-connect* signal is received		The *calling line identification* signal consists of the DNIC followed by the digits of the network terminal number and then the end-of-identification character (3/11). If the calling line identification is requested and is not available within the network receiving the request, the DNIC followed by character 3/11 shall be transmitted. See Appendix III.
Termination through-connection signal		Continuous repetitions of 1s (S = 1) from the called DTE received by the originating centre	This signal confirms through-connection in both directions of transmission in the originating centre (see § 2.13 of the text and Appendix III.)
Originating through-connection signal	Continuous repetitions of 1s (S = 1) received by the called DTE from the calling DTE		This signal confirms through-connection in both directions of transmission in the originating centre (see § 2.13 of the text and Appendix III.)
Call progress signals with clearing		S = 0, at least two SYN characters (1/6) followed by character 3/10 followed by 2 digits (see Table 7d/X.71) followed by the clearing signal	These signals are preceded by at least two SYN characters (1/6) when they follow a *waiting* signal.
Clearing signal	Continuous repetitions of 0s (S = 0) in the direction of clearing. The minimum recognition time is 16 bits and the maximum time is 60 ms		The minimum period of one signalling path which itself ensures the complete release of the connection is 60 ms.
Clear confirmation signal	Continuous repetitions of 0s (S = 0) in the opposite direction to clearing within 60 ms after reception of the *clearing* signal		The minimum and maximum periods for the release of the international circuit by a centre are 16 bits and 60 ms respectively.
Incoming guard delay	Period of 60-70 ms measured from the moment when continuous 0s (S = 0) has been established on both signalling paths by : - either recognizing or transmitting the *clearing* signal on one signalling path, and - either transmitting or recognizing the clear *confirmation* signal on the other signalling path		A new incoming call shall not be accepted until this guard period has elapsed.
Outgoing guard delay	Period of 130 ms measured from the moment when continuous 0s (S = 0) has been established on both signalling paths by : - either recognizing or transmitting the *clearing* signal on one signalling path, and - either transmitting or recognizing the *clear confirmation* signal on the other signalling path		A new outgoing call shall not be originated until this guard period has elapsed.

TABLE 1/X.71 *(concluded)*

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Automatic retest signal	S = 0 continuous repetitions of 1s for a period of 4 seconds followed by continuous repetitions of 0s for a period of 56 seconds and the signal sequence is then repeated		See § 2.16 of the text.
Backward busy signal		S = 0, continuous repetitions of 1s for a maximum period of 5 minutes	

a) The duration of the *calling* signal and return of the *call confirmation* signal is for further study in the light of experience.

Note 1 - The status bit may be OFF (= 0) or ON (= 1).

Note 2 - For call confirmation (CC) protocol and proceed-to-select (PTS) protocol see § 2.1.

2.5 *Selection* signals can be divided into two parts. The first part, designated the *network selection* signals, contains information regarding network and user requirements and may be composed of one to nine (or possibly more) characters (see Tables 2/X.71, 3/X.71, 3a/X.71, 4/X.71, 4a/X.71, 5/X.71 and 5a/X.71). The second part comprises the *address* signals (the called national terminal number which is preceded by the DNIC always in the case of a transit call and also for terminal calls unless the incoming destination country requests omission of the data country code portion, see Tables 6/X.71 and 6a/X.71).

The *network selection* signals used in the forward direction (see also Appendix II are further subdivided and assembled as follows (see §§ 2.5.1 to 2.5.4 below) for signalling purposes.

Note that the term "user class of service" is abbreviated in the following sections to "user class".

2.5.1 *First class-of-traffic character* (see Table 2/X.71)

The *calling* signal is always followed by at least one class-of-traffic character in addition to at least 2 SYN characters. The bit functions of the class-of-traffic character were chosen so that no further characters would be needed for most connections.

If there is a need for indication of further requirements, a second class-of-traffic character (see § 2.5.3 below) may be used. Whether the second class-of-traffic or user class characters follow or not, will be indicated by the bits b_3 and b_4 of the first class-of-traffic character.

2.5.2 *User class character (indication of speed and code)* (see Tables 3/X.71 and 3a/X.71)

This character, if used, will follow the first class-of-traffic character and will be required when, for example, this information cannot be derived from the incoming line.

As eight user classes in Table 3/X.71 are not sufficient, a second user class character may be added by means of an escape character. Whether a second user class character follows or not will be indicated by the bits b_1, b_2 and b_3 of the first user class character. Whether a second class-of-traffic character follows or not will be indicated by bit b_4 of the first user class character.

2.5.3 *Second and further class-of-traffic characters* (see Tables 4/X.71 and 4a/X.71)

These characters follow either the first class-of-traffic character or any user class characters required. The number of these class-of-traffic characters depends on the number of user facilities available.

The bit b_4 of the second or subsequent class-of-traffic characters indicate whether another class-of-traffic character follows or not.

TABLE 2/X.71

First class-of-traffic character a)

First four bits of character				Conditions signalled from X to Y
b_4	b_3	b_2	b_1	
0	0			No further network selection signal follows
0	1			Second class-of-traffic character follows (Table 4/X.71)
1	0			User class character follows (Table 3/X.71)
		0		Alternative routing not allowed
		1		Alternative routing allowed
			0	Transit traffic
			1	Terminal traffic
1 1 1 1	1 1 1 1	0 0 1 1	0 1 0 1	Not allocated

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

TABLE 3/X.71

First user class character [a]

First four bits of character				Conditions signalled from X to Y [b]
b_4	b_3	b_2	b_1	
0				No second class-of-traffic character follows
0				A second class-of-traffic character follows (Table 4/X.71)
	0	0	0	Synchronous classes derived from line
	0	0	1	300 bit/s (user class 1)
	0	1	0	50 bit/s (user class 2)
	0	1	1	100 bit/s (user class 2)
	1	0	0	110 bit/s (user class 2)
	1	0	1	134.5 bit/s (user class 2)
	1	1	0	200 bit/s (user class 2)
	1	1	1	A second user class character follows (Table 3a/X.71)

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) The user class character(s) may be omitted if, for example, the information can be derived from the incoming line.

TABLE 3a/X.71

Second user class character [a]

First four bits of character				Conditions signalled from X to Y [b]
b_4	b_3	b_2	b_1	
0	0	0	0	600 bit /s (user class 3)
0	0	0	1	2 400 bit /s (user class 4)
0	0	1	0	4 800 bit /s (user class 5)
0	0	1	1	9 600 bit /s (user class 6)
0	1	0	0	48 000 bit /s (user class 7)
0	1	0	1	Service (50 bit/s)
0	1	1	0	Telex (50 bit/s)
0	1	1	1	Gentex (50 bit/s)
1	0	0	0	TWX
1	0	0	1	Teletex (2400 bit/s)
1	0	1	0	Not allocated
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) The user class character(s) may be omitted if, for example, the information can be derived from the incoming line.

TABLE 4/X.71

Second class-of-traffic character [a]

First four bits of character				Conditions signalled from X to Y
b_4	b_3	b_2	b_1	
0				No third class-of-traffic character follows
1				Third class-of-traffic character follows (Table 4a/X.71)
	0			No closed user group sequence follows
	1			Closed user group sequence follows (Table 5/X.71)
		0		Called line identification not required
		1		Called line identification required
			0 1	Reserved for national use [b]

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) On international circuits bit b_1 should be set to zero.

TABLE 4a/X.71

Third class-of-traffic character [a]

First four bits of character				Conditions signalled from X to Y
b_4	b_3	b_2	b_1	
0				No fourth class-of-traffic character follows
1				Fourth class-of-traffic character follows [c]
	0			Redirection not allowed [d]
	1			Redirection allowed [d]
		0		Not multiple address call [d]
		1		Multiple address call [d]
			0 1	Not allocated [b]

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) On international circuits bit b_1 should be set to zero.

c) Reserved for future needs.

d) The international use of this signal requires further study.

2.5.4 *Closed user group characters* (see Tables 5/X.71 and 5a/X.71)

These characters are only used in conjunction with the second and possibly subsequent class-of-traffic characters which may follow.

The start of closed user group character shall precede the closed user group number which should be coded into a number of hexadecimal characters up to a maximum of four (see Table 5/X.71).

2.5.5 The numerical characters used for the second part of the *selection* signals are shown in Tables 6/X.71 and 6a/X.71. When the first class-of-traffic character indicates a terminal call, the incoming country can adopt the option not to receive the data country code portion of the DNIC.

TABLE 5/X.71

Start of closed user group character a) b)

Combination				Condition signalled from X to Y
b_4	b_3	b_2	b_1	
0				Without outgoing access
1				With outgoing access
	0			No DNIC c) follows
	1			DNIC follows c)
		0	0	1 }
		0	1	2 }
		1	0	3 } Number of hexadecimal closed user group characters which follow
		1	1	4 }

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) The start of closed user group character shall precede the DNIC of the representative user, followed by the closed user group number which should be coded into a number of hexadecimal characters up to a maximum of four, as indicated. The closed user group number shall be transmitted with the least significant bit of the least significant character first.

c) On international circuits bit b_3 should be set to 1.

TABLE 5a/X.71

Closed user group characters [a]

Combination				Conditions signalled from X to Y
b_4	b_3	b_2	b_1	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Hexadecimal closed user group character

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

TABLE 6/X.71

Miscellaneous forward path signals [a]

First four bits of character				Conditions signalled from X to Y
b_4	b_3	b_2	b_1	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
				Digits for: – data network identification code (DNIC) – called network terminal number – calling line identification signal
1	0	1	0	Transit centres through-connected (TTD)
1	0	1	1	End-of-calling line identification signal [b]
1	1	0	0	Not allocated
1	1	0	1	
1	1	1	0	
1	1	1	1	

a) All characters comprising these signals are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) This signal follows the DNIC when the calling line identification is not available (see § 2.12).

TABLE 6a/X.71

Other forward path signals (with odd parity)

IA5-character	Condition signalled from X to Y
1/6	SYN
2/11	End-of-selection
2/15	Start of extended address

2.6 The incoming equipment should maintain continuous 0s on the backward signalling path if the received character is spurious as indicated by a character other than continuous 1s (calling signal). This procedure provides a safeguard against false calls.

In the case of receipt of a spurious signal as indicated by a parity error or by a character other than a *selection* signal (with the possible exception of SYN characters), the incoming equipment should return the *call progress* signal No. 20 to the preceding centre immediately followed by the *clearing* signal after the *call confirmation* or *proceed-to-select* signal and the *network* or *service identification* signals.

The incoming equipment may release the connection if all of the *selection* signals are not correctly received within a period of 2 seconds from the recognition of the *calling* signal for the CC Protocol or from the start of transmission of the *proceed-to-select* signal for the PTS Protocol. In this event, the *call progress* signal No. 20 is returned to the preceding centre immediately followed by the *clearing* signal after the *call confirmation* or *proceed-to-select* signal and the *network* or *service identification* signals.

2.7 The international data number may have a maximum number of 14 digits comprising the 4 digit data network identification code and a 10 digit maximum network terminal number. Alternatively, the 14 digits can be considered as the 3 digit data country code followed by a national number of 11 digits maximum (see Recommendation X.121).

The possible address extension may either be included in the 14 digit international data number or may be separated from the international data number by a start-of-extension-address signal (2/15). In that case the extended address consists of up to 40 decimal digits. The network shall not be required to look at or operate on a network extension address. However some networks may look at the network address extension if they wish.

2.8 In the case of receipt of the *reception congestion* signal at a transit centre, the *call progress* signal No. 61 should be returned to the preceding centre (after the *call confirmation* or *proceed-to-select* signal, *network* or *service identification* signal) followed by the *clearing* signal.

2.9 The *network* or *service identification* signals shall be sent following the *call confirmation* or *proceed-to-select* signal in all cases. In all cases the country or network identity shall consist of four decimal digits. The value of the fourth digit should, in the case when it is not specifically defined by the numbering plan, be at the discretion of the country in question within the limits allowed by the numbering plan.

If several transit networks are involved in setting up a call the calling network will receive the network identifications one after the other. If a transit centre fails to receive the first character of the *network* or *service identification* signals, within two seconds of the *call confirmation* signal, it will return to the preceding centre, the *call progress* signal No. 20 (after the *call confirmation* or *proceed-to-select* signal and the *network* or *service identification* signal followed by the *clearing* signal).

The *network* or *service identification* signals could be useful for retracing the route followed by a call (for traffic statistics, international accounts, analysis of unsuccessful calls and the clearing of faults).

It is possible for a transit centre to receive backward path signals such as *network* or *service identification* signals, *call connected* signal or *call progress* signals from subsequent centres, while the backward path signals originated locally are still being sent. It is necessary for the transit centre to ensure that the received signals are passed to the preceding centre without mutilations or loss.

2.10 The backward path signals indicating effective and ineffective call conditions are scheduled in Tables 7/X.71, 7a/X.71, 7b/X.71, 7c/X.71 and 7d/X.71.

2.11 If the *call progress, call connected* or alternatively *terminating through-connection* signals are not received within 15 seconds from the end of selection, then the *call progress* signal No. 20 will be returned to the preceding centre (after the *call confirmation* or *proceed-to-select* signal, *network* or *service identification* signal), followed by the *clearing* signal. The further action to be taken in, the case of reception of *call progress* signals without clear is for further study.

2.12 In this type of signalling, originating and terminating national centres contain the identification of the calling or called subscribers respectively. These identifications may be exchanged within the network as an optional subscribers' feature.

If the called line identification has been requested but is not available, the terminating centre in the connection should send only the *end-of-line identification* signal (3/11).

If the calling line identification has been requested but is not available, the originating centre should send only the DNIC followed by the *end-of-line identification* signal (3/11).

2.13 The *call-connected* signal confirms that the call is accepted by the called subscriber and, if applicable, the calling line identification has been completely received by the terminating centre and passed to the called subscriber, and when applicable that the called line identification has been completely transmitted to the originating centre (see Appendix III).

The *terminating through-connection* signal confirms (by change of status bit from 0 to 1) that through-connection in both directions of transmission has been effected at the terminating exchange (see Appendix III).

The originating *through-connection* signal confirms that the *call connected* signal has been received by the originating centre and when applicable that the called line identification has been completely received by the originating centre and passed to the calling subscriber (see Appendix III).

The *call connected* signal is sent on the backward path by the terminating centre. The originating through-connection signal (change of status bit from 0 to 1) is sent by the originating centre both to the calling and called subscribers.

TABLE 7/X.71

Miscellaneous backward path signals [a]

First four bits of character				Conditions signalled from Y to X
b_4	b_3	b_2	b_1	
0	0	0	0	Digits for: – network or service identification signals – called line identification signal – call progress signal
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	Start of call progress signal (see Table 7d/X.71)
1	0	1	1	End-of-called-line identification signal [b] Start of network or service identification signal
1	1	0		Call connected signal
			0	Call metering
			1	No call metering
1	1	1	0	Start of transit through-connect signal (STTC) [c]
1	1	1	1	Further backward path signal follows (see Table 7a/X.71)

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) This signal is also used alone when the called line identification is not available.

c) This signal always precedes the *transit through-connect* signals detailed in Table 7b/X.71.

TABLE 7a/X.71

Further miscellaneous backward path signals [a) b)]

First four bits of character				Conditions signalled from Y to X
b_4	b_3	b_2	b_1	
0				Reserved for national use
1				Reserved for national use
	0	0	0	Not allocated
	0	0	1	
	0	1	0	
	0	1	1	
	1	0	0	
	1	0	1	
	1	1	0	
	1	1	1	

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) These signals follow combination 1111 in Table 7/X.71.

TABLE 7b/X.71

Transit through-connect signal [a) b)]

First four bits of character				Conditions signalled from Y to X
b_4	b_3	b_2	b_1	
0	0	0	0	Not allocated
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1			Transit through-connect (TTC)
		0		Calling line identification not required
		1		Calling line identification required
			0	Call metering
			1	No call metering

a) All characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) These signals follow the start of *transit through-connect* signal in Table 7/X.71.

TABLE 7c/X.71

Other backward path signals (with odd parity)

IA5-character	Condition signalled form Y to X
1/6	SYN
2/10	Call confirmation or proceed-to-select

TABLE 7d/X.71

Call progress signals [a) g)]

Numerical code first/second digit	Category	Significance
01	Without clearing	Terminal called
02		Redirected call
03		Connect when free
20	With clearing, due to short term condition [b)]	Network failure [f)]
21		Number busy
22		[c)]
23		[c)]
41	With clearing, due to long term condition [b)]	Access barred
42		Changed number
43		Not obtainable
44		Out of order
45		Controlled not ready
46		Uncontrolled not ready
47		DCE power off
48		[c)]
49		Network fault in local loop
51		Call information service
52		Incompatible user class of service
61	With clearing, due to network short term conditions [b)]	Network congestion
71	With clearing, due to network long term conditions [b)]	Degraded service
72		[e)]
81	With clearing, due to DTE-network procedure	Registration/cancellation confirmed [d)]
82		[c)]
83		[c)]

a) All characters comprising these signals are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give odd parity over the character.

b) "Short term" in this context approximates to the holding time of a call whilst "long term" implies a condition that can persist for some hours or even days.

c) These signals are only utilized between the first exchange and the subscriber and are not signalled on inter-network links.

d) Not yet included. To be studied in relation to Recommendation X.300 on network call control procedures.

e) Only utilized within national networks.

f) At the originating exchange, this results in sending a *call progress* signal "no connection" to the calling customer, and clearing the call.

g) A *call progress* signal without clearing should precede the *called line identification* signal. A *call progress* signal with clearing could precede or follow the *called line identification* signal.

2.14 If the terminating centre fails to receive the *transit centres through-connected* signal (TTD) or, if applicable, the first character of the *calling line identification* signals within 4 seconds after having sent the *transit through-connect* signal (TTC), it will return to the preceding centre the *call progress* signal No. 20 followed by the *clearing signal.*

2.15 If the originating centre fails to receive the *terminating through-connect* signal within 10 s after reception of the TTC or CC signal (whichever occurs first) the *call progress* signal No. 20 will be sent to the calling terminal followed by the *clearing* signal. Upon receipt of a *call progress* signal without clearing within the time limit, the timer should be reset with a new time-out period specified in accordance with that in Recommendation X.21 (T3B in Table C-1/X.21). The timer should be stopped upon receiving the terminating through-connection signal.

Note - The time-out supervision for the *connect-when-free/waiting allowed* facility is for further study.

2.16 The guard delays on clearing are measured from the moment when continuous 0s (S = 0) has been established on both signalling paths by:

- either recognizing or transmitting the *clearing* signal on one signalling path, and

- either transmitting or recognizing the *clear confirmation* signal on the other signalling path.

For incoming calls this guard period shall be 60-70 ms.

A new incoming call shall not be accepted until this guard period has elapsed. This is on the assumption that the terminating centre will be able to send the *call confirmation* signal after a negligible period from receipt of the *calling* signal.

The guard period on clearing for outgoing calls should be a period of at least 130 ms. A new outgoing call shall not be originated until this guard period has elapsed.

If centres are able to distinguish between the different clearing conditions, shorter periods may be introduced accordingly.

2.17 The automatic *retest* signal will be initiated, as indicated in § 2.4.

This signal transmitted over the forward signalling path is composed of a maximum of five successive cycles, each cycle incorporating:

S = 0, continuous repetitions of 1s for a period of 4 seconds, followed by:

S = 0, continuous repetitions of 0s for a period of 56 seconds.

The circuit should be marked "unavailable" for outgoing traffic and tested up to 5 times at nominal intervals of one minute, and a check made to confirm the receipt of the *call confirmation* or *proceed-to-select* signal on the backward path in response to each test. If the *call confirmation* or *proceed-to-select* signal has not been received at the end of this first group of tests, the retest will continue with a further group of up to 5 tests at either 5- or 30-minute nominal intervals. If 5-minute intervals are used and the *call confirmation* or *proceed-to-select* signal has not been received at the end of this second group of tests, further retests will be made at 30-minute intervals. An alarm will be given at an appropriate time. However, this retest procedure may be discontinued at any stage at the discretion of the outgoing Administration.

If, however, during the above sequence of retests, the *call confirmation* or *proceed-to-select* signal is received, a *clearing* signal will be transmitted in place of *the retest* signal. Following a valid *clear confirmation* signal, the incoming and the outgoing sides of the trunk circuit should not be returned to service until after expiry of the appropriate guard delay time.

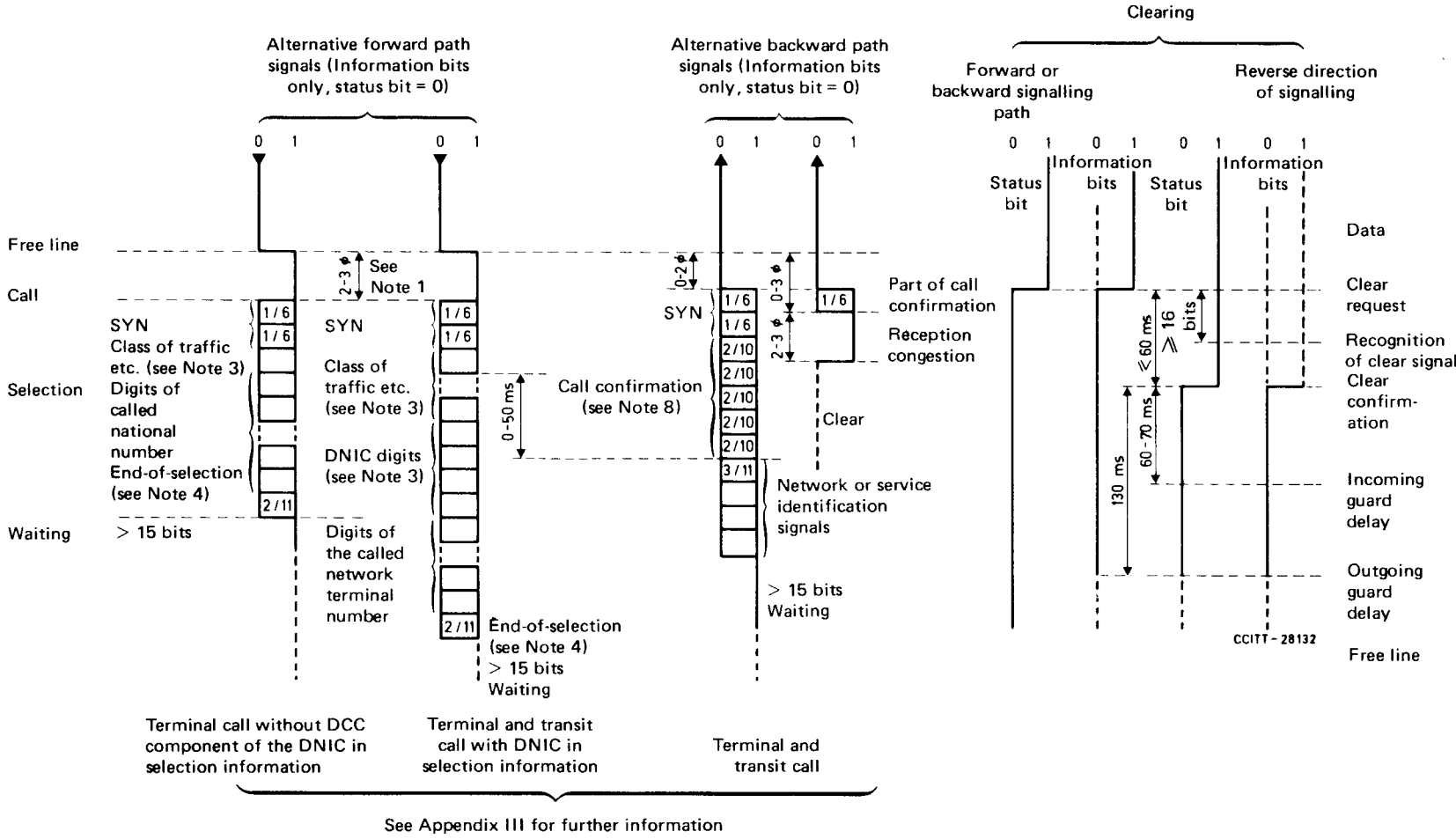
In order to cater for the possibility that a faulty circuit may be seized at both ends, the automatic retest equipment should be arranged to allow an incoming call to be received during continuous repetitions of 0s (S = 0). Administrations may, however, ignore such calls which occur during the incoming guard delay period.

The interval between the tests at the two ends of the trunk circuit should be made different by increasing the nominal interval by 20% at one end, to be sure that successive retests do not overlap at both ends. In general, the intercontinental transit centre having the higher DNIC should take the longer interval (i.e. 1.2, 6 and 36 minutes). Nevertheless, when this requirement would entail considerable difficulty, alternative arrangements may be adopted by agreement between the two Administrations or RPOAs concerned.

Where an exchange has knowledge of a transmission system failure, it is desirable that the *retest* signals shall not be applied to the circuits affected.

In order to avoid simultaneous seizure of too many registers at the distant centre, it is advisable that the *retest* signals, which may be sent simultaneously on various circuits subjected to this test, should be out of phase with one another.

2.18 If at the receiving end parity does not check, provisionally the connection should be cleared down unless otherwise specified. However, the possibility of different actions remains open for further study.



Note 1 – Timings may be shown in ms or in periods of information bits. The symbol ø indicates that the interval may be in multiples of 8 information bits or 5 ms whichever is greatest in time.

Note 2 – *Forward path* signals may also appear on the backward path, indicating a head-on collision on both-way circuits.

Note 3 – *Network selection* signals (class-of-traffic, user class characters, etc.). See Tables 2-5/X.71. DNIC comprises 4 digits.

Note 4 – *Selection* signals will be sent by the originating network in a single block always with an *end-of-selection* signal.

Note 5 – The *network identification* signal comprises character 3/11 followed by the DNIC of the network concerned.

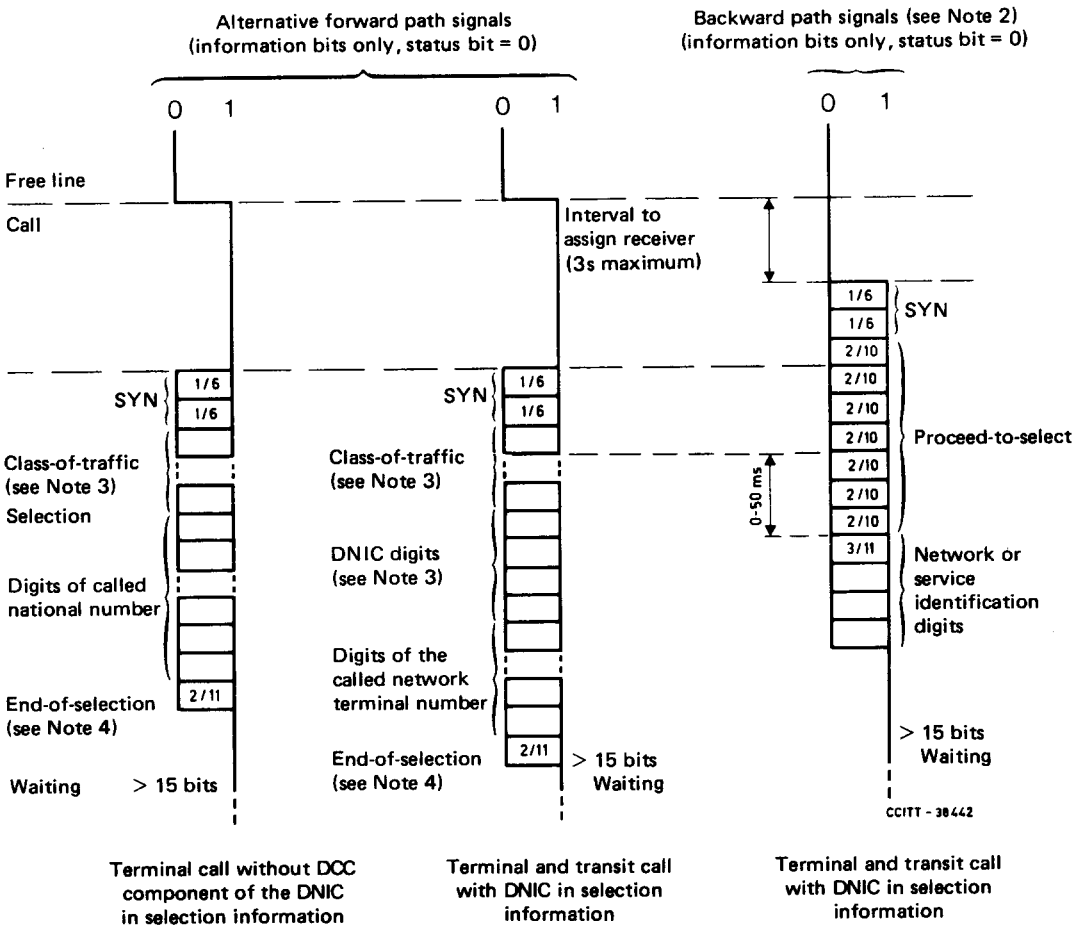
Note 6 – For further details on *call-connected* and *through-connection* signals and their timings see § 2.13 and Appendix III.

Note 7 – All characters shown are from the International Alphabet No. 5.

Note 8 – As an interim arrangement at the discretion of the incoming network, the transmission of the selection signals may be delayed until a *proceed-to-select* signal has been received. In this case the characters shown for the *call confirmation* signal will be used for the *proceed-to-select* signal.

FIGURE 1/X.71

Decentralized signalling between data networks of the synchronous type



Note – Where reference is made, these are the Notes of Figure 1/X.71.

FIGURE 1a/X.71

Initial phases of calls when the proceed-to-select protocol is employed

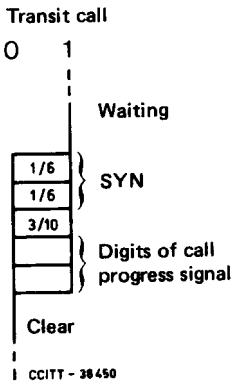


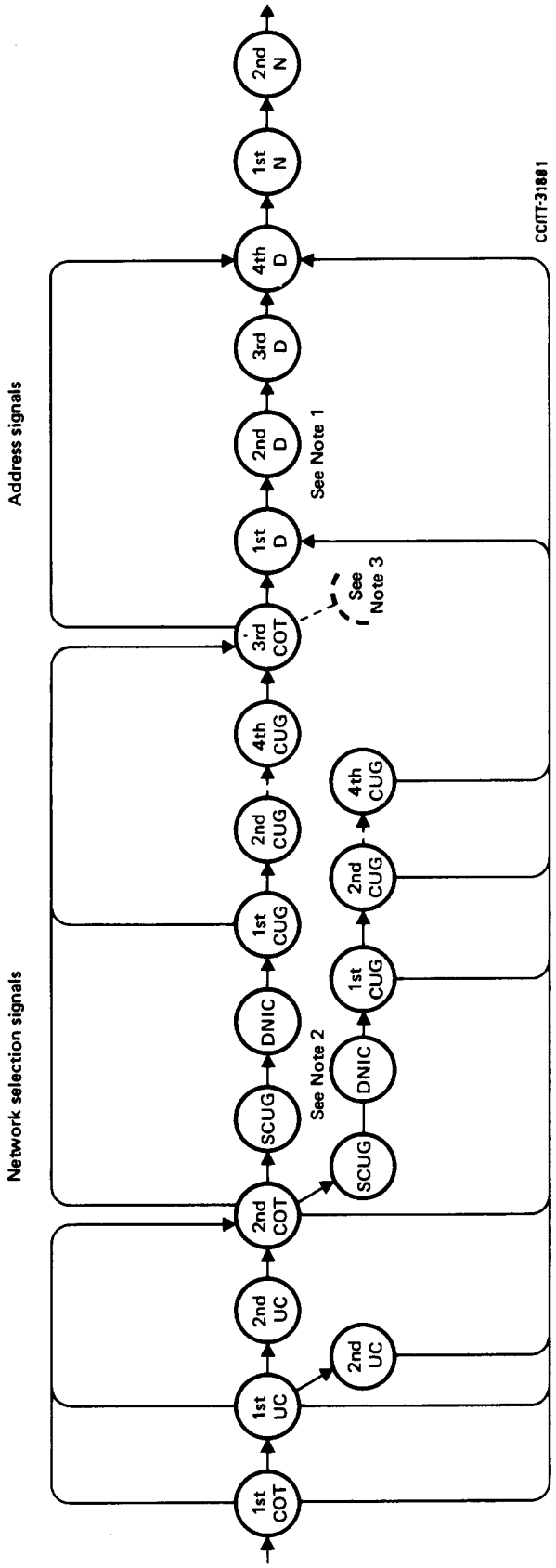
FIGURE 2/X.71

Call progress signal for a transit call

APPENDIX I

(to Recommendation X.71)

Possible sequences of network selection signals



Note 1 – The first three D digits form the data country code (DCC) component of the data network identification code (DNIC). The fourth D digit is the network or service digit of the DNIC.

Note 2 – The DNIC comprises four digits as defined in Note 1.

Note 3 – Reserved for future extension.

COT Class-of-traffic character
UC User class character
CUG Closed user group
D Data network (or service) identification code digit
N Called number digit
SCUG Start of closed user group character
DNIC Data network identification code

APPENDIX II

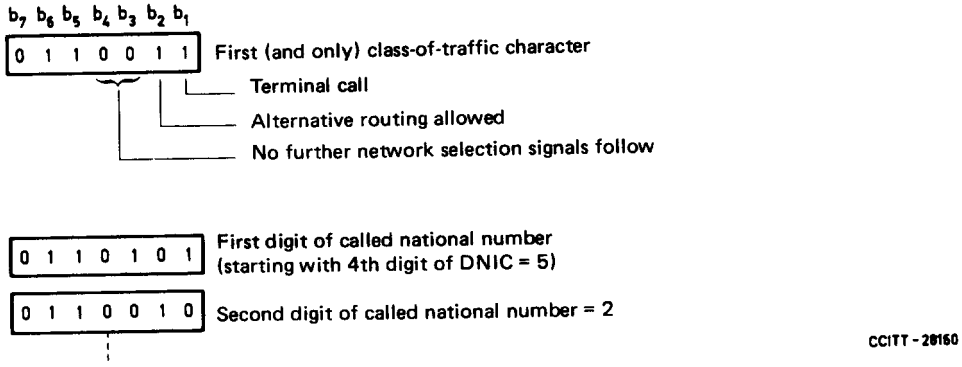
(to Recommendation X.71)

Examples of network selection signals

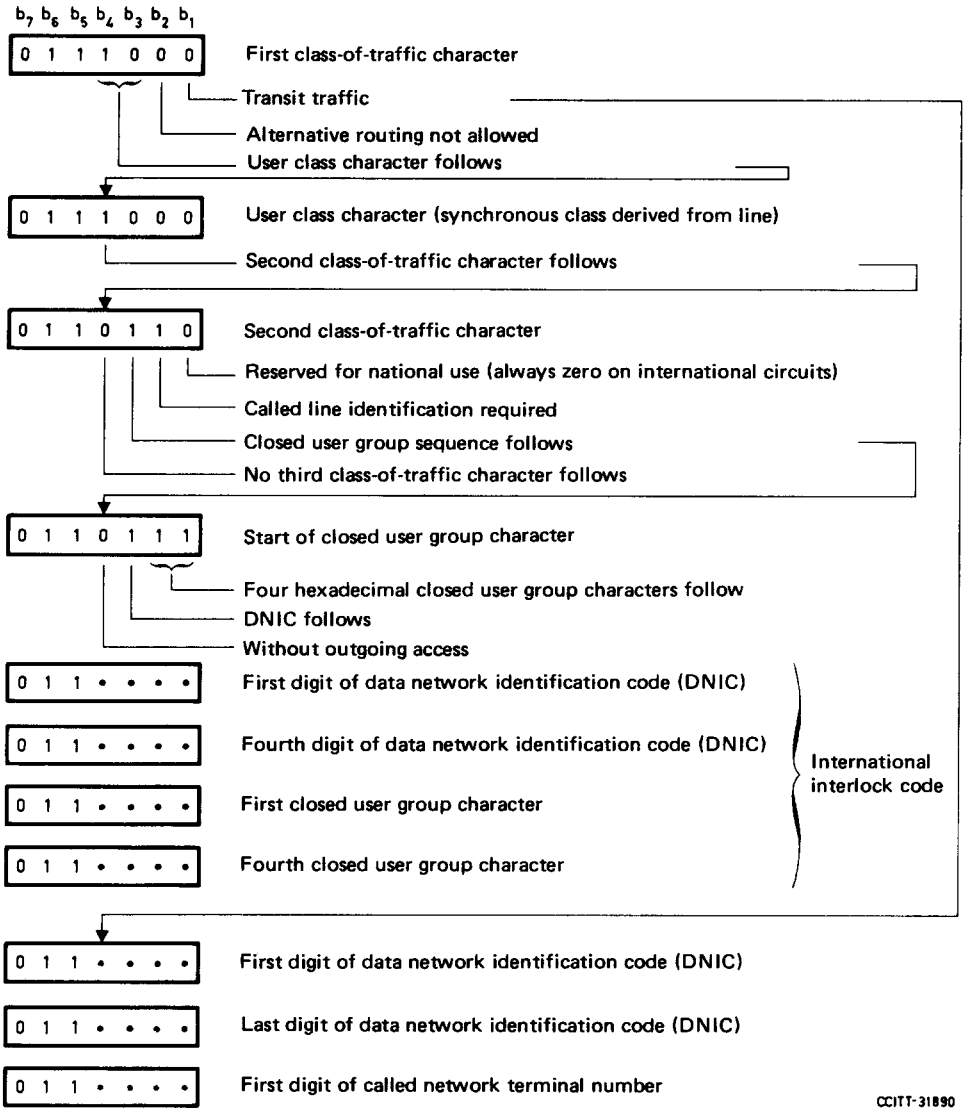
II.1 *First example* (minimum sequence of network selection signals)

This example shows a sequence of minimal length. (The remaining bits in each complete envelope and the preceding calling signal are not shown. The bits are shown in the order of b_7, b_6, b_5, b_4, b_3, b_2, b_1.)

In this example the country of destination has indicated that it does not wish to receive the DCC component of the DNIC.



II.2 *Second example* (a sequence of network selection including closed user group characters)

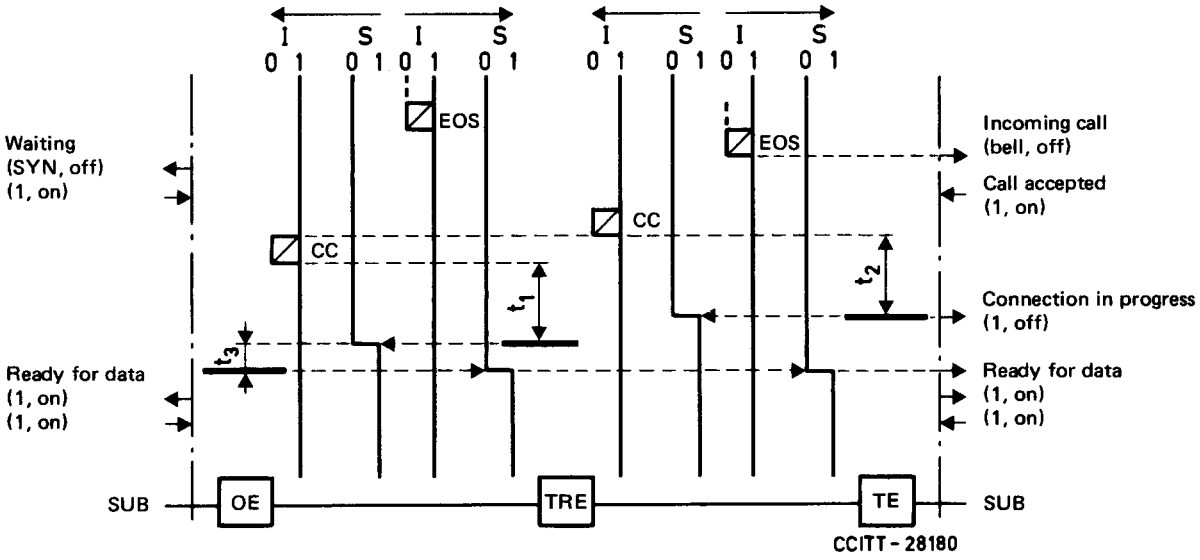


APPENDIX III (A)

(to Recommendation X.71)

Through-connection procedure

Called and calling line identification not required (No *connect-when-free* facility)



S	Status bit	CC	Call connected signal
– – – –	Correlation line	SUB	Subscriber
———	Through-connection	OE	Originating exchange
		TRE	Transit exchange
☒	IA5-character	TE	Terminating exchange
EOS	End-of-selection signal	I	Information bit

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 0-40 ms, t_3 = 0-40 ms.

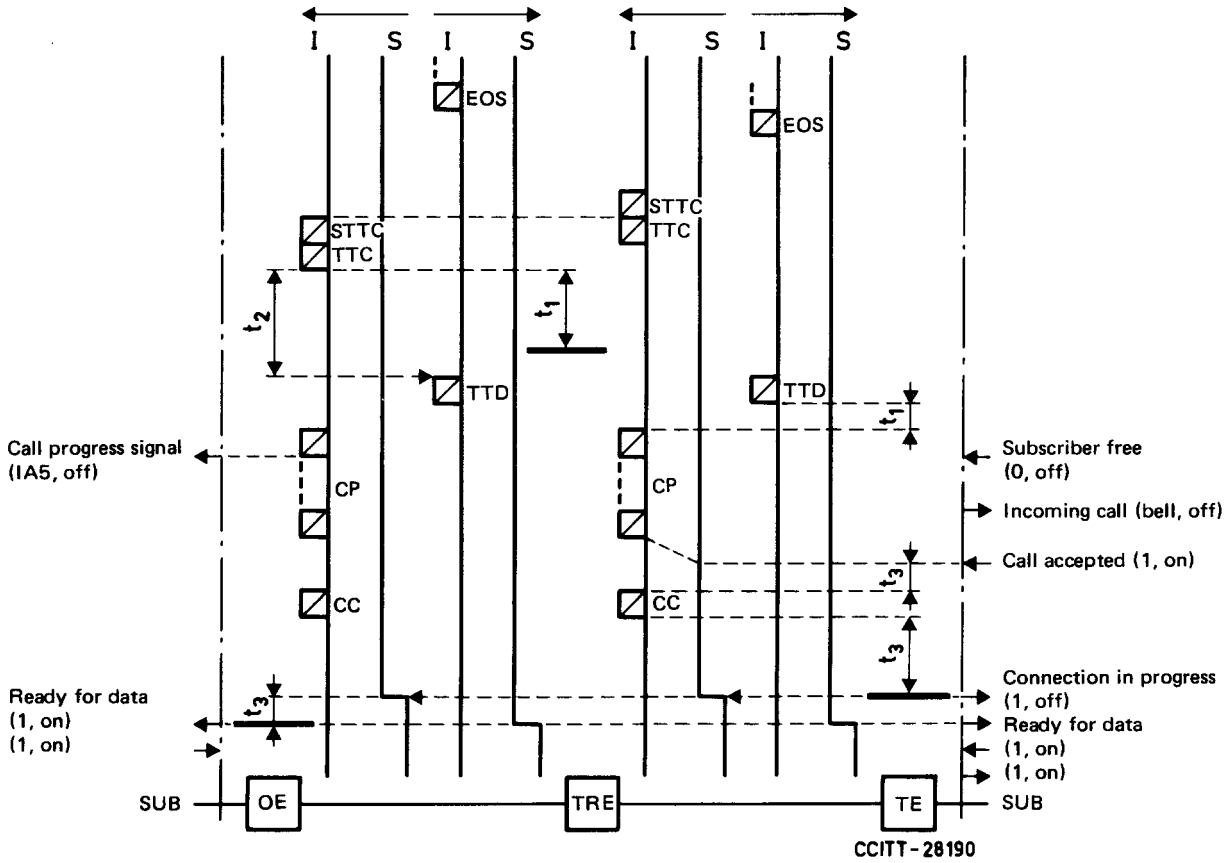
Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

APPENDIX III (B)

(to Recommendation X.71)

Through-connection procedure

Called and calling line identification not required *(Connect-when-free* facility, subscriber is busy)



S	Status bit	TTC	Transit through-connect signal
I	Information bit	TTD	Transit centres through-connected signal
– – – –	Correlation line	CP	Call progress signal
———	Through-connection	CC	Call connected signal
☒	IA5-character	SUB	Subscriber
EOS	End-of-selection signal	OE	Originating exchange
STTC	Start-of-transit through-connect signal	TRE	Transit exchange
		TE	Terminating exchange

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

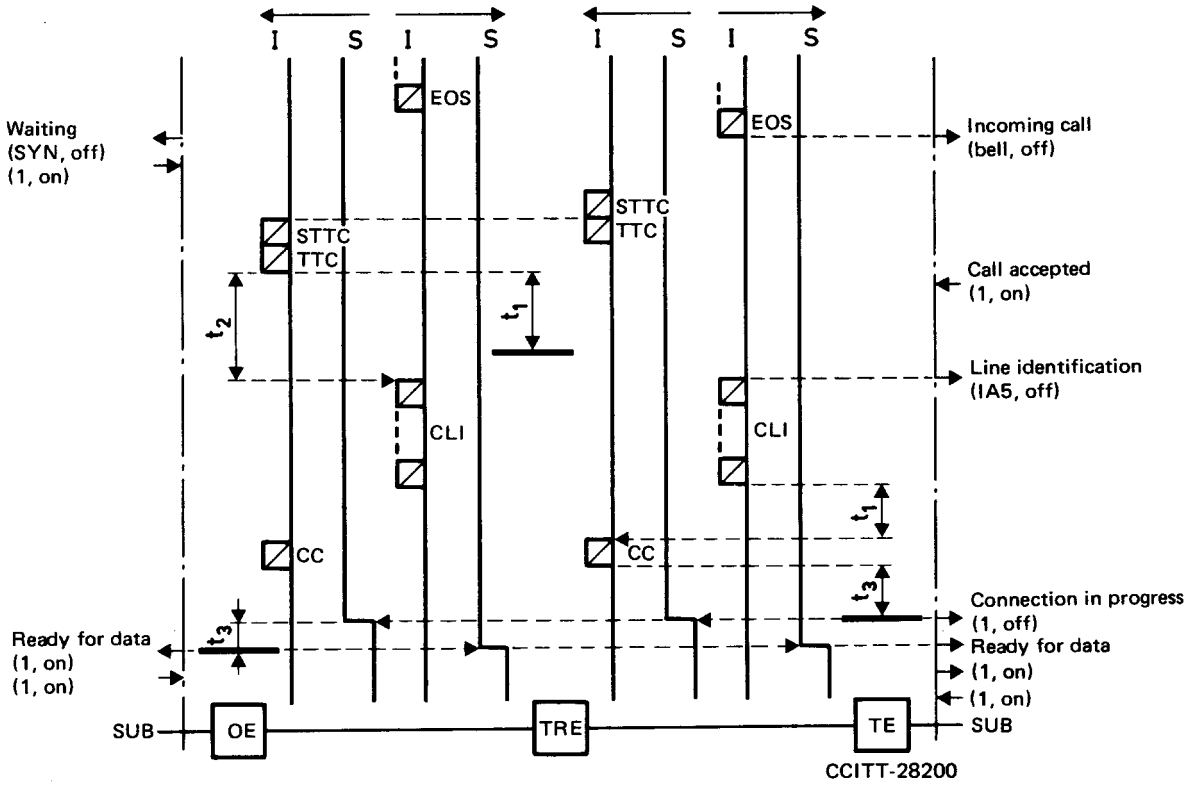
Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

APPENDIX III (C)

(to Recommendation X.71)

Through-connection procedure

Called line identification not required, calling line identification required (No *connect-when-free* facility)



S	Status bit	CLI	Calling line identification signals
– – – –	Correlation line	CC	Call connected signal
———	Through-connection	SUB	Subscriber
☒	IA5-character	OE	Originating exchange
		TRE	Transit exchange
EOS	End-of-selection signal	TE	Terminating exchange
STTC	Start-of-transit through-connect signal	I	Information bit
TTC	Transit through-connect signal		

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

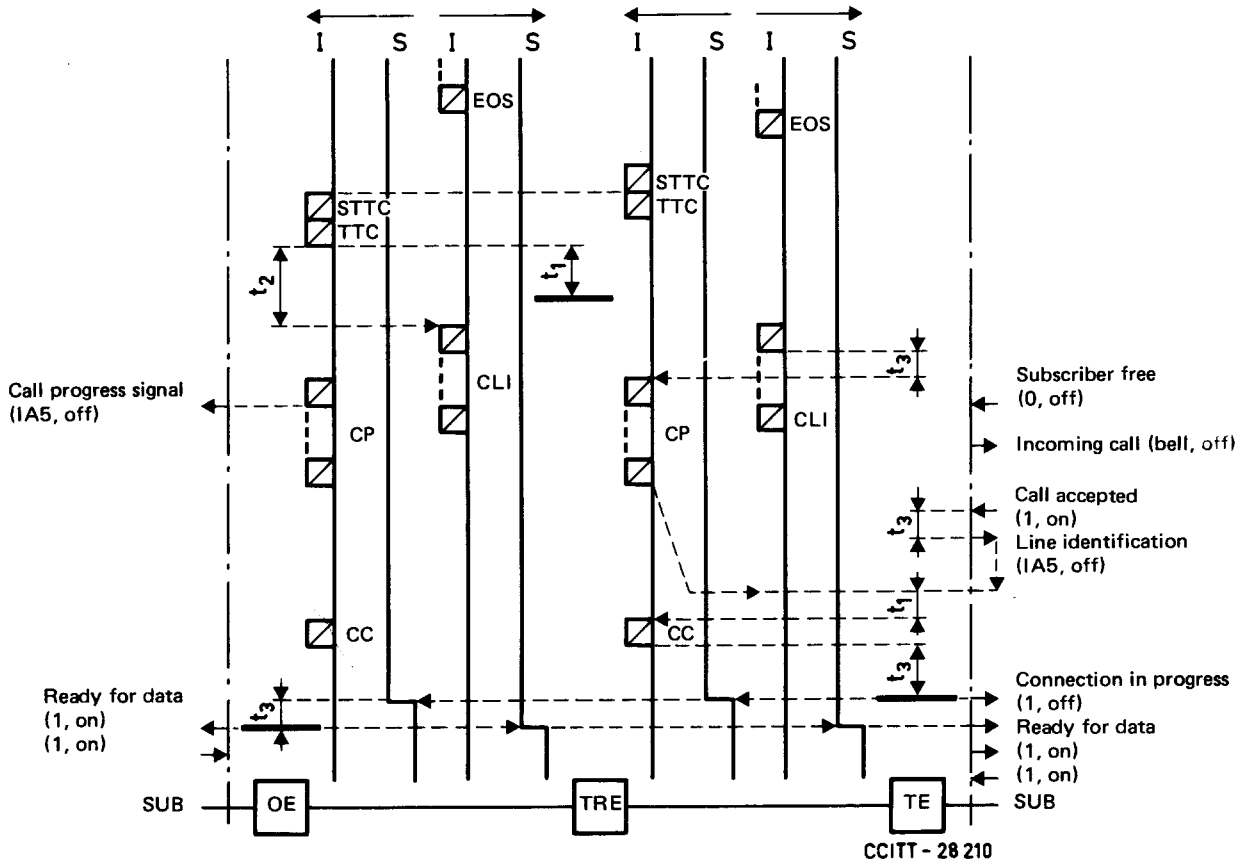
Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

APPENDIX III (D)

(to Recommendation X.71)

Through-connection procedure

Called line identification not required, calling line identification required *(Connect-when-free* facility, subscriber is busy)



S	Status bit	CLI	Calling line identification signals
– – – –	Correlation line	CP	Call progress signal
———	Through-connection	CC	Call connected signal
☒	IA5-character	SUB	Subscriber
		OE	Originating exchange
EOS	End-of-selection signal	TRE	Transit exchange
STTC	Start-of-transit through-connect signal	DE	Destination exchange
TTC	Transit through-connect signal	I	Information bit

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

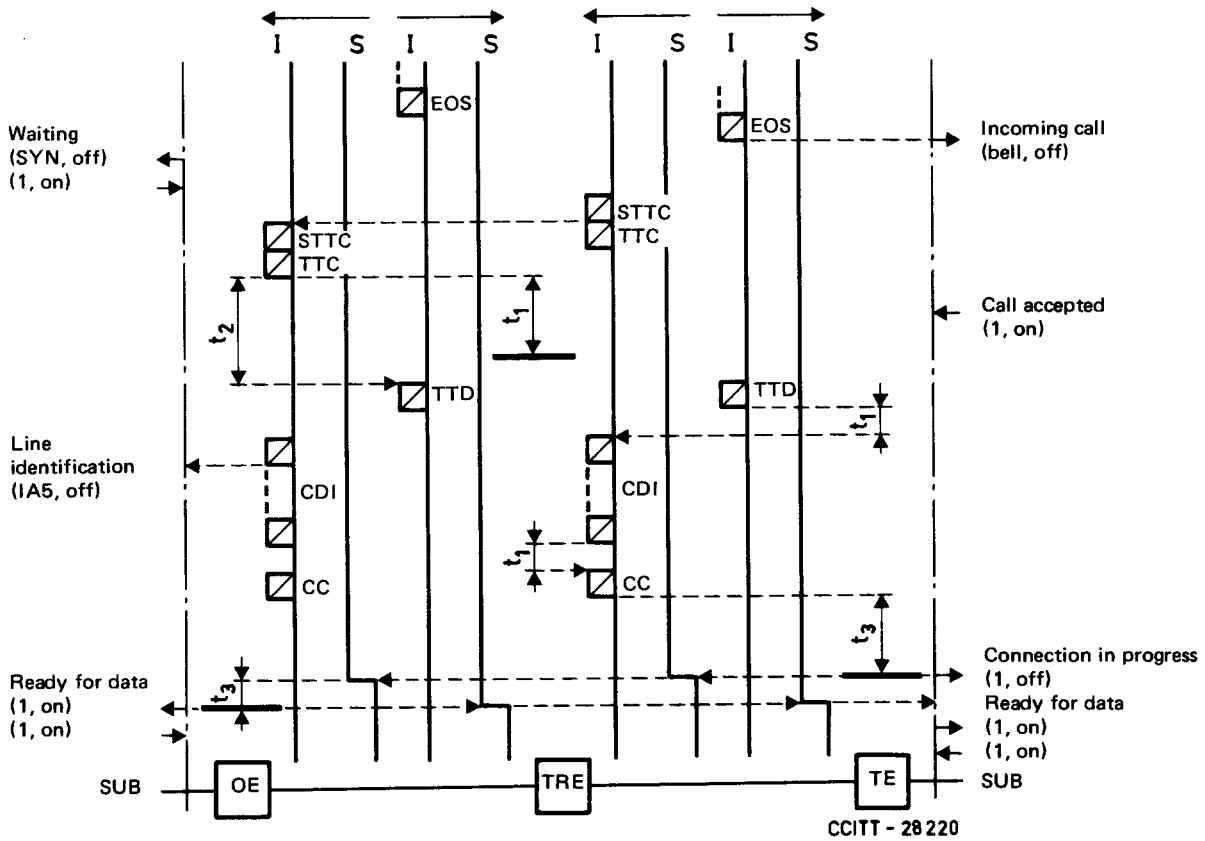
Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

APPENDIX III (E)

(to Recommendation X.71)

Through-connection procedure

Called line identification required, calling line identification not required (No *connect-when-free* facility)



S	Status bit	CDI	Called line identification signals
– – – –	Correlation line	CC	Call connected signal
———	Through-connection	SUB	Subscriber
☒	IA5-character	OE	Originating exchange
EOS	End-of-selection signal	TRE	Transit exchange
STTC	Start-of-transit through-connect signal	TE	Terminating exchange
TTC	Transit through-connect signal	I	Information bit
TTD	Transit centres through-connected signal		

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

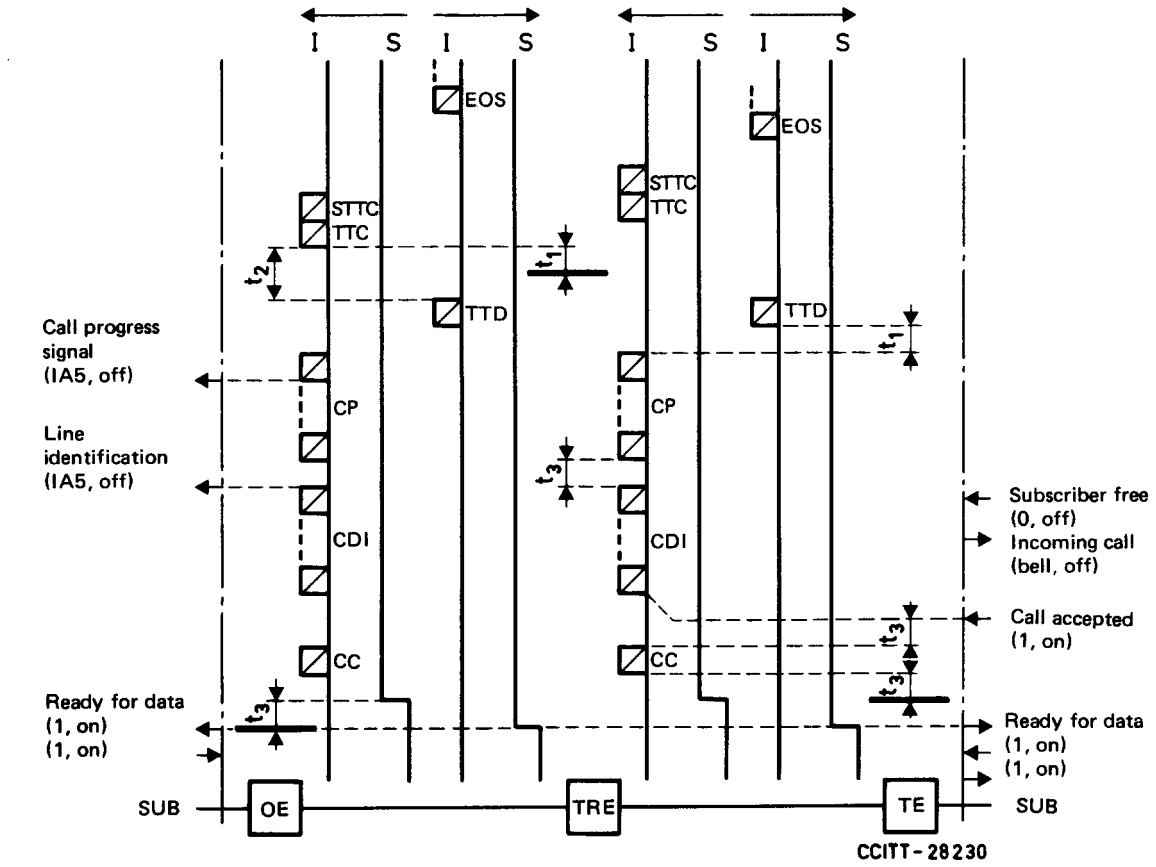
Note 4 - If the call is cleared, the relevant *call progress* signal should be send before or after the *called line identification* signal.

APPENDIX III (F)

(to Recommendation X.71)

Through-connection procedure

Called line identification required, calling line identification not required *(Connect-when-free* facility, subscriber is busy)



S	Status bit	TTD	Transit centres through-connected signal
– – – –	Correlation line	CP	Call progress signal
———	Through-connection	CC	Call connected signal
☒	IA5-character	SUB	Subscriber
		OE	Originating exchange
EOS	End-of-selection signal	TRE	Transit exchange
STTC	Start-of-transit through-connect signal	TE	Terminating exchange
TTC	Transit through-connect signal	I	Information bit

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

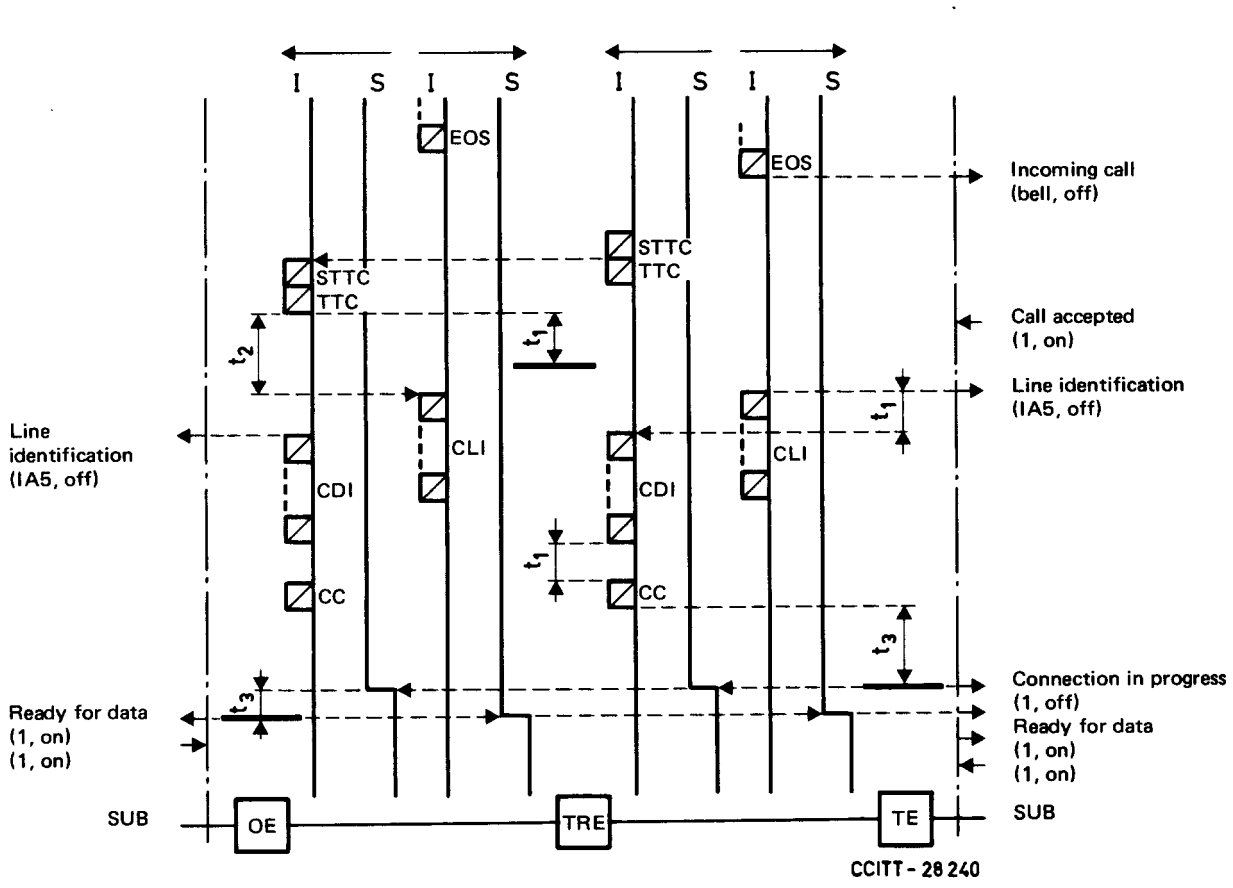
Note 4 - If the call is cleared after the sending of the *called line identification* signal, but before through-connection, a relevant *call progress* signal with clearing could be sent.

APPENDIX III (G)

(to Recommendation X.71)

Through-connection procedure

Called and calling line identification required (No *connect-when-free* facility)



S	Status bit	CDI	Called line identification signals
– – – –	Correlation line	CLI	Calling line identification signal
———	Through-connection	CC	Call connected signal
☒	IA5-character	SUB	Subscriber
		OE	Originating exchange
EOS	End-of-selection signal	TRE	Transit exchange
STTC	Start-of-transit through-connect signal	TE	Terminating exchange
TTC	Transit through-connect signal	I	Information bit

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

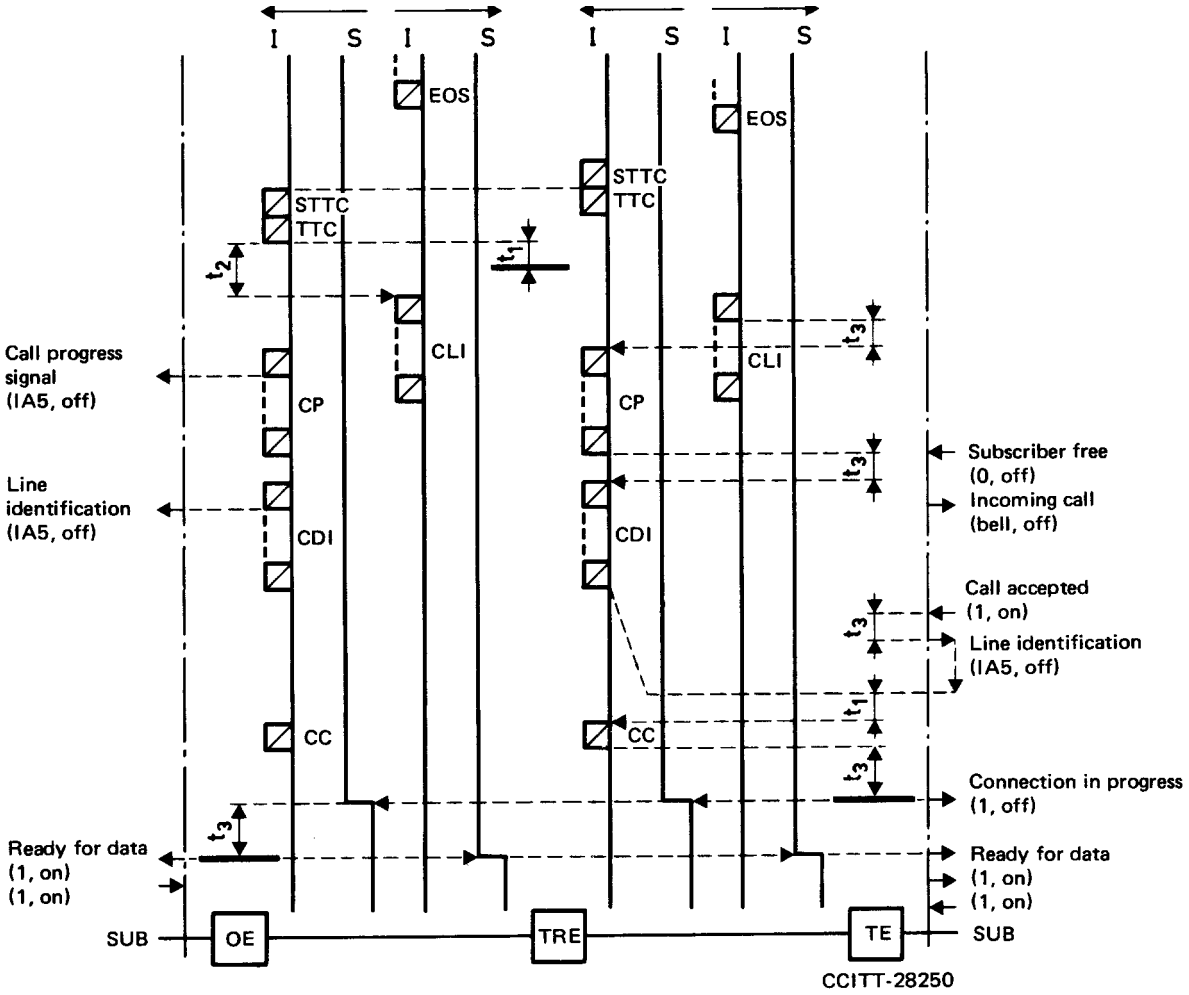
Note 4 - If the call is cleared, the relevant *call progress* signal should be send before or after the *called line identification* signal.

APPENDIX III (H)

(to Recommendation X.71)

Through-connection procedure

Called and calling line identification required *(Connect-when-free* facility, subscriber is busy)



S	Status bit
----	Correlation line
———	Through-connection
⊠	IA5-character
EOS	End-of-selection signal
STTC	Start-of-transit through-connect signal
TTC	Transit through-connect signal
CLI	Calling line identification

CP	Call progress signal
CDI	Called line identification signal
CC	Call connected signal
SUB	Subscriber
OE	Originating exchange
TRE	Transit exchange
TE	Terminating exchange
I	Information bit

Note 1 - Where groups of signalling characters are not contiguous, the *waiting* signal (S = 0, repetitions of 1s for a period of at least 15 information bits) must be sent during the interim period.

Note 2 - t_1 = 0-30 ms, t_2 = 30-50 ms, t_3 = 0-40 ms.

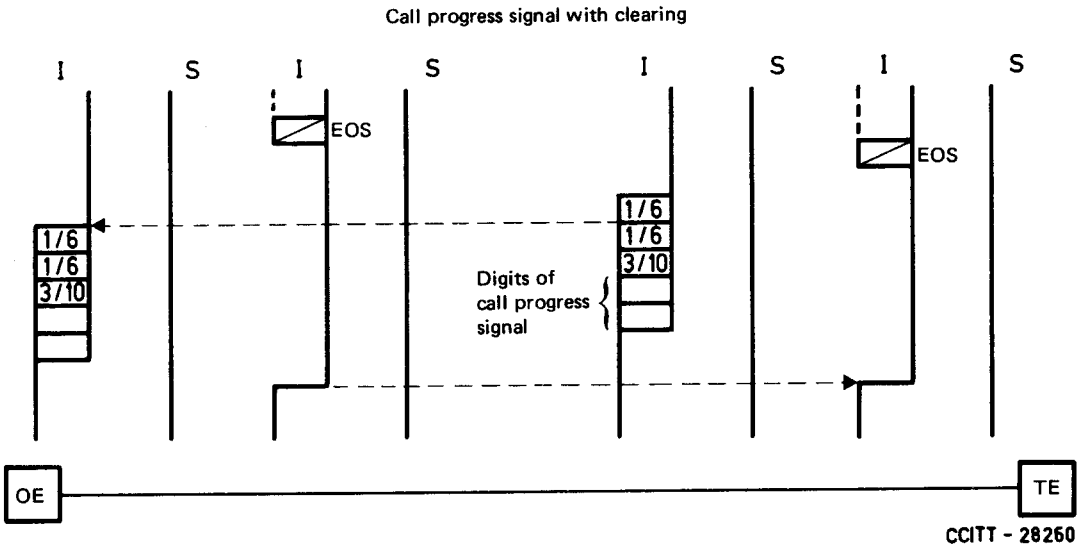
Note 3 - The timings given in Note 2 cover worst case conditions and exchange design should aim to keep them as short as possible.

Note 4 - If the call is cleared after the sending of the *called line identification* signal, but before through-connection, a relevant call *progress* signal with clearing could be sent.

APPENDIX IV

(to Recommendation X.71)

Unsuccessful call



S Status bit

I Information bit

Correlation line

IA5-character

EOS End-of-selection signal

OE Originating exchange

TE Terminating exchange

Note - Call progress signals without clearing may be included to indicate such facilities as call redirection.

APPENDIX V

(to Recommendation X.71)

Format of signalling characters within the Recommendation X.50

An example of three successive signalling characters within five octets of one channel of the Recommendation X.50 multiplex structure.

				a_1	a_2	a_3	0
F	a_4	a_5	a_6	a_7	a_8	b_1	0
F	b_2	b_3	b_4	b_5	b_6	b_7	0
F	b_8	c_1	c_2	c_3	c_4	c_5	0
F	c_6	c_7	c_8				

Status bits are 0s.

a_1..... a_8 is a signalling character

b_1..... b_8 is a signalling character

c_1..... c_8 is a signalling character

The framing bits F will be assigned on the multiplexed stream according to Recommendation X.50. No alignment of signalling characters with the envelopes of the multiplex structure is assumed or required.